RIO NUEVO ARCHAEOLOGY, 2000-2003:

Investigations at the San Agustín Mission and Mission Gardens, Tucson Presidio, Tucson Pressed Brick Company, and Clearwater Site

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ABSTRACT

Between October 2000 and January 2003, Desert Archaeology, Inc., conducted archaeological investigations at seven locations for the City of Tucson as part of the Rio Nuevo Archaeology project. The City of Tucson plans to revitalize the downtown area, including the re-creation of the historic San Agustín Mission and the Spanish Presidio fortress, as well as the construction of new homes and businesses. Excavations were conducted to either provide basic data for planned reconstructions, or to mitigate the effects of development.

Hundreds of cultural features were excavated, with more than 160,000 artifacts recovered. This work documented 4,100 years of occupation and 3,500 years of irrigated agriculture in the floodplain of the Santa Cruz River just west of downtown Tucson, Arizona. Well-preserved remains of the late eighteenth century Spanish period mission and mission gardens were also revealed on the western side of the river, as was a portion of the Tucson Presidio, founded in 1775, on the eastern side. Territorial period features and artifacts could be associated with Chinese gardeners and residents of a boardinghouse. These findings establish Tucson as one of the oldest continuously occupied settlements in the United States.

Public interest in the project was high, with an estimated 5,000 visitors during the course of fieldwork. Exhibits at the Arizona Historical Society, Southern Arizona Division, museum brought the Rio Nuevo project to a much larger audience.

The 22 chapters and two appendices of this report summarize the results of fieldwork, providing descriptions of archaeological features and analyses of the artifact assemblages recovered during the project.

ACKNOWLEDGMENTS

A very large number of people participated in the course of the Rio Nuevo Archaeological project. Luis Gutierrez, former City Manager for the City of Tucson, conceived the use of tax increment financing to bring tax money back to the community for revitalization measures. Proposition 400 was placed on the ballot by the City of Tucson council and was passed in November 1999, by a majority of voters. The City of Tucson subsequently asked for proposals to conduct archaeological and historical research and Desert Archaeology, Inc., submitted the winning proposal.

John Jones, the first director of the Rio Nuevo Project, and Karen Thoresen, the Assistant City Manager, were instrumental in helping with the archaeological work. Marty McCune, the City of Tucson's Historic Program Administrator, served as the City's point person for the project. Her assistant, Kristi Jenkins, provided valuable assistance, as did J. T. Fey. Additional City of Tucson personnel who helped make the projects run smoothly included John Updike, Lucy Amparano, Chris Leighton, Ray Murray, and Mike Carson.

The archaeological field crew excavated in a variety of conditions. The crew included Richard "Sonny" Anton, Jesse Ballenger, Patti Bell, Andrew Bockhurst, Avi Buckles, Brandy Ciaccio, Robert Ciaccio, Coya Coleman, Michael Cook, Patti Cook, Edward Corella, Frances Cote, Jennifer Dejong, Allen Denoyer, Steve Ditschler, John Fino, Edmund Gaines, Diedre Hayden, Gloria Inserra, Adam Kiel, Thomas Klimas, Michael Lindeman, Dottie Olman, Fred Perry, Sara Plescia, Mary Prasciunas, Paul Rawson, Stacy Ryan, Ray Sanchez, Karl Seitz, Gaylen Tinsley, Catherine Treat, Ochirkhuyag Tseveendorj, Sandra Wadsworth, Greg Whitney, and Caramia Williams. Mr. Homer Thiel, Dr. Jonathan Mabry, Dr. Michael Lindeman, and Dr. Michael Diehl were Project Directors. Dan Arnit, of Innovative Excavating, performed the backhoe work for the project. William Doelle served as Principal Investigator for the project; Patricia Castalia was the operations director.

Specialists were often called in to provide assistance during excavation, analysis, or report preparation. Dr. John McClelland and Dr. Robert Dayhoff coordinated the excavation and analysis of human remains. Fred Nials provided information on site geomorphology. Charla Hedberg and Stacy Ryan conducted preliminary analysis of Native American ceramics under the direction of James Heidke. Dr. Beth Miksa, Carlos Lavayen, and Dr. Sergio Castro-Reino conducted the petrographic analysis. Dr. Susan Stinson identified fired and unfired figurines. Arthur Vokes of the Arizona State Museum identified shell artifacts. Jane Sliva analyzed the flaked stone artifacts. Dr. Jenny Adams examined the ground stone artifacts recovered. Stacy Ryan and Caramia Williams helped analyze historic artifacts. Jennifer Waters, consultant Dr. Judi Cameron, and Dr. Barnet Pavao-Zuckerman, Vince LaMotta, Rachel Diaz de Valdez, and Felicia Coppola-Pavao of the Arizona State Museum, and Peter Schulz of the University of California at Davis analyzed zooarchaeological materials. Dr. Michael Diehl identified plant macrobotanical remains, while Dr. Owen Davis of the University of Arizona examined pollen samples. Dr. Manuel Palacios-Fest of Terra Nostra Earth Science Research identified ostracode samples from canal sediments. Dr. Steven Shackley, Jennifer Kahn, Elizabeth Eklund, and Caroline Ogasawara of the University of California, Berkeley, identified the source for obsidian artifacts. Radiocarbon dates were provided by Beta-Analytic. Western Mapping, Inc. (formerly GeoMap, Inc.) provided essential mapping assistance.

Desert Archaeology's proposal called for an extensive public education program. Personnel from the Arizona Historical Society—Dr. Anne Woosley, Executive Director, and Thomas H. Peterson, Director of the Southern Arizona Division—spearheaded the effort to bring the Rio Nuevo project to local residents and tourists. Staff members of the Education Department—Gwen Harvey, Kyle McKoy, Brooke Myers, and Emily Spargo-Guerrero—prepared a teacher's guide and elementary classroom activities book, hosted several lecture series, and mounted an impressive exhibit of Rio Nuevo archaeology. The construction of the exhibit required the skills of Kevin Mills and Leslie Roe, who built new cases, prepared elaborate photographs, and created an interactive children's backhoe. An earlier exhibit, "Carrillo's Chinese Gardeners," which opened at the Sosa-Carrillo-Frémont House Museum, was designed by curator Julia Arriola.

Dr. Bruce Hilpert, Beth DeWitt, and Annamarie Schaecher of the Arizona State Museum coordinated efforts to bring the Rio Nuevo project to local grade schools. Dr. Douglas Gann of the Center for Desert Archaeology prepared computer animations of the mission, presidio, and prehistoric sites, and presented these animations at numerous meetings.

Historical research was conducted by Michael Weber, Naomi Estrada-Weber, and Charles Polzer of Estrada-Weber Cultural Connections. Dr. Sergio Castro-Reino translated Spanish language documents, and Jinshan Tang translated Chinese characters. Christopher Sugnet of the University of Nevada

Las Vegas provided help in acquiring Spanish documents. Assistance with preparation of the computer model of the San Agustín Mission was provided by Bob Vint, Dr. R. Brooks Jeffery, Dr. Bernard Fontana, and Charles Polzer. Rogers prepared a scale model of the chapel and convento with funding provided by the Tucson-Pima County Historical Commission. Members of the Tucson Presidio Trust for Historic Preservation assisted at the Open House held at the presidio site at the end of fieldwork.

Desert Archaeology personnel who assisted in the fieldwork and report production phases of the project included office manager Jean Kramer, equipment manager Jason Hastings, and Sara Lely, who entered the field forms into a computer database. Robert Ciaccio and Dr. Scott Van Keuren photographed artifacts. Robert Ciaccio also prepared hand-drawn illustrations. Emilee Mead and Andrea Mathews spent hundreds of hours editing and formatting the final report.

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CHAPTER 1

AN OVERVIEW OF THE RIO NUEVO ARCHAEOLOGY PROJECT, 2000-2003

J. Homer Thiel and Jonathan B. Mabry
Desert Archaeology, Inc.

Between October 2000 and January 2003, Desert Archaeology, Inc., conducted archaeological investigations at seven locations (Figure 1.1) for the City of Tucson as part of the Rio Nuevo Archaeology project. Hundreds of cultural features were excavated, with more than 160,000 artifacts recovered. This work documented 4,100 years of occupation and 3,500 years of irrigated agriculture in the floodplain of the Santa Cruz River just west of downtown Tucson, Arizona. Some well-preserved remains of the late eighteenth century Spanish period mission and mission gardens were also revealed on the western side of the river, as was a portion of the Tucson Presidio—founded in 1775—on the eastern side. These findings establish Tucson as one of the oldest continuously occupied settlements in the United States. Significant discoveries include:

- the remains of a 4,100-year-old farming settlement with pithouses, storage pits, maize (corn) remains, and sherds decorated with incised designs—the oldest known pottery in the southwestern United States;
- two Early Agricultural period villages occupied between about 2,600 and 2,200 years ago, and Hohokam occupations dating between approximately 1,250 and 700 years ago;
- a sequence of 36 irrigation canals buried in the upper layers of the floodplain, the earliest dating to 3,500 years ago—the oldest known canal in North America—and the most recent being the "Acequia Madre Primera" shown on an 1862 map of Tucson's agricultural fields (Figure 1.2);
- the surviving fragments of the San Agustín Mission and the Tucson Presidio, both constructed in the late 1700s;
- a hand-dug well filled with trash discarded by Chinese gardeners in the 1890s; and
- foundations of the Tucson Pressed Brick Company factory, where bricks for many prominent southern Arizona buildings were manufactured between the 1890s and the 1960s.

Some of these discoveries have dramatically changed current understanding about Tucson prehistory and history, while others have added substantially to the information obtained during previous archaeological work. Portions of the three major archaeological sites—the San Agustín Mission and Mission Gardens loci of the Clearwater site, AZ BB:13:6 (ASM), the canal systems west of the Santa Cruz River, AZ BB:13:481 (ASM), and the Tucson Presidio, AZ BB:13:13 (ASM)—will lie undisturbed in the planned Tucson Origins Heritage Parks scheduled for construction in the coming years. Additional archaeological work is necessary in several locations to mitigate the impacts of Rio Nuevo construction projects and interpretive exhibits. The results of all archaeological work completed through 2003 is summarized in this report.

EAST OF INTERSTATE 10

Archaeological testing of the area at the southeastern corner of the Interstate 10 (I-10) frontage road and Congress Street (see Figure 1.1) was conducted in two phases in October 2000 and May 2001. Backhoe trenches were excavated throughout the area. No significant archaeological features were discovered, although a small number of prehistoric and historic-era artifacts were found scattered throughout the area.

THE SAN AGUSTÍN MISSION

Archaeological exploration at the San Agustín Mission locus began on 20 November 2000, and was completed on 12 February 2001. Many layers of occupation were uncovered there, at Tucson's birthplace at the base of A-Mountain. During the 9-week project, 206 cultural features were identified as being associated with prehistoric and historic occupations of the site (Figure 1.3). Historic-era features included a well filled by Chinese farmers, a pit containing Carrillo family trash from the 1860s, and the last remnants of the Spanish mission established in the 1770s. Below these were a Hohokam canal built 1,000 years ago and a much older early farming village.

An Early Agricultural Community

Remnants of an early farming village occupied between 2,500 and 2,400 years ago during the Early Cienega phase of the Early Agricultural period were preserved beneath the remains from the mission occupation over a large area west and south of the 1950s landfill. Pithouses (or rather, houses in pits), outdoor pits for cooking and food storage, human burials, and two canals were identified and investigated. These features, including the burials, were relatively evenly distributed across the exposed area. The superpositioning of some pithouses indicates continuous or repeated occupations over a period of time.

Of the 45 Early Cienega phase pithouses identified, 21 were excavated completely or partially; 43 of the 124 pits were excavated wholly or in part. Following the procedures of a burial agreement developed through prior consultations, four human burials dating to this prehistoric occupation were excavated and subsequently repatriated to the Tohono O'odham Nation for reburial.

On the floor of one of the pithouses were found two complete knobbed stone trays—a rare, possibly ritual-related artifact type that had only been found previously as fragments. A few sherds of crude pottery, another rare artifact type from this period, were also recovered. Segments of two canals dating to this occupation were documented.

These features are related to the Early Agricultural period features previously found in archaeological test trenches in the City of Tucson properties west of Brickyard Lane and north of Mission Lane (Elson and Doelle 1987). Based on current knowledge, Early Agricultural period features are probably also preserved beneath Brickyard Lane in this area.

A Hohokam Canal

A large canal built and used by the Hohokam between about 1,200 and 700 years ago was found crossing the investigated area from southeast to northwest. Just under 2 m wide and 1 m deep, it was probably the main canal that diverted water from the Santa Cruz River onto the western floodplain along this stretch of the river for several centuries. Only a few Hohokam canals have previously been found and investigated in the Tucson area; this is one of the largest to date. More of this canal is probably preserved beneath Brickyard Lane and in City of Tucson properties to the west.

A handful of other Hohokam features were identified, including a bell-shaped pit, two cremations, three burials, and a pithouse. The burials and cremations were repatriated to the Tohono O'odham Nation. The area investigated was likely used primarily as an agricultural field, with the main Hohokam community located to the northwest, perhaps at the current location of St. Mary's Hospital.

The San Agustín Mission and a Piman Ranchería

In 1694, Father Kino, Captain Manje, and Lieutenant Martín, some of the earliest European visitors to the region, traveled along the Santa Cruz River and visited a Piman Native American community located at the base of what is now known as A-Mountain. Manje described the area:

> Here the river runs with much water . . . there is good pastorage, and agricultural land with many canals to irrigate it. From this land they harvest much maize, beans, cotton from which they make their clothing, and other fruits of squash, cantaloupe and watermelon (Burrus 1971:348).

Pima groups from the Tucson area, the Gila River Valley (Gileños), the San Pedro River Valley (Sobaipuris), and the desert to the south and west (Papagos) were all residents of the mission during its history.

San Agustín became a *visita* of San Xavier and was visited regularly by priests stationed at Bac. The local Native Americans asked that a church be built at San Agustín, and one was completed in 1771. After construction of the Franciscan structures at San Xavier were finished in 1797, the workers apparently moved to San Agustín and built a two-story convento (a priest's residence and possibly a trade school), a chapel, a granary, cemetery areas, and a surrounding compound wall. Historical descriptions, drawings, and oral histories indicate that, by the 1840s, the mission was abandoned and the adobe structures were decaying. In 1956, the area where the convento and church had stood—and where visible remnants of adobe walls remained—was destroyed when the city used the area as a landfill.

During the Rio Nuevo Archaeology project, the stone foundations of three mission-occupation structures were discovered and excavated. The granary was located along the western side of the mission and was about 17 m long by 8 m wide. This structure had a row of pillar bases running down the center of the building; central pillars were necessary, because there were no timbers available in the Tucson area long enough to span the entire width of the building. The western wall of the mission was preserved along a 97-m-stretch, with the southwestern corner and a short segment of the southern wall also preserved (Figure 1.4). This wall foundation was 0.6 m wide. It was made by digging a shallow trench, or by placing rocks on the existing ground surface. The wall foundation was two to four rocks wide, with up

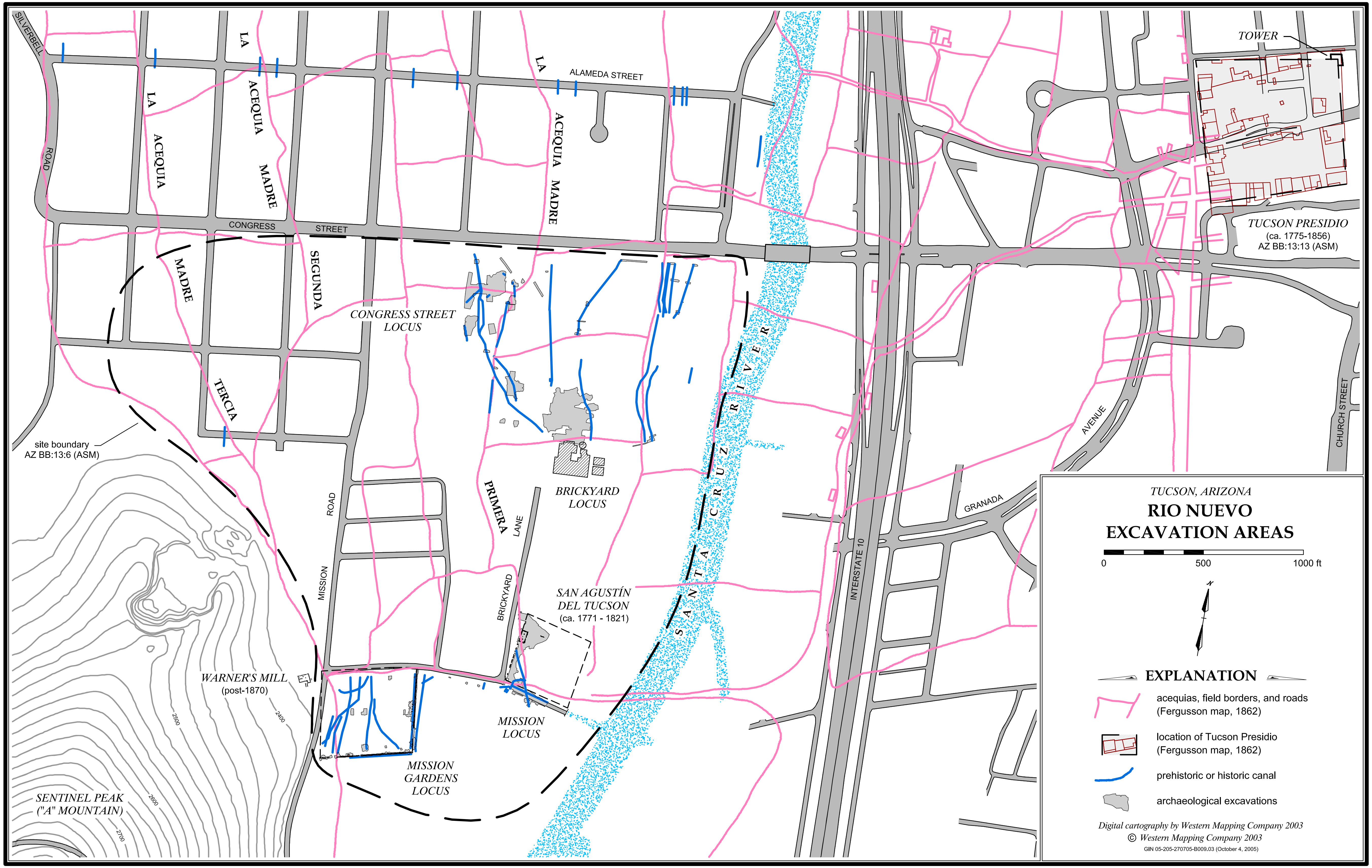

Figure 1.1. Map showing loci of archaeological investigations of the Rio Nuevo Archaeology project, 2000-2003.

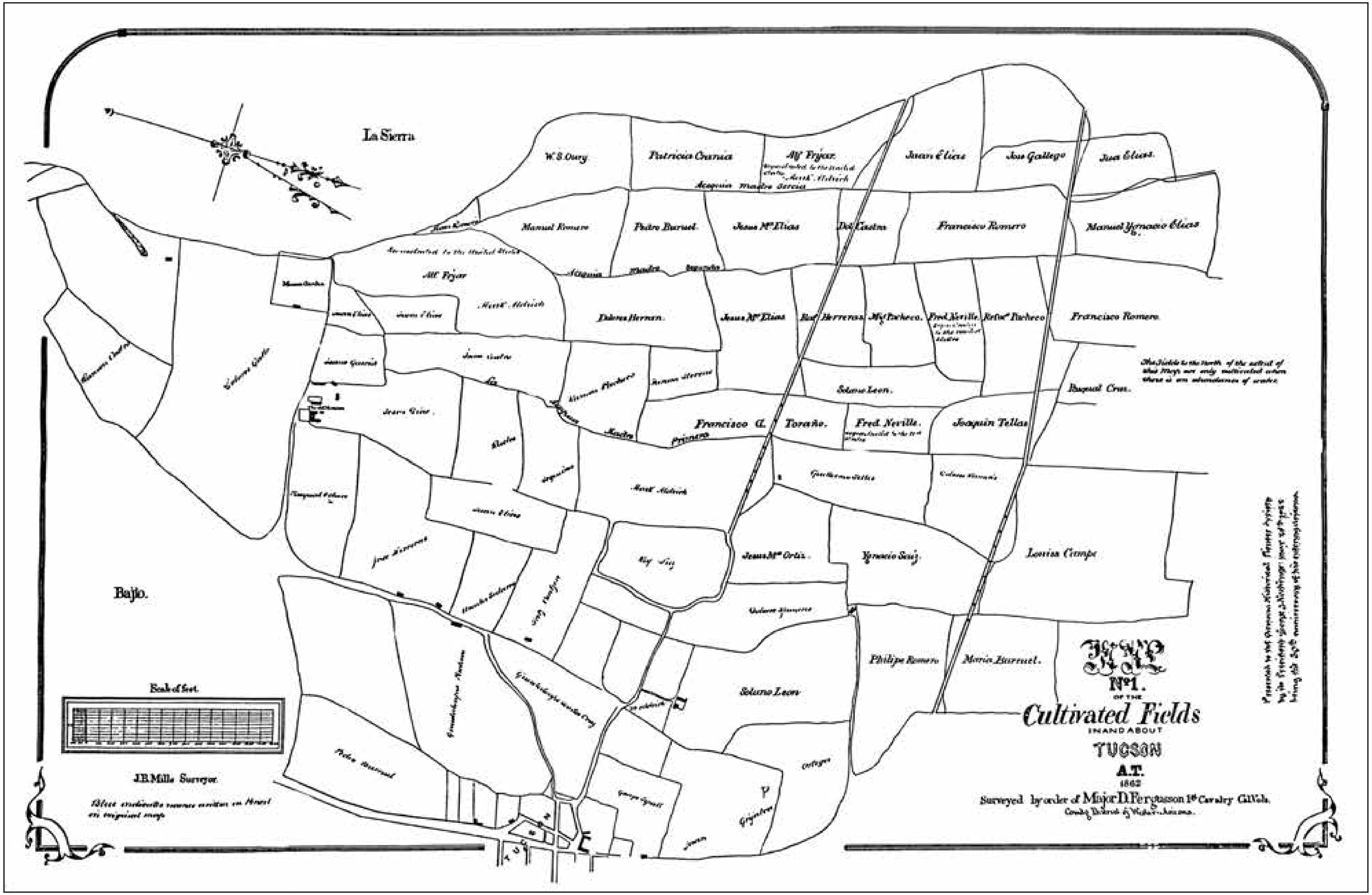

Figure 1.2. Map No. 1 of the cultivated fields in and about Tucson, A.T., 1862 (drafted by John B. Mills).

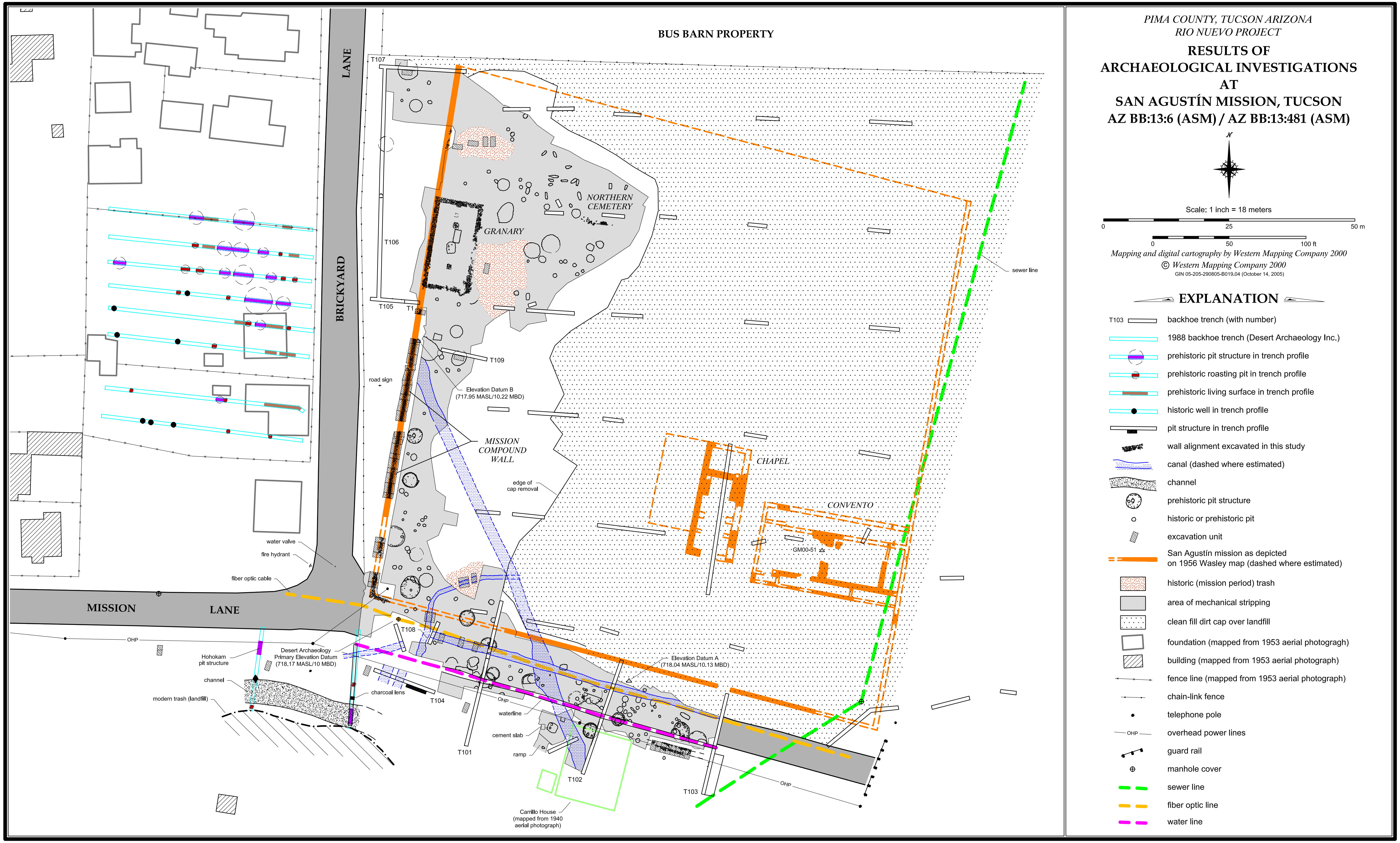

Figure 1.3. Map of archaeological features at the San Agustín Mission locus, AZ BB:13:6 (ASM).

Figure 1.4. A volunteer clears a section of the western compound wall foundation at the San Agustin Mission, AZ BB:13:6 (ASM).

to two courses of rock preserved. Adobe was smeared over the rocks, forming a flat base upon which an adobe wall was built.

A portion of the foundation of the southern wall of the northern mission cemetery was also discovered. Although poorly preserved, the surviving fragment marks the southern boundary of the cemetery. Four burials and nine additional possible burials were present north of the wall. This area was partially excavated between 1949 and 1953, by archaeologists from the Arizona State Museum (ASM). The discovery of intact burials during the Rio Nuevo investigations was particularly important. The exposed graves were left in place, following the burial agreement which required that any mission-occupation burials be left in place. Additional graves are likely present within the backhoe-stripped area and also in the area immediately to the north and to the east, where a large backdirt pile prohibited further stripping.

Three trash dump areas dating to the mission occupation were discovered. Excavation units were placed in each, resulting in the recovery of chopped animal bones, Native American pottery sherds, small Piman arrow points, and several pieces of colorful Mexican majolica pottery. These items provide information about the lifeways of the mission's Native American residents. Three trash-filled pits and one roasting pit were located nearby and also yielded artifacts, animal bone, and charred plant materials. No other Piman cultural features of this period have previously been excavated in Tucson.

Backhoe trenches were cut in the locations of the chapel and the convento, known from historical maps, photographs, and archaeologists' surveying notes. These trenches probed 4.9 m below the modern ground surface, penetrating the recent landfill and reaching about 3.7 m below the Spanish period ground surface. Only layers of the 1950s landfill were exposed. None of the foundations of these structures have survived.

Leopoldo Carrillo's House

Leopoldo Carrillo, one of Tucson's founding fathers, purchased the property on the southern side of the mission from Dolores Gallardo in May 1871 (Pima County Deed Record Book 1:527-529). Carrillo was already living at the farm and may have been growing crops there. Carrillo's residency at the property was relatively short, because he soon moved to the eastern side of the Santa Cruz River into what is now called the Sosa-Carrillo-Frémont House, used as a museum by the Arizona Historical Society (AHS).

Two features associated with the Carrillo occupation of the site were discovered. A small, trash-filled pit was excavated that included a few decorated European ceramic sherds, animal bone, and Native American pottery; the pit was filled prior to 1880. An 1880 photograph from Carrillo's backyard shows a ditch running along the northern side of Mission Lane, and this ditch cuts through this earlier pit. No trace of Carrillo's house, which was torn down in the 1940s, was found. However, aerial photographs from the early 1940s allow for its accurate placement on today's topography. The house was visited in 1937, as part of the Works Progress Administration's (WPA) work on the Historic American Buildings Survey in Tucson, and the resulting floor plans, facade drawings, and photographs document the structure in great detail and are available on the Library of Congress website.

The railroad reached Tucson in March of 1880. Chinese laborers laid much of the track, and the 1880 census found over 900 men still building the railroad (Lister and Lister 1989). Several hundred of the men stayed in Tucson and, of these, about 35 became gardeners, growing produce along the Santa Cruz River. Carrillo rented his property to these men, and an 1885 lawsuit ensued after Carrillo and other businessmen arbitrarily cut off water to downstream Mexican farmers north of St. Mary's Road. The Chinese gardeners required a larger share of water for their produce, which included watermelon, strawberries, and cabbages sold in town. Chinese farmers continued using the area as late as the 1930s.

Excavations revealed a hand-dug well and an adjacent pit containing artifacts discarded by the Chinese gardeners (Figure 1.5). These included an iron wok, soy sauce jugs, rice wine bottles, rice bowls, wine cups, fish bones, and cuttlefish bone (from a squid-like creature). Only one other Chinese gardener's

Figure 1.5. Archaeologists excavate the well filled with Chinese artifacts, the San Agustin Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

site has been excavated, several blocks west along Spruce Street (Thiel 1997). Analysis of the artifacts and food materials from the Rio Nuevo project provides information about the everyday lives of these men, information that was not typically written down. An exhibit on "Carrillo's Chinese Gardeners" was displayed from 2001 to 2003, first in the Sosa-Carrillo-Frémont House and then in the AHS Museum on Second Street, Tucson.

The 1950s Landfill

Work also delineated the boundaries of the 1950s landfill (see Figure 1.3). The western side of the site was partially mined for clay for bricks, and a small amount of trash was discarded in the area. Toward the east, the landfill drops off dramatically and is approximately 6.0-7.5 m deep in the eastern one-third of the mission area. The southern boundary of the landfill begins within 3 m (10 ft) of the northern side of Mission Lane, and again drops steeply downward. Artifacts found within the edges of the landfill included newspapers from November 1957, bottles, dolls, and cloth. Once the top of the landfill was revealed, no attempt was made to excavate. The exception was the area within the convento and chapel, where exploratory trenches were monitored by the city's Department of Waste Management.

Future Work at the San Agustín Mission

In sum, archaeological exploration has revealed that a roughly L-shaped area east of Brickyard Lane has survived the twentieth century brick-mining and landfill operations. While a sample of the 206 features was excavated, many other features remain unexcavated and undiscovered. For example, in the area beneath Mission Lane, archaeologists uncovered over 50 archaeological features, including pit structures, outdoor pits, a canal, human burials and cremations, and historic pits. The site has multiple layers of cultural features, and additional features lie beneath the levels uncovered.

Because impacts of construction from the City of Tucson's Rio Nuevo project at the San Agustín Mission were not known during the current project, the archaeological fieldwork conducted during this phase was only an initial exploration of the area to identify the types of archaeological resources present and their states of preservation. Not all of the property was tested, not all identified cultural features were excavated, and not any portion of the property was adequately investigated to allow clearance for construction at this time. However, the impacts of construction on prehistoric and historic cultural resources can be mitigated through further archaeological testing and data recovery fieldwork once the areas of planned construction are identified.

Public Involvement and Open Houses

A principal goal of the archaeological work was informing and involving the public. Of the 580 person-days expended in investigating the site, 80 person-days (14 percent) were provided by volunteers. Well over 2,000 individuals visited the site during the fieldwork. A tour guide was on duty from 10:00 a.m. to 2:30 p.m. daily, taking approximately 500 persons through the site in small groups. Five groups of grade school and high school students visited the site on specially arranged tours, as did a group of Pima County planners. The official open-house day was rained out; however, approximately 500 people toured the site the previous day, drawn by a newspaper article that incorrectly reported the open-house date.

On 3 February 2001, over 1,000 people toured the site, watching archaeologists at work, examining artifacts and exhibits, viewing a reconstructed pithouse (Figure 1.6) and a computer simulation of the mission, and witnessing demonstrations of spearthrowing and stone toolmaking. Visitors were enthusiastic about the archaeological project and expressed excitement about the proposed cultural park. Most stated an interest in the proposed reconstructions,

Figure 1.6. An Early Agricultural period pithouse was reconstructed in its original pit, the San Agustin Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

and many specifically asked that one or more of the pithouses be reconstructed.

Media coverage was consistently high throughout the project. Approximately 12 television news stories were aired (all three major channels, public television, and the City of Tucson channel), and eight newspaper articles appeared in the *Arizona Daily Star* and the *Tucson Citizen*. Newspaper articles and photographs of the project were carried in several other communities, including Phoenix and Dallas. After each media event, a rise in the number of visitors occurred. An article also appeared in the magazine *American Archaeology* (Bawaya 2001).

THE MISSION GARDENS

The Mission Gardens are located 122 m west of the San Agustín Mission (Figure 1.7). This area was once surrounded by an adobe wall built on a stone foundation, probably constructed in the late 1790s or early 1800s. An 1862 map of Tucson's fields depicts the wall and a small structure built along its eastern side. Historic photographs from the 1880s and 1890s indicate the wall was partially intact until the end of the nineteenth century.

Testing of the gardens began in October 2001, and continued through December of that year. A series of backhoe trenches were cut, revealing numerous features underlying a shallow plowzone. Unlike the mission, few Early Agricultural period features (only three burials) were located, and these were found along the southern side of Mission Lane between the Mission Gardens and the San Agustín Mission. Two Early Ceramic period pithouses and two Hohokam pithouses were located, as were several Hohokam pits, two caches of stone hoes, and a hearth. Eight Hohokam burials and cremations were also discovered within the gardens. All the identified burials were excavated and repatriated to the Tohono O'odham Nation. The plowzone contained large quantities of Hohokam artifacts, and many additional features from that horizon were likely destroyed by historic-era plowing (Figure 1.8).

The eastern and southern foundations of the garden walls were completely exposed by the excavations. The rock foundations are mostly intact, and include small buttresses spaced every 12-15 m along the interior of the wall. A probable gate area was discovered along the southern wall. The structure along the eastern wall had four interior column bases and was approximately 17 m long by 8 m wide—very similar to the size of the granary at the mission. Fragments of English transfer-print ceramics suggest that the building was a house and that it was occupied from at least the 1850s to the 1880s. A nearby well was located and partially excavated, and it likely supplied water to the house. Several historic-era to modern houses and a shed were also mapped.

A total of 13 prehistoric to historic-era canals were documented within or adjacent to the gardens area. These canals include the largest Hohokam canal found, to date, in the Tucson Basin. This canal was 7.95 m wide and 2.20 m deep, large enough to divert the entire flow of the Santa Cruz River at that time. Four other canals were much smaller, most of them running roughly south to north. Four Protohistoric period canals also crossed the area from south to north. Four Historic era canals were identified—two crossing the western interior of the gardens and two running along the exteriors of the southern and eastern garden walls.

During fieldwork, a tour guide took visitors, including many school groups, through the site. An open house at the end of the project attracted several hundred people. An article describing the experience of a volunteer on the project appeared in *Smithsonian* magazine (Lichtenstein 2002).

Future Work at the Mission Gardens

Many of the features found at the gardens were located directly beneath the shallow plowzone. These included several of the Hohokam burials. The identified prehistoric burials were scattered across the property. Dozens of additional burials are likely present within the garden walls and undisturbed areas outside the walls. Any ground-disturbing activities at this location will have to be monitored by archaeologists. If the area is going to be used as a

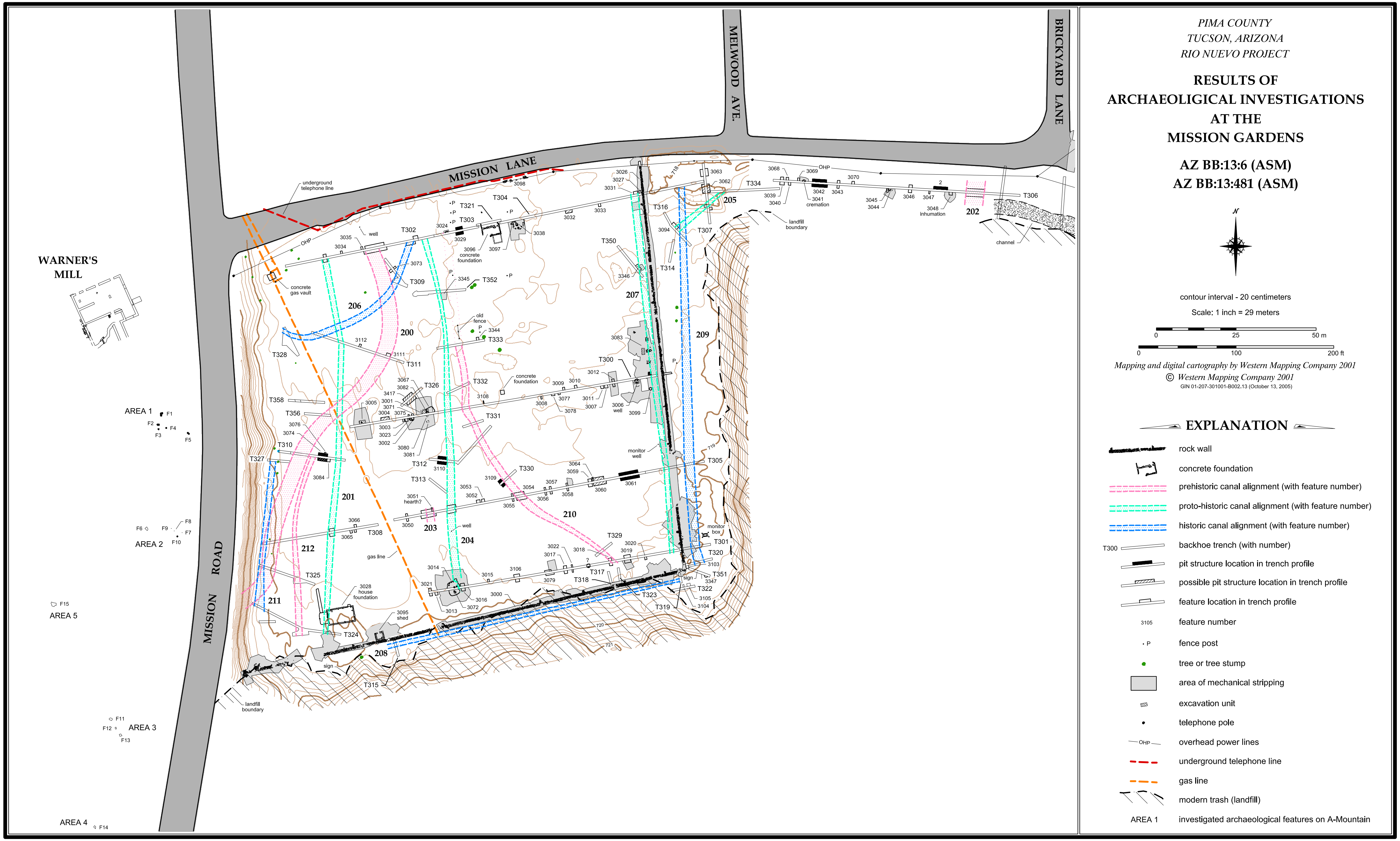

Figure 1.7. Map of archaeological features at the Mission Gardens locus, AZ BB:13:6 (ASM).

Figure 1.8. Hohokam pottery sherds found in the plowzone at the Mission Gardens locus, AZ BB:13:6 (ASM).

demonstration or community garden, it is recommended that additional soil be added to the area to prevent disturbance of archaeological features during routine plantings and plowings.

THE CONGRESS STREET LOCUS

The archaeological remains located west of I-10, south of Congress Street, and north of the bus barn are referred to as the Congress Street and Brickyard loci of the Clearwater site (Figure 1.9). The first stage of fieldwork was conducted in the summer and fall of 2001, and a second stage was carried out during the summer of 2002. This work was designed to mitigate the impacts of construction during the city's Rio Nuevo Project, clearing the area for building activities.

A 4,100-year-old Farming Settlement

The earliest occupation preserved in the Congress Street locus was a small farming settlement buried in a layer of alluvium (Stratum 504) approximately 1.5 m below the present ground surface (Figures 1.10-1.11). In one area, a cluster of seven pithouses and numerous storage pits were exposed and excavated. These features contained grinding tools made from river cobbles, flaked stone dart points resembling the San Jose or "Armijo" style of the Colorado Plateau, Cortaro points, a flat stone used for processing ochre, a few pottery sherds made of untempered, low-fired clay and decorated with incised patterns, fired-clay figurine fragments, and charred maize remains. Several maize samples have provided radiocarbon dates of roughly 2100 B.C. (calibrated). The pit structures and the maize are among the oldest that have been found in the Southwest, and the pottery and figurines are the oldest fired ceramics known from the region.

A 3,500-year-old Canal

A canal and several pits were identified as originating in the layer of alluvium (Stratum 503) overlying the 4,100-year-old farming settlement (see Figure 1.10). Radiocarbon dates on plant remains from two nearby pits indicate the canal was built around 1500 B.C. This is the oldest known canal north of central Mexico. It shows that canal irrigation was used by some of the earliest farmers in the Sonoran Desert, and it extends the beginning of canal technology back to 1,500 years before the oldest known Hohokam canal in southern Arizona.

A Cienega Phase Village

Beneath the historic brick factory (see below) in the Brickyard locus, and in some other portions of the Clearwater site, remains of an early farming village were found (Figure 1.12). The village was occupied from about 2,600-2,400 years ago, during the Early Cienega phase. A smaller area of this Cienega phase occupation was investigated in 1995 (Diehl 1997). During the Rio Nuevo project, 22 pithouses, numerous outdoor pits for storage and cooking, and four burials were found in the area beneath the brick factory. Several of the pithouses appear to have been arranged in a ring around a shared courtyard. A large, deep, and carefully constructed pithouse that may have been a ceremonial building was nearby. It is one of a small number of examples now known for this phase, which are the earliest "kiva"-like buildings in the Southwest. In other areas, another five burials and four canals dating to this phase were found. Two canals passing west of the village have been radiocarbon dated to about 2,500 and 2,100 years old. Many of the burials were clustered along one of the canal alignments, outside the habitation area, in the manner of a cemetery.

Later Prehistoric Canals and Fieldhouses

In the area of the historic brick factory, two pithouses and a roasting pit dating to the Early Ceramic period (circa 1,900-1,500 years ago) were found. Dating to later Hohokam phases (between circa 1,500-500 years ago) were eight canals, three isolated pithouses (probably fieldhouses located away from villages), and one burial in the Clearwater site area.

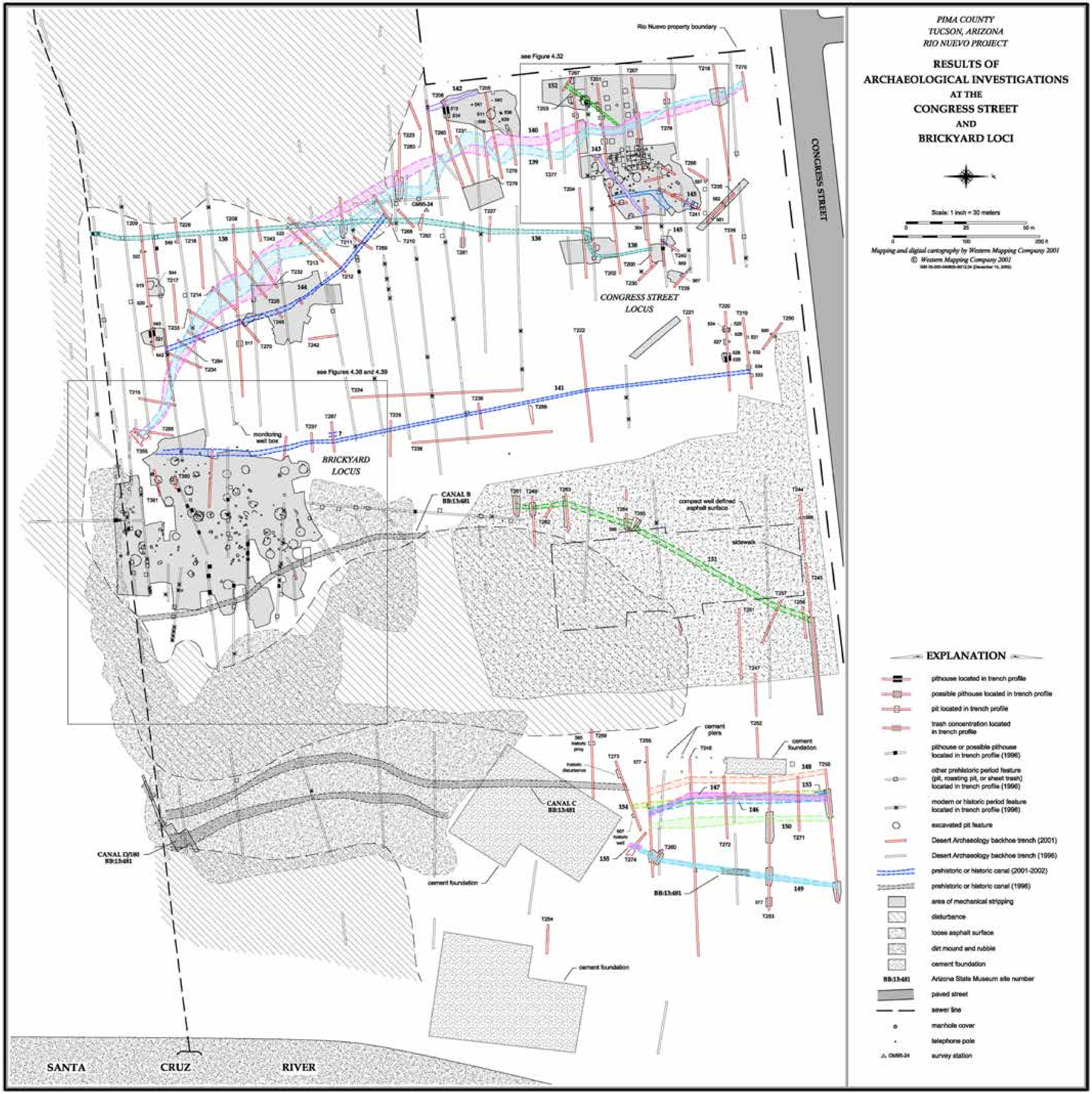

Figure 1.9. Map of archaeological features at the Congress Street and Brickyard loci, the Clearwater site, AZ BB:13:6 (ASM).

Figure 1.10. Map of archaeological features in strata 503 and 504, Block 5, Congress Street locus, the Clearwater site, AZ BB:13:6 (ASM).

Figure 1.11. Archaeologists uncover the remains of a 4,100-year-old farming settlement at the Congress Street locus, the Clearwater site, AZ BB:13:6 (ASM).

A Long Sequence of Canals

In addition to the numerous prehistoric canals, seven historic canals, including the Acequia Madre Primera shown on an 1862 map of Tucson's fields, were found (Figure 1.13). With the most recent canals built to convey pumped groundwater during the early twentieth century, this represents 3,500 years of continuous irrigated agriculture in this part of the floodplain. The canal dating to 3,500 years ago is the oldest canal that has been found north of Mexico.

For most of the last 4,000 years, the reliable springs, river flow, and high water table in this location sustained an oasis that was the focus of habitation and irrigated agriculture. This continued until the water table dropped and the river channel became incised during the late nineteenth century, largely due to drought and modern human impacts such as groundwater pumping, overgrazing by cattle, and construction of very large canals.

The Tucson Pressed Brick Factory

The Tucson Pressed Brick Factory was established in the 1890s by the architect Quintus Monier. The factory was in operation until 1962, and it provided bricks for many important structures in Tucson, including numerous University of Arizona buildings. Portions of the brick factory were discovered in 1995 during the A-Mountain Drainage project (Diehl 1996). Additional portions were discovered in the summer of 2002, including foundations of scove kilns, drying racks, the pug mill, offices, outhouses, and borrow pits (Figure 1.14). Pieces of machinery and samples of bricks, cornice pieces, and tiles were recovered.

Public Outreach

Visitors were invited to tour the Clearwater site on two occasions, once after the exposure of the brick factory features and again after the prehistoric features were excavated. Approximately 400 people came to the site to see the brick factory, including many former brickworkers and family members, some of whom brought photos and other items from the factory. The second open house coincided with the nearby Fiesta de San Juan, and despite the extremely hot weather, drew some 200 visitors.

THE TUCSON PRESIDIO

The Tucson Presidio was established in August 1775, by Captain Hugo O'Conor of the Spanish military. Soldiers moved north from Tubac the following year, and the fort was first enclosed with a wooden palisade, later replaced by a 2.4- to 3.7-m-high adobe wall that was approximately 213 m on each side. The presidio remained in use until the American entrance into Tucson in March 1856, and was quickly dismantled afterward. The last standing segment of the wall was torn down in 1918. In the years since then, efforts have been made to mark and locate portions of the walls. City Engineer Donald Page discovered the eastern and southern walls when the 1929 Pima County Courthouse was being constructed. This wall was relocated by staff from the Center for Desert Archaeology in 1992, and is marked with a polished granite strip set into the central sidewalk of the courthouse courtyard. The western wall was found in the western lawn of City Hall by the Center for Desert Archaeology in 1998 and 1999 (Thiel 2004; Thiel et al. 1995).

Courthouse Testing

Archaeological work has been conducted in three areas within the boundaries of the Tucson Presidio as part of the Rio Nuevo Archaeology project. The first project consisted of the excavation of two 2-m by 1-m test units in the area on the eastern side of the colonnade of the 1929 Pima County Courthouse, in an area that was to be relandscaped. Undisturbed deposits were found beneath fill associated with the courthouse construction. The only feature located was the rock and mortar foundation of the 1883 City Firehouse. The work suggests other intact features are likely to be present, but deeply buried, in this general location.

Figure 1.12. Map of prehistoric archaeological features in the Brickyard locus, the Clearwater site, AZ BB:13:6 (ASM).

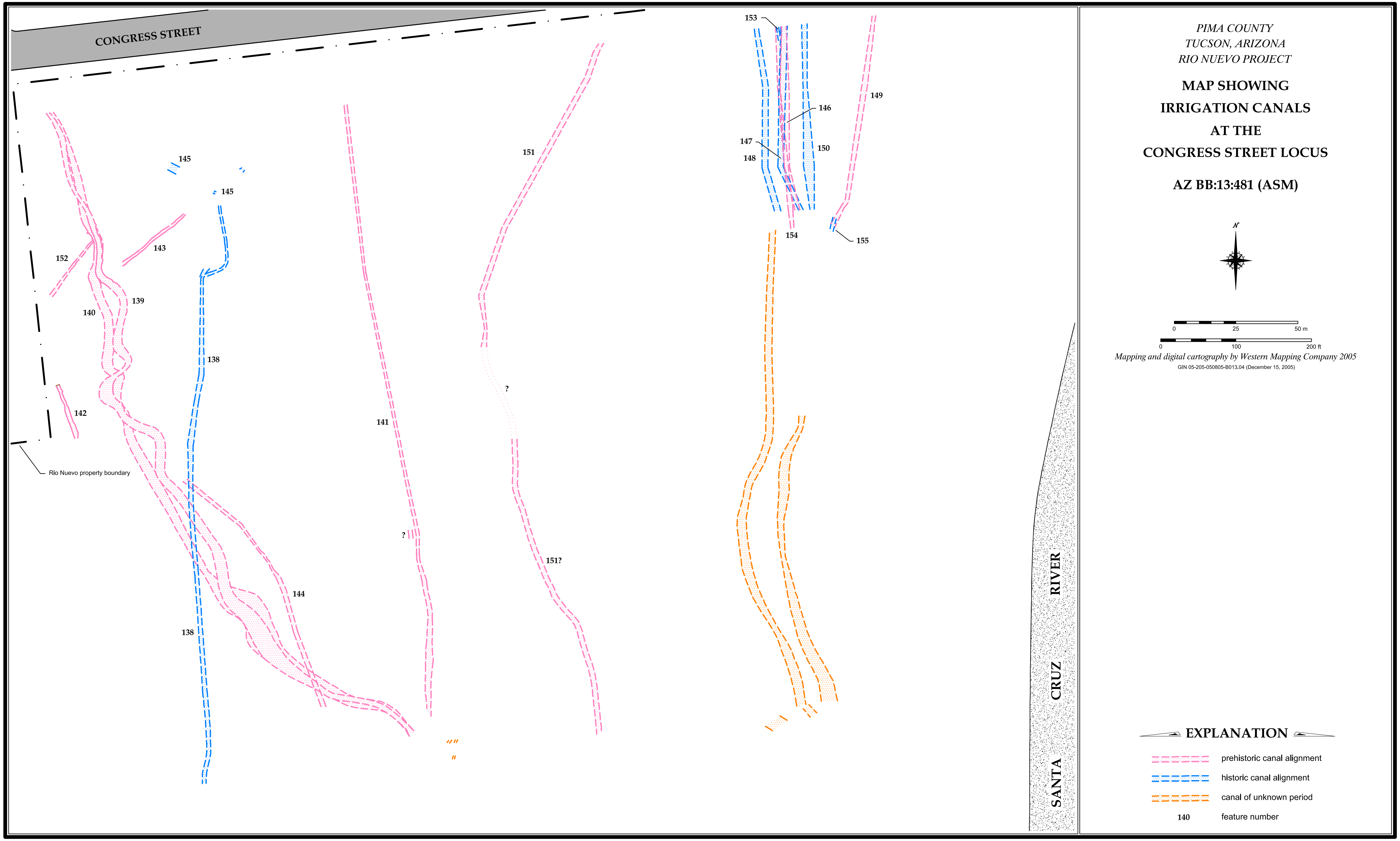

Figure 1.13. Map of prehistoric and historic irrigation canals in the Congress Street locus, the Clearwater site, AZ BB:13:6 (ASM).

Art Museum Testing

In January 2002, work shifted to the area between the Edward Nye Fish and Hiram Stevens houses on Main Street (Figure 1.15). Plans by the Tucson Museum of Art to enclose this area and to install a drainpipe led to the excavation of the drainpipe trench by archaeologists. A room constructed in the 1860s once stood at this location; it was torn down in the early 1900s. Remnants of its adobe foundations were quickly found. A series of floors and adobe walls dating to the presidio occupation was beneath these foundations (Figure 1.16). Walls from two rooms were found, probably built against the western wall of the presidio. The earlier room had a thin adobe wall on a rock foundation. A fireplace was discovered in the northwestern corner of the room, with a sample of the ash and charcoal yielding wheat and saguaro cactus seeds.

This room was demolished and a much thicker adobe-walled room constructed on top. The function of this later room is unknown, and, after demolition of the presidio wall, the room was partially demolished as well. One wall was reused for a probable corral or boundary wall, depicted on the 1862 map of Tucson. Many presidio-occupation artifacts were recovered from soil layers in the trench, including Mexican majolica, Native American pottery, a crucifix, coins, buttons, lead musket balls, gun flints, and animal bones. The western presidio wall could likely be discovered if excavations could proceed beneath the sidewalk or the eastern edge of Main Street.

A Surprise Beneath a Parking Lot

In December 2002 through February 2003, efforts turned to the parking lot at the southwestern corner of Church Avenue and Washington Street (Figure 1.17). This area was previously partially excavated in 1954, by University of Arizona archaeologists under the direction of Dr. Emil Haury and Alan Olson. They discovered a wide adobe wall that turned a corner, which they thought was the northeastern corner of the presidio. A Hohokam pithouse, dating to circa A.D. 900, was found to lie beneath this wall. After the excavation was completed, the area was backfilled and became a parking lot (Olson 1985).

During the current testing project, only a limited number of individual parking spaces could be explored because the lot was still needed for parking after the project was completed. Backhoe operator Dan Arnit removed the asphalt and then switched to his wide scraping blade. His first scrape in the area explored in 1954 revealed the wide adobe brick wall. The area next to the wall was then emptied of backfilled dirt, and most of the Hohokam pithouse was uncovered.

As the pithouse was cleared by hand, archaeologist Avi Buckles joked, “Are we going to find a time capsule?" It didn't seem possible, but when he cleared out one of the floor pits within the house, he discovered an 8-inch-tall pickle jar, lying on its side (Figure 1.18). Through the glass could be seen a folded envelope with a return address from Tucson Newspaper, Inc. George Chambers, who had organized the 1954 dig, had been the business manager for this company. Two days later, an opening ceremony was held, and after the jar lid was removed, Mayor Bob Walkup reached in and pulled out the envelope. The letter inside, on George Chambers' letterhead, stated: “To whomever may be as much concerned as I: and more successful in arousing public interest in this historic site." Also inside the jar was a copy of the *Arizona Daily Star* from 26 December 1954, which featured a story on the backfilling of the site, and three 1954 coins: a penny, a nickel, and a dime.

The Northeastern Tower

Archaeologists soon moved into previously unexplored areas. An additional segment of the wall was found south of the wall and pithouse. However, instead of continuing south, which is what the outer wall of the presidio should have done, it turned and headed to the west. Similarly, the northern wall found in 1954 was 15 m long before turning to the south. This structure was not the actual presidio wall; instead, it was a two-story, corner *torreón* (tower). The eastern wall of the presidio had been found in 1992, and its location projected across the parking lot.

Figure 1.15. Archaeologists document adobe walls in a trench between the Edward Fish and Hiram Stevens houses along Main Avenue, the Tucson Presidio, AZ BB:13:13 (ASM).

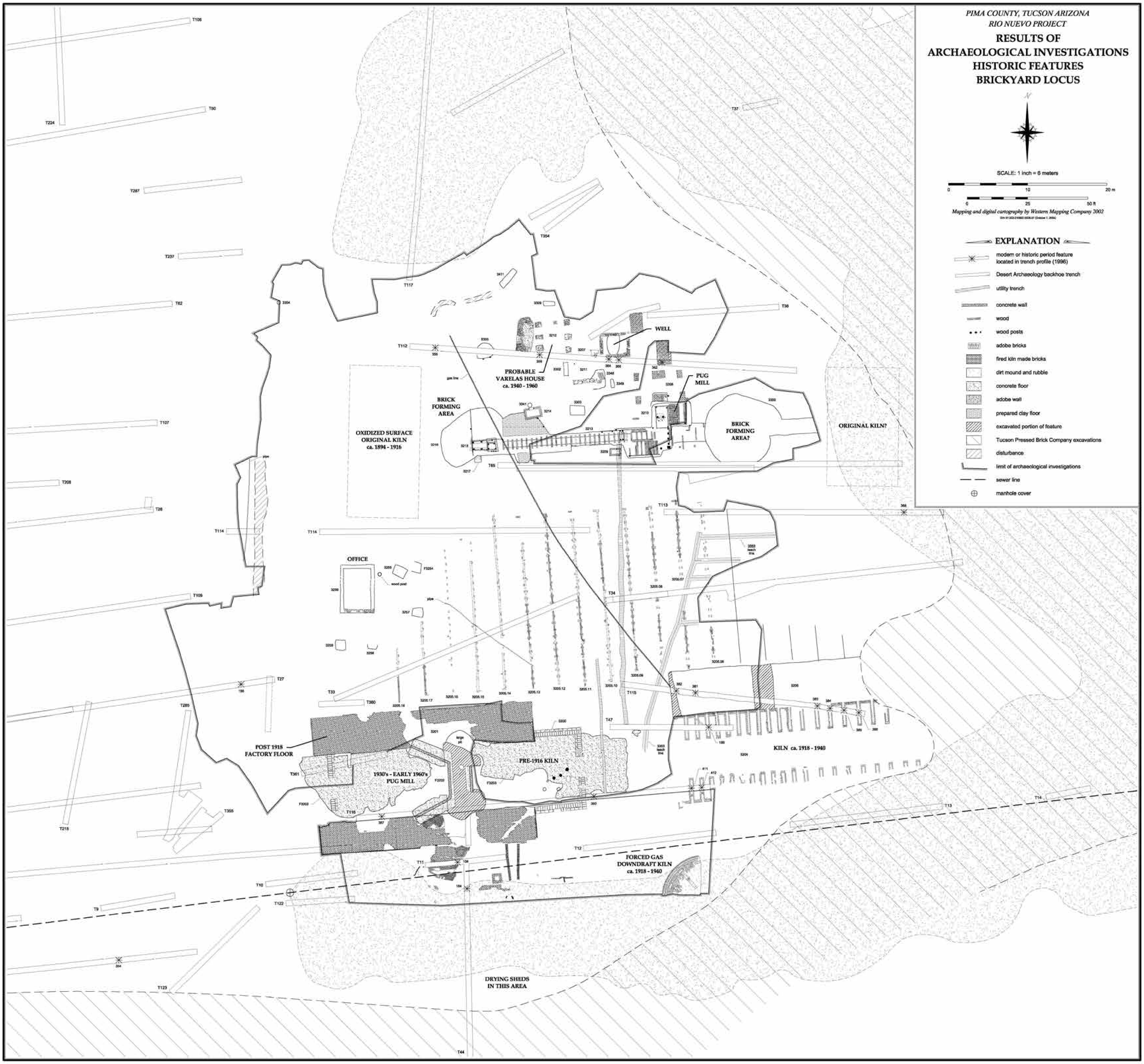

Figure 1.14. Map of historic archaeological features in the Brickyard locus, the Clearwater site, AZ BB:13:6 (ASM).

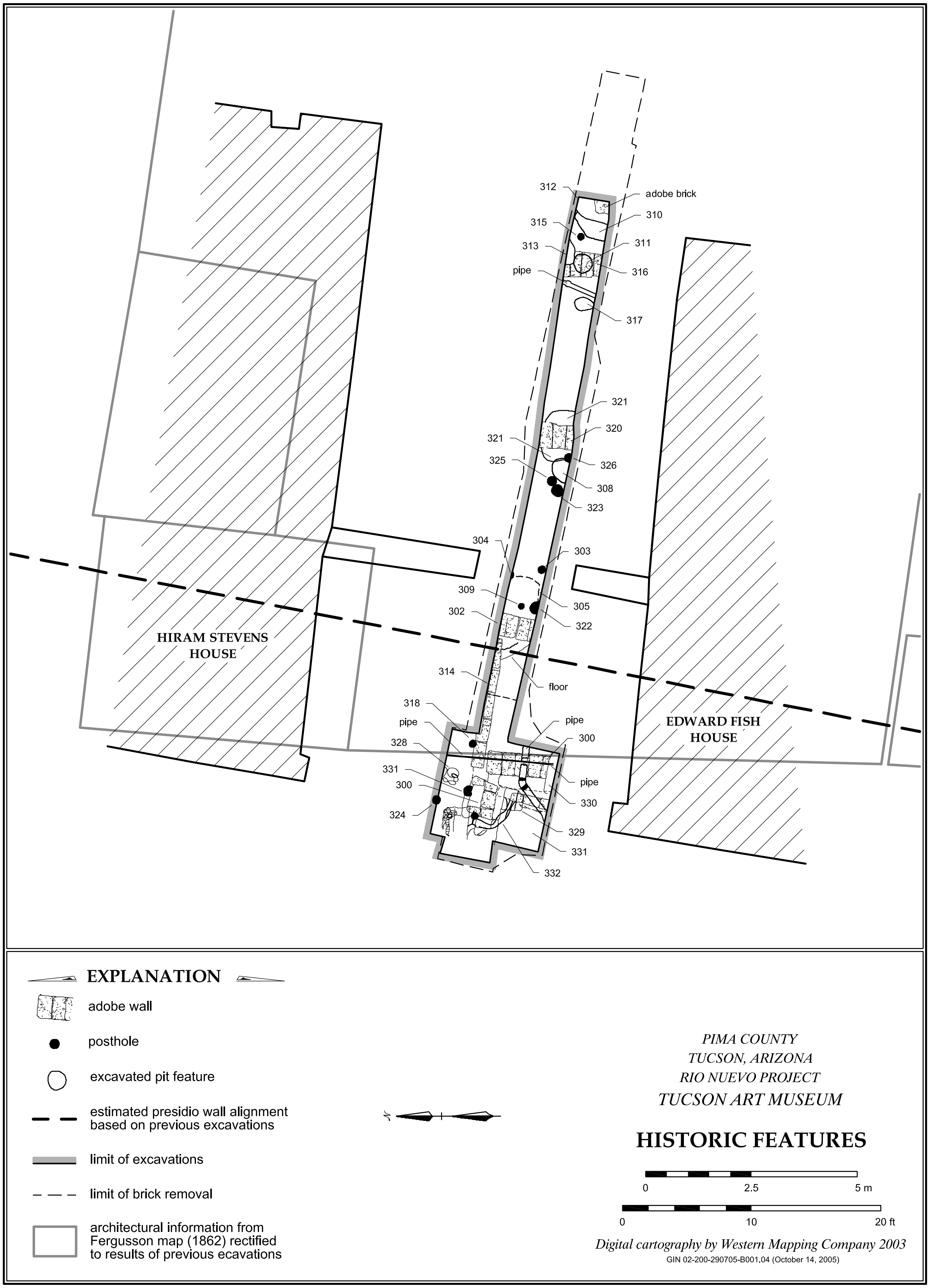

Figure 1.16. Map of historic archaeological features between the Stevens and Fish houses, Tucson Museum of Art, the Tucson Presidio, AZ BB:13:13 (ASM).

Archaeologists eventually found a small intact segment of the eastern wall, within 41 cm of where it was expected. The wall was 56 cm wide, in contrast to the tower foundations, which were 122 cm wide. The thicker walls were needed to support the height of the 6-m-tall tower. Inside the *torreón*, an adobe and stone post support was found, probably for a wooden walkway that lined the inside of the structure. Soldiers would have stood on the walkway and peered through the tower's gunports, allowing them to fire their muskets down the length of the wall.

A number of borrow pits, dug to mine dirt to make adobe, were found inside the presidio. These small pits were filled with trash, including: English ceramics from the 1820s to the 1840s; jars, tortilla griddles, bowls, and cups made by local Native Americans; brightly colored Mexican majolica pottery; musket balls and gun flints; beads; buttons; and a bone hair comb. Bones of cattle, sheep, and chickens indicate the presidio residents primarily ate domesticated animals. Charcoal recovered from flotation samples have revealed the types of plants eaten or used for firewood and building materials. Altogether, these items form the largest collection of presidio-occupation artifacts found since the excavations conducted during Tucson's Urban Renewal project, and they provide information that has not survived in written records about the lives of Tucson's presidio soldiers and their families.

Other Parking Lot Finds

Beneath the presidio-occupation features were four other pithouses, dating from the Hohokam Pioneer and Colonial periods (A.D. 500 to 950). At least six other pithouses have been found within 305 m of the parking lot, all dating to the same timespan. This suggests a small, relatively long-lived village was present on the eastern terrace above the Santa Cruz River floodplain, in what is now downtown Tucson. Residents of the village likely walked down from the terrace to care for their fields and canals in the floodplain.

Features postdating the presidio were also common in the parking lot. Archaeologists excavated two parking lots west of the 1954 dig area. In one corner, they found a borrow pit dating to the early 1900s, which yielded infant-food bottles, ceramic dolls, and a yellow-and-blue chamber pot and lid. In the opposite corner, an outhouse from the same period was found. Unfortunately, bottle hunters had dug into the area before the parking lot had been built, removing artifacts and destroying the upper portion of the feature.

The archaeologists then began stripping away soil layers in the 5.5-m by 4.6-m area. They came down onto a series of hard layers, formed where people had walked or purposely compacted the area. A series of postholes were found, once part of ramada-like structures built against the presidio wall in the 1850s and 1860s.

At the southwestern corner of the parking lot, workers excavated an area that contained a massive borrow pit filled with trash dating from the late 1870s to 1890s, probably dug for material to build the homes constructed on the block during the late nineteenth century. Large numbers of artifacts were found, including pieces of jewelry, a reconstructible Mexican ceramic canteen, marbles, and numerous tin can fragments. A pit found along the northern tower wall turned out to be a second outhouse pit, this one undisturbed by bottle hunters. When the upper fill was removed, medicine bottles, syringes, buttons, and even a kitchen sink were found. These American Territorial period artifacts were discarded by the Mexican, Anglo, and Chinese residents of the lot, individuals who lived in an adobe house and an apartment house from the early 1880s until the 1910s. After about 1915, trash collection began in Tucson, and most garbage was hauled to the dump. The artifacts recovered provide a good selection of items used in everyday life during this timespan.

A tour guide was on duty throughout the project. Approximately 1,500 people visited the site, with 500 attending a weekend open house, despite relatively poor publicity.

Figure 1.18. An archaeologist removes the time capsule from a pit inside a Hohokam pithouse, the Tucson Presidio, AZ BB:13:13 (ASM).

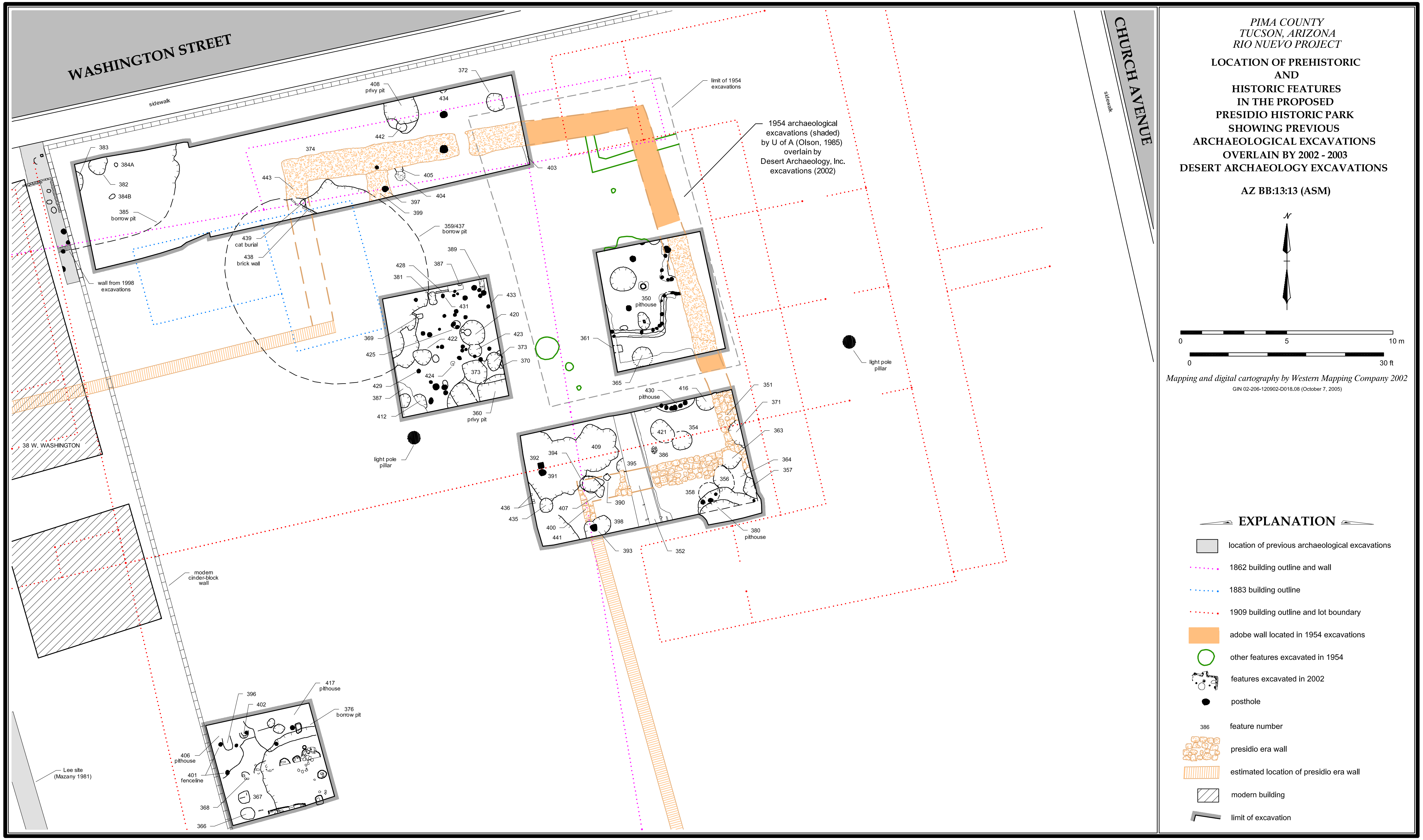

Figure 1.17. Map of archaeological features at the Tucson Presidio, AZ BB:13:13 (ASM).

Future Work at the Tucson Presidio

Historic and prehistoric era features and artifacts are well preserved beneath the parking lot. The best-preserved section of the Tucson Presidio is probably within this area. Any ground-disturbing activities in this area, such as the construction of new walls for the Tucson Origins Presidio Park, should be preceded by archaeological excavations. Many visitors to the site hope to see portions of the presidio tower wall and the underlying pithouse exhibited in some manner in the park.

Historical Research

In addition to archaeological fieldwork, Desert Archaeology has been conducting historical research. Family histories of all individuals who lived in Tucson prior to 1856 have been compiled and will be published in the near future.

Report Organization

Summary data on the archaeological features, artifacts, and historical data uncovered during the Rio Nuevo project are presented in this report. Each chapter is self-contained, with text, figures, tables, and reference materials. All project materials, including artifacts, samples, and fieldwork records, are curated at the Arizona State Museum (ASM).

Acknowledgments

A large number of people participated during the course of the project. Luis Gutierrez, former City of Tucson City Manager, conceived the use of tax increment financing to bring tax money back to the community for revitalization measures. Proposition 400 was placed on the ballot, and passed by a large margin in November 1999. The City of Tucson asked for proposals to conduct archaeological and historical research, and Desert Archaeology, Inc., submitted the winning proposal.

John Jones, the first director of the Rio Nuevo Project, and Karen Thoresen, the Assistant City Manager, were instrumental in helping the archaeological work. Marty McCune, the City of Tucson's Historic Program Administrator, served as the city's point person for the project. Her assistant, Kristi Jenkins, provided valuable assistance, as did J. T. Fey. Other City of Tucson personnel who helped make the projects run smoothly included John Updike, Lucy Amparano, Chris Leighton, and Mike Carson.

The archaeological field crew excavated in a variety of conditions. The crew consisted of Richard "Sonny" Antone, Jesse Ballenger, Patti Bell, Andrew Bockhurst, Avi Buckles, Brandy Ciaccio, Robert Ciaccio, Coya Coleman, Michael Cook, Patti Cook, Edward Corella, Frances Cote, Jennifer Dejong, Allen Denoyer, Steve Ditchler, John Fino, Ned Gaines, Diedre Hayden, Gloria Inserra, Adam Kiel, Tom Klimas, Michael Lindeman, Dottie Ohman, Fred Perry, Sara Plescia, Mary Prasciunas, Paul Rawson, Stacy Ryan, Ray Sanchez, Karl Seitz, Gaylen Tinsley, Catherine Treat, Ochirkhuyag Tseveendorj, Sandra Wadsworth, Greg Whitney, and Caramia Williams. Dan Arnit, owner of Innovative Excavating, performed most of the backhoe work for the project.

At times, specialists were asked to handle certain aspects of the excavation or analysis. John McClelland and Bob Dayhoff coordinated the excavation and analysis of human remains. Fred Nials provided information on site geomorphology. Western Mapping Company (formerly Geo-Map, Inc.) provided essential mapping assistance. Rachel Diaz de Valdez and Felicia Coppola-Pavao assisted in the analysis of the zooarchaeological materials. Charla Hedberg and Stacy Ryan conducted preliminary analysis of Native American ceramics. Stacy Ryan and Caramia Williams helped analyze historic artifacts.

Desert Archaeology's proposal called for an extensive public education program. Personnel from the Arizona Historical Society, supervised by Dr. Anne Woosley, Executive Director, and Thomas H. Peterson, Director of the Southern Arizona Division, spearheaded the effort to bring the Rio Nuevo Project to local residents and tourists. Staff members of the Education Department—Gwen Harvey, Kyle McKoy, Brooke Myers, and Emily Spargo-Guerrero— prepared a teacher's guide and elementary classroom activities book, hosted several lecture series, and mounted an impressive exhibit of Rio Nuevo archaeology. The construction of the exhibit required the skills of Kevin Mills and Leslie Roe, who built new cases, prepared elaborate enlarged photographs, and created an interactive children's backhoe. An earlier exhibit, "Carrillo's Chinese Gardeners," which opened at the Sosa-Carrillo-Frémont House Museum, was designed by curator Julia Arriola. Bruce Hilpert, Beth DeWitt, and Annamarie Schaecher of the Arizona State Museum coordinated efforts to bring the Rio Nuevo project to local grade schools.

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CHAPTER 2

EXCAVATION METHODS

J. Homer Thiel and Jonathan B. Mabry
Desert Archaeology, Inc.

From October 2000 through February 2003, archaeological testing and excavations at seven major locations within or close to downtown Tucson were conducted by Desert Archaeology, Inc. (see Figure 1.1). Two of the areas—one at the southeastern corner of Congress Street and Interstate 10 (I-10), and the other on the southern side of Congress Street west of I-10, are scheduled to be developed for new residences, businesses, and museums. The City of Tucson plans to create cultural parks at the three other locations—the San Agustín Mission, the Mission Gardens, and the Tucson Presidio, AZ BB:13:13 (ASM).

The archaeological research conducted for the Rio Nuevo Archaeology project had several goals, including the mitigation of archaeological resources in areas where development was to occur. Work in the planned cultural parks documented the range of cultural resources present and identified areas damaged by previous ground-disturbing activities. Selected features were also sought that would guide the planned reconstructions. Finally, artifacts and historical information was sought that will be used in future exhibits.

STANDARD EXCAVATION METHODS

A combination of mechanical and hand-excavation was used during the Rio Nuevo Archaeology project. Dan Arnit, Innovative Excavating, Inc., operated his backhoe during trenching and stripping of overburden. Trenches were excavated to a depth of 1.5 m (5.0 ft) below the present ground surface, with selected segments excavated to a depth of 3 m (10 ft) to expose the natural layers of the floodplain. The walls of these deeper segments were shored to ensure safety and compliance with OSHA requirements. The sides of the trenches were scraped by hand, and measured drawings were made of archaeological features visible in the trench sides.

Subsets of the identified cultural features were selected for hand-excavation. All hand-excavated sediments were screened through ¼-inch mesh. In certain instances, 1/8-inch mesh was used to ensure complete recovery of bones and other artifacts.

Standardized forms were used in all phases of the Rio Nuevo Archaeology project. These forms were entered into a computer database and then proofed to ensure that all data were correct. Black-and-white negative and color slide photographs were taken throughout the course of the project.

Artifacts were sorted and bagged by material type in the field. The bags were returned to the laboratory, and the information written on each bag was compared with the provenience catalogues to ensure accuracy. The artifacts were then washed, a sample labeled, and they were re-bagged and placed in archival storage boxes.

All field notes, photographs, artifacts, and samples created or discovered during the Rio Nuevo Archaeology project will be curated at the Arizona State Museum (ASM).

Prior to the start of the project, Desert Archaeology, Inc., consulted with ASM personnel, Native American groups, and Los Descendientes del Presidio de Tucson to prepare a burial agreement, identifying what actions should be taken if human remains were discovered during fieldwork. The agreement stated that all prehistoric burials were to be excavated after notification and were to be analyzed in the field. The human remains and their associated artifacts were to be repatriated to the Tohono O'odham Nation, as were the occasional isolated human bones found during the project. The burial agreement further specified that any historic-era burials located at the San Agustín Mission be left in place, unexcavated.

EAST OF INTERSTATE 10, AZ BB:13:510 (ASM)

Area 1 of the Rio Nuevo project is located within the former floodplain of the Santa Cruz River, east of the current channel. Historical documents indicate Area 1 was used predominantly for irrigated agriculture between the late seventeenth century and the late nineteenth century. During the 1690s, Father Eusebio Francisco Kino and Captain Juan Mateo Manje described irrigation canals and fields in the floodplain between A-Mountain and the Rillito. Canals and fields in Area 1 are recorded on the 1862 Fergusson map (see Figure 1.2). The 1883 Sanborn Fire Insurance Company map of Tucson shows a 3-m- (10-ft-) wide canal on the eastern side of the current location of Granada Avenue. Sanborn maps and other documents indicate the area was cultivated until the turn of the nineteenth century. During monitoring of recent construction projects and utility installations and replacements, archaeologists from Desert Archaeology have identified a possible prehistoric canal and two possible historic canals in this area.

From the mid-nineteenth century until an urban renewal project began in the late 1960s, Area 1 was on the margins of several historic barrios. It was just north of the historic El Membrillo and El Hoyo barrios, and just north and west of Barrio Libre (designated a National Register Historic District and a City of Tucson Historic District, and assigned the archaeological site number AZ BB:13:38 [ASM]). Barrio Libre was half razed during construction of the Tucson Community Center between 1969 and 1971; the remaining southern half is now called Barrio Historico (or Barrio Viejo). These predominantly Mexican-American neighborhoods were established between the 1850s and the 1880s.

Also just south of Area 1, at the northwestern corner of Simpson Street and Main Avenue, is the former location of "El Ojito," the spring that was Tucson's primary water source from presidio times until the 1880s. In the late nineteenth century, a privately operated park, called Carrillo's Gardens and later the Elysian Grove, was located slightly farther south. The park was west of Main Avenue, between Simpson and Seventeenth streets, and had a small lake between 1870 and the turn of the nineteenth century.

Previous Work

Previous archaeological monitoring, testing, and data recovery projects in Area 1 and surrounding areas—most of them conducted by Desert Archaeology—have documented several possible canals, both prehistoric and historic; a few possible Early Agricultural period (circa 2100 B.C.-A.D. 50) pit structures and surfaces with prehistoric artifacts; historical household features, such as trash pits, privy pits, and wells, and household debris dating between the 1870s and the 1930s; historical community trash dumps dating to the same interval; a few human burials dating to the Protohistoric period (circa A.D. 1450-1694); and a nineteenth-century Mexican-American burial (Ayres 1990; Faught 1993; Gilman 1997; Gilman and Swartz 1998; Heidke and Masse 1988; Levi 1997; Sliva 1997; Thiel 1996a).

Goals

Archaeological testing in Area 1 of the Rio Nuevo project was conducted in phases, according to when access was available to different portions. The goals of archaeological testing were to: (1) determine the nature, location, and condition of subsurface archaeological features; (2) assess the significance of those features in terms of the research questions identified in the Research Design for the Rio Nuevo archaeological program; and (3) obtain sufficient information to plan specific data recovery efforts.

Rio Nuevo Archaeological Work in Area 1

Archaeological work at the southeastern corner of the intersection of the I-10 frontage road and Congress Street was conducted in two phases. The first phase was in October 2000, in the area west of the train tracks and south of Congress Street. A series of nine east-west backhoe trenches was cut in the area, which was discovered to consist primarily of cienega clay, which develops in marshy areas. Although a small number of prehistoric and historic artifacts were found, no intact cultural features were revealed in this area.

The second phase occurred in 2001, with the excavation of eight additional trenches, six along the now-abandoned Southern Pacific Railroad tracks. Trenching resulted in the location of six features dating to the American Statehood period, all related to homes that once stood along Clark Street and Sentinel Avenue. The features were not likely to provide significant information and were not excavated. No additional work was conducted in this area.

THE SAN AGUSTÍN MISSION AND THE MISSION GARDENS, THE CLEARWATER SITE, AZ BB:13:6 (ASM)

The San Agustín Mission and the Mission Gardens, the Clearwater site, AZ BB:13:6 (ASM), are located south of the Clearwater property and are immediately east of Mission Road. They were explored in separate phases. The area was first occupied about 2,500 years ago, during the Cienega phase of the Early Agricultural period (Chapter 20, this report). A number of pithouses were found on, or to the west of, the mission area. Hohokam artifacts are also abundant in the area, suggesting use of the area between about 1,500 and 500 years ago. Father Kino documented a Piman village in the area in the 1690s.

The San Agustín Mission was established in the mid-1700s, with the convento built in the late 1790s to early 1800s. The mission included the convento, a chapel, a granary, and other outbuildings—all surrounded by a wall. Nearby were the Mission Gardens and a Piman village. The mission was abandoned by the 1840s, with the chapel falling down after 1854. The convento, however, remained in good condition until the late 1890s. By the 1940s, clay mining had encroached into the mission, and in the 1950s and 1960s, the City of Tucson used the area as a dump (Hard and Doelle 1978).

Previous Work

The San Agustín Mission was largely neglected by archaeologists until the 1940s. Prior to that time, the mission was the focus of treasure-hunting activities, which damaged the standing structures and subsurface remains. The University of Arizona conducted several excavations in the area between 1949 and 1956, mapping the convento and the chapel and recovering burials from several cemetery areas (Wasley 1956). The Arizona Historical Society explored the western side of the mission in 1967, exposing the granary and western compound wall; a report was not prepared for this project. In the mid-1970s, ASM tested the eastern portion of the mission, revealing that this area was disturbed (Hard and Doelle 1978).

In 1987, the Institute for American Research (now Desert Archaeology, Inc.) tested the parcel immediately west of Brickyard Lane and discovered Early Agricultural period pithouses and a house foundation dating to the mid-1800s (Elson and Doelle 1987). Jack Williams conducted excavations just south of the convento on the southern side of Mission Lane, discovering an *acequia* (canal). He also excavated test trenches in the Mission Gardens and exposed several wall alignments. However, a report on this work has not been completed, and the disposition of the recovered artifacts is unknown. In 2000, Desert Archaeology excavated a test unit in the Mission Gardens, revealing that prehistoric cultural features and deposits are preserved up to 1.0 m (3.3 ft) below the present ground surface (Dutt 2000).

Goals

The 1956 excavation by the University of Arizona documented the convento and chapel foundations. It was unclear if these were destroyed when the City of Tucson was using the area as a dump. A large pile of fill material lay on top of the mission, perhaps preserving undisturbed cultural resources.

Three areas in the mission complex were slated for testing and excavation: (1) the location of the main mission complex area at the northeastern corner of Mission Lane and Brickyard Lane; (2) the Mission Gardens; and (3) the area south of Mission Lane and east of the Mission Gardens where the location of features such as *acequias* (canals) and the Carrillo House were expected to be found.

Work at the mission site had several goals, one of which was to determine how much of the mission had survived clay mining and use of the area as a landfill between 1949 and 1960. Another goal was to discover and inventory features from other time periods to increase current understanding about the history of human use at the location.

Rio Nuevo Archaeological Work at the Mission

Archaeological work at the San Agustín Mission began in November 2000, and continued through early February 2001.

A series of 30 east-west backhoe trenches were cut across the project area and quickly delineated the zone of disturbance. Approximately 19 percent of the area within the mission walls had survived at least partially intact. The area beneath Mission Lane, directly south of the mission, was fairly intact, although an east-to-west water main had damaged some archaeological resources. Testing south of Mission Lane revealed that the northern boundary of the landfill present in that area, beginning approximately 15 m (50 ft) south of the southern side of Mission Lane.

After determining the boundaries of the undisturbed area of the mission, 16 additional backhoe trenches were cut to examine site stratigraphy or to confirm that the convento and chapel foundations had been destroyed in the 1950s. Afterward, a wide scraping blade was attached to the backhoe. The blade was used to strip away overburden down to undisturbed sediments. Features were typically located based on differences in sediment color and texture. Most features had been cut through the underlying greenish-brown cienega clays and were filled with either water-deposited light brown silts or redeposited cienega clays containing abundant charcoal and fire-cracked rocks.

A total of 204 features was discovered, including Cienega phase pithouses, pits, and canals; the mission granary; trash deposits and Native American burials dating to the mission occupation; the northern cemetery of the mission; Solomon Warner's millrace; and a well filled with trash by Chinese gardeners in the 1890s. Excavations were directed toward clearing the foundations of the granary, the western compound wall, and the southern wall of the northern cemetery. A sample of the other features discovered was selected for excavation, including Cienega phase pithouses, prehistoric and historic-era canals, mission-occupation trash middens, and other historic-era features. In all, 85 features (42 percent) of the documented features were partially or completely excavated. All excavated soils were screened through ¼-inch mesh screen, and all artifacts were collected.

Nine prehistoric human burial features were excavated, analyzed in the field, and repatriated to the Tohono O'odham Nation. The 13 mission-occupation burials discovered in the northern cemetery were left in place. Four canals and Solomon Warner's millrace were also discovered at the mission and were assigned site number AZ BB:13:481 (ASM). These features were profiled, and several excavation units were placed within the canals, allowing for the collection of artifacts and soil samples.

Rio Nuevo Archaeological Work at the Mission Gardens

The Mission Gardens, located at the southeastern corner of Mission Road and Mission Lane, were tested in November 2001 through January 2002. A total of 39 backhoe trenches were cut within and adjacent to the garden in an effort to identify the density and types of features present, trace irrigation canals, and determine the boundary between undisturbed sediments and the nearby 1950s landfill. In all, 100 features were documented during this project, 34 of which were partially or completely excavated. Additionally, 13 prehistoric and historic-era canals were assigned to site BB:13:481 and were documented through profiles and sediment samples, and their courses were mapped.

The rock foundations of the gardens were uncovered and mapped, where possible. Excavation of features was limited to two Early Ceramic period pithouses, the remnants of several historic-era structures, a historic-era well, and several pit features. All soil from the excavated features was screened through ¼-inch mesh, and all artifacts—except Native American ceramics smaller than a U.S. quarter—were collected. Fourteen Native American inhumations and cremations were discovered. These were excavated, analyzed in the field, and all human remains and associated artifacts were repatriated to the Tohono O'odham Nation.

A floorplan was made of the foundation of Warner's Mill, located on the western side of Mission Road, and the locations of nearby petroglyphs and bedrock mortars on the eastern slope of A-Mountain were mapped.

THE CONGRESS STREET AND BRICKYARD LOCI OF THE CLEARWATER SITE, AZ BB:13:6 (ASM)

Area 3 (also known as the Rio Nuevo South property) is located in the western floodplain of the Santa Cruz River, bounded on the east by the Santa Cruz River channel, on the north by Congress Street, on the west by private residences, and on the south by a privately owned bus maintenance facility. The northern part of this large area is referred to as the Congress Street locus, and the southern part is called the Brickyard locus. A series of investigations by Desert Archaeology personnel and others has identified and recovered limited data from prehistoric occupations dating back at least 4,100 years, numerous prehistoric and historic-era canals, and a historic brick factory (see "Previous Work" section below).

Historical documents indicate irrigation canals and fields, a brick factory, a welding shop, a grocery store, a private sports club, and several residences were located on the property between the late seventeenth century and the 1970s. Much of the surface has been disturbed by the agricultural, industrial, and residential uses of the property during the last 200 years. Large mounds of construction fill are currently located in the central and southern parts of the property.

Previous Work

The Rio Nuevo South property has been archaeologically surveyed several times in the last 25 years (the results of the first few surveys are summarized in Betancourt 1978). The Institute for American Research excavated seven trenches across the property as part of the Mission Road Extension testing project (Elson and Doelle 1987). No archaeological features were identified in those trenches (although several trenches contained bricks from the historic Tucson Pressed Brick Company), but numerous features were identified south of the property. Williams (1989) resurveyed this and other areas at the base of A-Mountain. He identified several possible archaeological sites, although site cards and information about what he found are not on file with ASM.

In 1993, Desert Archaeology personnel surveyed an area along the proposed right-of-way for a storm drain that crossed the property and identified surface evidence of several archaeological sites (Thiel 1993b). Subsequent borehole testing delimited the boundaries of trash deposits and deep subsurface disturbances created by the brick factory, as well as later landfill operations on the property (Thiel 1993a). In 1994, additional auger testing on the Rio Nuevo South property identified extensive undisturbed areas between the disturbed areas (Ahlstrom et al. 1994).

In March and April of 1995, Desert Archaeology personnel conducted archaeological testing on the Rio Nuevo South property, as well as on the remainder of the property (Thiel 1995a, 1995b). Sixty-eight trenches were excavated, revealing 104 potentially significant features. These included prehistoric burials, roasting pits, canals, pit structures, and a possible historic-era burial and portions of the brickyard.

A further testing stage was conducted by Desert Archaeology between October and December of 1995 (Diehl 1996). Nineteen additional trenches were excavated in the Rio Nuevo South property, and several more prehistoric and historic features were identified. These features included Early Agricultural period pit structures, pits, and burials; Hohokam period pithouses, pits, and burials; segments of prehistoric and historic canals; portions of the historic brick factory; and remains from late twentieth century uses of the area.

During the fall and winter of 1995, Desert Archaeology personnel conducted data recovery fieldwork concurrently with testing within the portion of the A-Mountain storm drain right-of-way that crossed the Rio Nuevo South property. Excavated prehistoric features, all dating to the Cienega phase (circa 800 B.C.-A.D. 50) of the Early Agricultural period, included two pithouses, 13 extramural pits, a trash midden, and a human burial (Diehl 1997). Archaeological remains of the Tucson Pressed Brick Company, in operation between the 1890s and the 1960s, were also excavated in the storm drain right-of-way where it crossed the Rio Nuevo South property (Diehl and Diehl 1996).

Goals

This area is the focus of planned construction for the City of Tucson's Rio Nuevo project on the western side of the Santa Cruz River. Plans were developed for the placement of new housing units, businesses, and museums on the property. This required the mitigation of the cultural resources present at the locality.

The first goal of data recovery in this area was to test previously untested areas with additional backhoe trenches. Several areas could not be tested during previous stages, either because certain parcels had not yet been acquired, or because they were covered with cement building foundations. In particular, this additional testing would help identify the alignments of canals across the property.

The second goal was to investigate the prehistoric occupations. Work focused on two areas where previous work had indicated that prehistoric features were concentrated, and it included exposure of the settlement layout, excavation of a representative sample of the range of pit structures and other features, and recovery of samples of artifacts and subsistence remains from both features and outdoor "trash" areas.

The third goal was to define, date, and sample the prehistoric and historic canals crossing the property. A series of carefully located short trenches were placed to reveal the alignments of canals and the designs of the canal systems, including primary and secondary canals, turnout structures, and other water-control features. Multiple cross sections through canals allowed reconstruction of gradients, flow capacities, and other engineering and hydraulic characteristics. The trenches also provided a range of contexts for sampling sediments that indicate flow characteristics and that provide materials for radiocarbon dating and biological indicators of environmental conditions.

The fourth goal was to further investigate the historic brick factory. The facilities of the Tucson Pressed Brick Company in the south-central part of the property were only partially excavated during a previous data recovery phase. During the Rio Nuevo Archaeology project, the layouts of other buildings were defined and their functions identified.

The fifth goal was to locate and excavate human burials on the property. A combination of trenching, horizontal exposure, and test excavations identified burials that would potentially be damaged through the proposed construction. All identified burials were excavated and treated according to a prior consultation agreement negotiated by ASM with groups claiming affinity.

The final goal was to examine the sequence of floodplain layers that record the history of the river and its floodplain in this location.

Rio Nuevo Archaeological Work in the Congress Street and Brickyard Loci

The first stage of fieldwork in this area was conducted in the summer and fall of 2001, and a second stage was carried out during the summer of 2002. Archaeologists excavated 100 new backhoe trenches to identify subsurface cultural features and to document canals. In Block 5 of the Congress Street locus, a grid of 2-m by 2-m excavation units was laid out; 38 of these units were excavated to extramural cultural deposits in strata 503 and 504. Within these strata, extramural deposits in the units were excavated in 10-cm levels. A total of 335 features, not including canals, was discovered during archaeological work, and 174 (52 percent) were partially or completely excavated. These ranged from 4,100-year-old pithouses and pits, to Cienega phase pithouses, to structures associated with the Tucson Pressed Brick Company. A total of 10 burials was found, and all were excavated, analyzed in field, and repatriated to the Tohono O'odham Nation. Eighteen prehistoric and historic-era canals from BB:13:481 were documented through profiles, mapping, and sediment sampling.

THE TUCSON PRESIDIO, AZ BB:13:13 (ASM)

The Tucson Presidio was located in the downtown core of the community, bounded by Washington Street, Church Avenue, Pennington Street, and Main Street. This area was a prehistoric Hohokam village over 1,000 years ago. Historic settlement began in 1775, when the Tubac Presidio was moved north to this location. By 1783, the thick adobe walls of the presidio were in place, protecting soldiers and civilians. The fortress stood until 1856, although within a few years of the American entrance into the community, the walls were dismantled and reused to build new structures.

Previous Work

Archaeological exploration of the presidio began in 1929, only 11 years after the last wall segment had been torn down. City Engineer Donald Page mapped the location of the eastern wall and collected bricks that were later used in a display (Thiel et al. 1995). Archaeologists from the University of Arizona uncovered the northeastern corner in 1954, also locating a Hohokam pithouse at this time (Olson 1985). The Tucson Urban Renewal project saw the excavation of a portion of the presidio cemetery, as well as a backyard area that yielded large numbers of artifacts (Barnes 1983).

In 1992, a Center for Desert Archaeology excavation located the eastern wall beneath the sidewalk of the Pima County Courthouse courtyard. The previous year, Desert Archaeology staff had excavated over 20 burials from the presidio cemetery, discovered in a gasline trench (Thiel et al. 1995). The presidio area was revisited in 1995, with excavations within Sunset Park; a foundation of a presidio-occupation structure was uncovered during this work (Thiel 1996b). The Center for Desert Archaeology excavated trenches around the perimeter of the walls in 1998 and 1999, ultimately discovering the western wall in the western lawn of City Hall (Thiel 2004). A few smaller projects have occurred within the area, including testing of the backyard west of the corner parking lot (Mazany 1981). Altogether, these projects indicate that, despite modern development of the area, many portions of the presidio have intact archaeological deposits.

Goals

The final report of the Tucson Origins project identifies the parking lot at the southwestern corner of Church Avenue and Washington Street as the primary area for interpretive development for the Tucson Presidio. However, due to uncertainties regarding the types of features and archaeological deposits and their degree of preservation, it is critical that this area be explored thoroughly. A second goal of the work in Area 2 was to more firmly document the full footprint of the presidio. The eastern and western walls are the best-documented, but what remains of the northern and southern walls is currently inadequately understood.

The primary focus of the Rio Nuevo project excavations within the presidio were at the northeastern corner of the fort—today, a parking lot located at the southwestern corner of Church Avenue and Washington Street. The parking lot was the location of the 1954 excavations by the University of Arizona, during which a thick adobe wall and a puddled adobe wall that formed a corner were discovered (Olson 1985). This is probably either the corner of the wall or the foundation of a corner *torreón* (tower).

Work in the parking lot was directed toward answering the following questions. (1) Is the section found in 1954 the presidio wall? (2) Do other sections of the wall survive? (3) Are other presidio-occupation structures or features present inside the walls? (4) How was the area used during the American Territorial period? (5) Are additional prehistoric pithouses and features present?

Rio Nuevo Archaeological Work at the Tucson Presidio

Work was conducted in three locations within the boundaries of the Tucson Presidio. Project RNA 9 consisted of the excavation of two 1-m by 2-m units on the eastern side of the 1929 Pima County Courthouse and the excavation of a long trench between the Edward Nye Fish and Hiram S. Stevens houses on the eastern side of Main Avenue. The courthouse work resulted in the discovery of one feature, a portion of the foundation of the 1883 City Firehouse. Both units revealed that intact Territorial period archaeological deposits were present several meters below the current ground surface, similar to a previous excavation conducted in the courtyard of the courthouse in 1992 (Thiel et al. 1995).

The work between the Fish and Stevens houses was conducted in February 2002, and resulted in the discovery of 34 archaeological features, all of which were excavated. The features included adobe walls, compact ground surfaces, postholes, and a dog burial. Most of the features and artifacts uncovered dated to the occupation of the presidio. The adobe walls were left in place and covered with protective fabric. The area was later covered with fine gravel and a modern room was built over the area.

Work beneath the parking lot installed in 1954 at the southwestern corner of Church Avenue and Washington Street was conducted between November 2002 and February 2003. Because the lot was to remain in use after the project was completed, only a limited number of parking spaces could be made available. Eventually 15 spaces, each measuring about 15 ft by 9 ft, and two corner areas where parking did not take place, were opened up. A backhoe was used to remove the asphalt and strip a small amount of soil down to undisturbed sediments. An area previously excavated in 1954 was reopened, revealing a Hohokam pithouse and a segment of a wide adobe wall. Most of the remaining areas had not been previously excavated. Work uncovered a total of 85 features, ranging from Hohokam pithouses and adobe walls, to large trash-filled borrow pits. All of the features were partially or completely excavated.

All in situ soil excavated at these three locations was hand-excavated and screened through ¼-inch mesh. All artifacts were collected except Native American ceramics smaller than a U.S. quarter. Large numbers of flotation samples were collected. Consequently, a large number of artifacts, animal bone, and macrobotanical materials were recovered.

SUMMARY

In all, archaeologists located 764 archaeological features and 36 irrigation canals during the course of the Rio Nuevo Archaeology project. Of the non-canal features, 412 (54 percent) were excavated according to the procedures described here. This approach yielded a large amount of data about the prehistory and history of Tucson. Excavated features are described in detail in Chapter 4 (this volume).

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CHAPTER 3

CULTURAL HISTORY OF THE TUCSON BASIN AND THE PROJECT AREA

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Over the last century, archaeologists have documented the long history of human activities in southern Arizona. Excavations ranging from Paleoindian mammoth kill sites to 1940s trash dumps have allowed reconstruction of the prehistory of the region and added depth to understanding of the Historic era. A basic outline of the cultural history of the region and a discussion of previous research in the project area are presented in this chapter.

CULTURAL BACKGROUND

The history of the Southwest and the Tucson Basin is marked by a close relationship between people and the natural environment. Environmental conditions have strongly influenced subsistence practices and social organization, and social and cultural changes have, in turn, made it possible to more efficiently exploit environmental resources. Through time, specialized adaptations to the arid region distinguished people living in the Southwest from those in other areas. Development of cultural and social conventions also became more regionally specific, and by A.D. 650, groups living in the Tucson Basin can be readily differentiated from those living in other areas of the Southwest. Today, the harsh desert climate no longer isolates Tucson and its inhabitants, but life remains closely tied to the unique resources of the Southwest. The chronology of the Tucson Basin is summarized in Table 3.1.

Paleoindian Period (11,500?-7500 B.C.)

Artifact finds suggest the Tucson Basin was initially occupied some 13,000 years ago, a time wetter and cooler than today. The Paleoindian period is characterized by small, mobile groups of hunter-gatherers who briefly occupied temporary campsites as they moved across the countryside in search of food and other resources (Cordell 1997:67). The hunting of large mammals, such as mammoth and bison, was a particular focus of the subsistence economy. A Clovis fluted spear point characteristic of the early Paleoindian period (circa 11,500-11,000 B.C.) was collected from the Valencia site, AZ BB:13:74 (ASM), located along the Santa Cruz River in the southern Tucson Basin (Doelle 1985:181-182). Another fluted Paleoindian point was found in Rattlesnake Pass, in the northern Tucson Basin (Agenbroad 1967). These rare finds suggest prehistoric use of the Tucson area probably began at this time. Post-Clovis occupation of the Tucson Basin by Paleoindian groups is indicated by Plainview-like, unfluted spear points found in several locations (Mabry 1998:47). Paleoindian use of the Tucson Basin is supported by archaeological investigations in the nearby San Pedro Valley and elsewhere in southern Arizona, where Clovis points have been discovered in association with extinct mammoth and bison remains (Huckell 1993, 1995). However, because Paleoindian occupation sites have yet to be found in the Tucson Basin, the extent and the intensity of this occupation are unknown.

Archaic Period (7500-2100 B.C.)

The transition from the Paleoindian period to the Archaic period was accompanied by marked climatic changes. By the end of this time, the environment came to look much like it does today. Archaic period groups pursued a mixed subsistence strategy, characterized by intensive wild plant gathering and the hunting of small animals. The only Early Archaic (7500-6500 B.C.) site known from the Tucson Basin is found in Ruelas Canyon, south of the Tortolita Mountains (Swartz 1998:24). However, Middle Archaic sites dating between 3500 and 2100 B.C. are known from the bajada zone surrounding Tucson, and, to a lesser extent, from floodplain and mountain areas. Recent investigations conducted at Middle Archaic sites include excavations along the Santa Cruz River (Gregory 1999), and in the northern Tucson Basin (Roth 1989) and the southern foothills and bajada of the Santa Catalina Mountains (Chavarria 1996; Dart 1984, 1986; Douglas and Craig

Table 3.1. Periodization and chronology of the Santa Cruz Valley-Tucson Basin.

Era/Period	Phase	Date Range
Historic		
American Statehood	—	A.D. 1912-present
American Territorial	—	A.D. 1856-1912
Mexican	—	A.D. 1821-1856
Spanish	—	A.D. 1694-1821
Protohistoric	—	A.D. 1450-1694
Prehistoric		
Hohokam Classic	Tucson	A.D. 1300-1450
	Tanque Verde	A.D. 1150-1300
Hohokam Sedentary	Late Rincon	A.D. 1100-1150
	Middle Rincon	A.D. 1000-1100
	Early Rincon	A.D. 950-1000
Hohokam Colonial	Rillito	A.D. 850-950
	Cañada del Oro	A.D. 750-850
Hohokam Pioneer	Snaketown	A.D. 700-750
	Tortolita	A.D. 500-700
Early Ceramic	Late Agua Caliente	A.D. 350-500
	Early Agua Caliente	A.D. 50-350
Early Agricultural	Late Cienega	400 B.C.-A.D. 50
	Early Cienega	800-400 B.C.
	San Pedro	1200-800 B.C.
	(Unnamed)	2100-1200 B.C.
Archaic	Chiricahua	3500-2100 B.C.
	(Occupation gap?)	6500-3500 B.C.
	Sulphur Springs-Ventana	7500-6500 B.C.
Paleoindian		11,500?-7500 B.C.

1986). Archaic period sites in the Santa Cruz floodplain were found to be deeply buried by alluvial sediments, suggesting more of these sites are present, but undiscovered due to the lack of surface evidence.

Early Agricultural Period (2100 B.C.-A.D. 50)

The Early Agricultural period (previously called the Late Archaic period) was when domesticated plant species were first cultivated in the Greater Southwest. The precise timing of the introduction of cultigens from Mexico is not known, although direct radiocarbon dates on maize (corn) indicate it was being cultivated in the Tucson Basin and several other portions of the Southwest by 2100 B.C. (Mabry 2006). By at least 400 B.C., groups were living in substantial agricultural settlements in the floodplain of the Santa Cruz River. Recent archaeological investigations suggest canal irrigation also began sometime during this period.

Several Early Agricultural period sites are known from the Tucson Basin and its vicinity (Diehl 1997; Ezzo and Deaver 1998; Freeman 1998; Gregory 2001; Huckell and Huckell 1984; Huckell et al. 1995; Mabry 1998; Mabry, ed. 2006; Roth 1989). While there is variability among these sites—probably due to the 2,150 years included in the period—all excavated sites to date contain small, round, or oval semisubterranean pithouses, many with large internal storage pits. At some sites, a larger round structure is also present, which is thought to have been for communal or ritual purposes.

Stylistically distinctive Cienega, Cortaro, Empire, and San Pedro type projectile points are common at Early Agricultural sites, as are a range of ground stone and flaked stone tools, ornaments, and marine shell jewelry (Diehl 1997; Mabry 1998). The fact that marine shell and some of the material used for stone tools and ornaments were not locally available in the Tucson area suggests trade networks were operating. Agriculture, particularly the cultivation of maize, was important in the diet and increased in importance through time. However, gathered wild plants—such as tansy mustard and amaranth seeds, mesquite seeds and pods, and agave hearts—were also frequently used resources. As in the preceding Archaic period, the hunting of animals such as deer, cottontail rabbits, and jackrabbits continued to provide an important source of protein.

Early Ceramic Period (A.D. 50-500)

Although ceramic artifacts, including figurines and crude pottery, were first produced in the Tucson Basin at the beginning of the Early Agricultural period (Heidke and Ferg 2001; Heidke et al. 1998; Chapter 7, this volume), the widespread use of ceramic containers marks the transition to the Early Ceramic period (Huckell 1993). Undecorated plain ware pottery was widely used in the Tucson Basin by about A.D. 50, marking the start of the Agua Caliente phase (A.D. 50-500).

Architectural features became more formalized and substantial during the Early Ceramic period, representing a greater investment of effort in construction, and perhaps more permanent settlement (Wallace 2003). A number of pithouse styles are present throughout this period, including small, round, and basin-shaped houses, as well as slightly larger subrectangular structures. As during the Early Agricultural period, a class of significantly larger structures may have functioned in a communal or ritual manner during the Early Ceramic period.

Reliance on agricultural crops continued to increase, and a wide variety of cultigens—including maize, beans, squash, cotton, and agave—were an integral part of the subsistence economy. Populations grew as farmers expanded their crop production to floodplain land near permanently flowing streams, and canal irrigation systems are also assumed to have expanded. Evidence from archaeological excavations indicates trade in shell, turquoise, obsidian, and other materials intensified and new trade networks developed.

Hohokam Sequence (A.D. 500-1450)

The Hohokam tradition developed in the deserts of central and southern Arizona sometime around A.D. 500, and is characterized by the introduction of red ware and decorated ceramics: red-on-buff wares in the Phoenix Basin and red-on-brown wares in the Tucson Basin (Doyel 1991; Wallace et al. 1995). Red ware pottery was introduced to the ceramic assemblage during the Tortolita phase (A.D. 500-700). The addition of a number of new pottery vessel forms suggests that, by this time, ceramics were utilized for a multitude of purposes.

Through time, Hohokam artisans embellished pottery with highly distinctive geometric figures and life forms such as birds, humans, and reptiles. The Hohokam diverged from the preceding periods in a number of other important ways: (1) pithouses were clustered into formalized courtyard groups, that, in turn, were organized into larger village segments, each with their own roasting area and cemetery; (2) new burial practices appeared (cremation instead of inhumation), in conjunction with special artifacts associated with death rituals; (3) canal irrigation systems were expanded and, particularly in the Phoenix Basin, represented huge investments of organized labor and time; and (4) large communal or ritual features, such as ballcourts and platform mounds, were constructed at many village sites.

The Hohokam sequence is divided into the pre-Classic (A.D. 500-1150) and Classic (A.D. 1150-1450) occupations. At the start of the pre-Classic, small pithouse hamlets and villages were clustered around the Santa Cruz River. However, beginning about A.D. 750, large, nucleated villages were established along the river or its major tributaries, with smaller settlements in outlying areas serving as seasonal camps for functionally specific tasks such as hunting, gathering, or limited agriculture (Doelle and Wallace 1991). At this time, large, basin-shaped features with earthen embankments, called ballcourts, were constructed at a number of riverine villages. Although the exact function of these features is unknown, they probably served as arenas for playing a type of ball game, as well as places for holding religious ceremonies and for bringing different groups together for trade and other communal purposes (Wilcox 1991; Wilcox and Sternberg 1983).

Between A.D. 950 and 1150, Hohokam settlement in the Tucson area became even more dispersed, with people utilizing the extensive bajada zone as well as the valley floor (Doelle and Wallace 1986). An increase in population is apparent, and both functionally specific seasonal sites, as well as more permanent habitations, were now situated away from the river; however, the largest sites were still on the terraces just above the Santa Cruz. There is strong archaeological evidence for increasing specialization in ceramic manufacture at this time, with some village sites producing decorated red-on-brown ceramics for trade throughout the Tucson area (Harry 2000; Heidke 1988, 1996; Huntington 1986).

The Classic period is marked by dramatic changes in settlement patterns and possibly in social organization. Aboveground adobe compound architecture appeared for the first time, supplementing, but not replacing, the traditional semisubterranean pithouse architecture (Haury 1928; Wallace 1995). Although maize agriculture was still the primary subsistence focus, extremely large Classic period rock-pile field systems associated with the cultivation of agave have been found in both the northern and southern portions of the Tucson Basin (Doelle and Wallace 1991; Fish et al. 1992).

Platform mounds were also constructed at a number of Tucson Basin villages sometime around A.D. 1275-1300 (Gabel 1931). These features are found throughout southern and central Arizona and consist of a central structure that was deliberately filled to support an elevated room upon a platform. The function of the elevated room is unclear; some were undoubtedly used for habitation, while others may have been primarily ceremonial. Building a platform mound took organized and directed labor, and the mounds are thought to be symbols of a socially differentiated society (Doelle et al. 1995; Elson 1998; Fish et al. 1992; Gregory 1987). By the time platform mounds were constructed, most smaller sites had been abandoned, and Tucson Basin settlement was largely concentrated at only a half-dozen large, aggregated communities. Other research has suggested that aggregation and abandonment in the Tucson area may be related to an increase in conflict and possibly warfare (Wallace and Doelle 1998). By A.D. 1450, the Hohokam tradition, as presently known, disappeared from the archaeological record.

Protohistoric Period (A.D. 1450-1694)

Little is known of the period from A.D. 1450, when the Hohokam disappeared, to A.D. 1694, when Father Eusebio Francisco Kino first traveled to the Tucson Basin (Doelle 1984). By that time, the Tohono O'odham people were living in the arid desert regions west of the Santa Cruz River, and groups who lived in the San Pedro and Santa Cruz valleys were known as the Sobaipuri (Doelle and Wallace 1990; Masse 1981). Both groups spoke the Piman language and, according to historic accounts and archaeological investigations, they lived in oval jacal surface dwellings rather than pithouses. One of the larger Sobaipuri communities was located at Bac, where the Spanish Jesuits, and later the Franciscans, constructed the mission of San Xavier del Bac. However, due to the paucity of documents and archaeological research, little can be said regarding this inadequately understood period.

Spanish and Mexican Periods (A.D. 1694-1856)

Spanish exploration of southern Arizona began at the end of the seventeenth century A.D. Early Spanish explorers in the Southwest noted the presence of Native Americans living in what is now the Tucson area. These groups comprised the largest concentration of population in southern Arizona (Doelle and Wallace 1990). In 1757, Father Bernard Middendorf arrived in the Tucson area, establishing the first local Spanish presence. Fifteen years later, the construction of the San Agustín Mission near a Native American village at the base of A-Mountain was initiated, and by 1773, a church was completed (Dobyns 1976:33).

In 1775, the site for the Presidio of Tucson was selected on the eastern margin of the Santa Cruz River floodplain. In 1776, Spanish soldiers from the older presidio at Tubac moved north to Tucson, and construction of defensive and residential structures began. The Presidio of Tucson was one of several forts built to counter the threat of Apache raiding groups who had entered the region at about the same time as the Spanish (Thiel et al. 1995; Wilcox 1981). Spanish colonists soon arrived to farm the relatively lush banks of the Santa Cruz River, to mine the surrounding hills, and to graze cattle. Many indigenous settlers were attracted to the area by the availability of Spanish products and the relative safety provided by the presidio. The Spanish and Native American farmers grew corn, wheat, and vegetables, and cultivated fruit orchards, and the San Agustín Mission was known for its impressive gardens (Williams 1986).

In 1821, Mexico gained independence from Spain, and Mexican settlers continued farming, ranching, and mining activities in the Tucson Basin. By 1831, the San Agustín Mission had been abandoned (Elson and Doelle 1987; Hard and Doelle 1978), although settlers continued to seek protection within the presidio walls.

American Territorial and American Statehood Periods (1856-Present)

Through the 1848 settlement of the Mexican-American War and the 1853 Gadsden Purchase, Mexico ceded much of the Greater Southwest to the United States, establishing the international boundary at its present location. The U.S. Army established its first outpost in Tucson in 1856, and in 1873, Fort Lowell was moved from town to the confluence of the Tanque Verde Creek and Pantano Wash, to become a major base for the final campaigns to pacify the Apache.

Railroads arrived in Tucson and the surrounding areas in the 1880s, opening the floodgates of Anglo-American settlement. With the surrender of Geronimo in 1886, Apache raiding ended, and the region's settlement boomed. Local industries associated with mining and manufacturing continued to fuel growth, and the railroad supplied the Santa Cruz River valley with commodities it could not produce locally. Homesteaders established numerous cattle ranches in outlying areas, bringing additional residents and income to the area.

By the turn of the century, municipal improvements to water and sewer service, and the eventual introduction of electricity, made life in southern Arizona more hospitable (Mabry et al. 1994). New residences and businesses continued to appear within an ever-widening perimeter around Tucson, and city limits stretched to accommodate the growing population. Tourism, the health industry, and activities centered around the University of Arizona and Davis-Monthan Air Force Base have contributed significantly to growth and development in the Tucson Basin in the twentieth century (Sonnichsen 1982).

PREVIOUS ARCHAEOLOGICAL RESEARCH

The Prehistory of the Mission, Brickyard, and Congress Street Loci

Archaeologists have worked in the Tucson area for over 100 years, mapping and excavating sites and collecting artifacts. Until recently, there was less fieldwork in the floodplain of the Santa Cruz River than in other areas, due to either the decreased visibility of sites in this zone or because development occurred elsewhere.

The area west of the Santa Cruz River and south of Congress Street was first investigated in the late 1940s through 1956, during salvage projects at the San Agustín Mission. Archaeologists excavating a portion of the northern mission cemetery found an Early Agricultural period pit structure with ground stone artifacts resting on its floor (Wasley 1956). At that time, this was one of only a few pit structures from that time period excavated in southern Arizona.

Betancourt (1978) surveyed the banks of the Santa Cruz River in the 1970s. His work indicated that portions of the San Agustín Mission complex had survived clay mining and landfill activities. Unfortunately, the Hohokam village site south of Mission Lane, AZ BB:13:22 (ASM), had been destroyed by the landfill in this area.

In the mid-1980s, the City of Tucson planned to reroute Mission Road through the area. The Institute for American Research (later Desert Archaeology, Inc.) conducted test trenching from Congress Street south to Mission Lane. A cluster of Early Agricultural period pithouses and pits was found west of Brickyard Lane, across the street from the former mission. An isolated Hohokam burial was found nearby. The Early Agricultural component (later determined to be Cienega phase, circa 800 B.C.-A.D. 50) contained at least 14 pithouses, 10 possible pithouses or living surfaces, and 14 pits, indicating a substantial settlement was present in the area (Elson and Doelle 1987). The road project was never completed due to protests of historic preservationists and neighborhood residents, and no further work was conducted at the site.

Plans for a drainage system leading from the base of A-Mountain (Sentinel Peak) east to the Santa Cruz River led to an archaeological testing project in 1995, that was later expanded to include the entire Rio Nuevo South property. Several dozen prehistoric features were located, including Cienega phase pithouses, prehistoric pits, a Hohokam burial, and canals (Thiel 1995a, 1995b). The following year saw excavation of that portion of the prehistoric site within the drainage system and additional testing throughout the property. The work indicated that a Cienega phase village underlay the former Tucson Pressed Brick Company factory. Numerous canals ran through the nearby property, generally trending south to north. Occasional Hohokam burials were scattered about the area (Diehl 1996, 1997). Plans to redevelop the Rio Nuevo South parcel failed to coalesce, and no further work was conducted.

The previous archaeological projects indicated that one or more Cienega phase villages were present in the area south of Congress Street extending to Mission Lane, and from the western side of the Santa Cruz River west to the base of A-Mountain. Clusters of pithouses were present in several areas, although the presence of clay mining pits and modern housing prevented a determination about whether they represented a single large community or several small ones.

The later Hohokam used the area as irrigated agricultural fields. Occasional fieldhouses were constructed in field areas, and a larger village was probably once present in the area south of Mission Lane, and subsequently destroyed by landfill activities in the 1950s. Many Hohokam features were probably lost due to the historic-era plowing of fields.

The Prehistory of Downtown Tucson

The Spanish and Mexican soldiers of the presidio and the later American Territorial period villagers probably found many pieces of Hohokam pottery scattered about the downtown area. However, it is unlikely that they understood the long history of their community.

In 1943, ditchdiggers found a pair of decorated Hohokam pots on Block 184, at the northwestern corner of Alameda Street and Court Avenue. Efforts to locate prehistoric features on the block were unsuccessful (*Arizona Daily Star* 1943). In December 1954, work at the southwestern corner of Church Avenue and Washington Street located a Rillito phase Hohokam pithouse lying beneath a presidio-occupation wall (Olson 1985). Additional work on the block documented portions of four other pithouses and several pits (Diehl 1999; Gilman 1997; Mazany 1981; Thiel 1998).

Work on the block to the east in the late 1980s uncovered several pithouses, a probable fieldhouse, and several pits (Ciolek-Torrello and Swanson 1997). The installation of a gasline down Alameda Street resulted in the discovery of a possible pithouse and seven pits of varying function (Thiel et al. 1995). Test trenching of the western lawn of City Hall also located two pithouses (Thiel 2004).

Ceramic analysis suggests occupation began during the Early Ceramic period (A.D. 50-500) and was most intense during the Rillito phase of the Colonial period to the Rincon phase of the Sedentary period (roughly A.D. 850 to 1150). Most of the documented Hohokam features (12 pithouses and 14 pits) found prior to the Rio Nuevo project date in this time frame. A few Classic period sherds have also been recovered, but it is uncertain if there was actually an occupation during this time period or if these ceramic sherds arrived in the downtown area incorporated into adobe bricks.

The area between the terrace edge and the Santa Cruz River was probably utilized as irrigated agricultural fields. Test trenching at one parcel, located between Alameda Street and Franklin Street west of Granada Avenue, resulted in the discovery of numerous Hohokam canals (Thiel 2005).

The San Agustín Mission

When Father Kino visited the Piman village of *Schook-shon* in 1694, located at the base of a small peak known today as A-Mountain, he found a community of several hundred Native Americans. He made several trips to the village, establishing San Agustín as a *visita*, a visiting mission, of the larger Mission of San Xavier del Bac, located to the south (Dobyns 1976). There was never a permanent priest at San Agustín, although Father Middendorff spent a few months there in 1757, before fleeing to San Xavier after his Piman parishioners rebelled.

In 1762, the Sobaipuri Pima living along the San Pedro River moved to San Agustín (Dobyns 1976). In 1770, the residents debated a move to the Gila River, although this was prevented by the Spaniards. In response, the residents asked that a chapel be built, which was completed the following year. The movement of the presidio north from Tubac in 1776 resulted in conflicts over the usage of water and agricultural fields (Dobyns 1976).

The church at San Xavier del Bac was completed in 1797, and the architects likely came to Tucson and planned the completion of the San Agustín Mission. The chapel was remodeled, and a two-story convento was built, as were walls enclosing the mission and the nearby Mission Gardens. A granary, a kitchen, and other outbuildings were also completed. The mission was to be used as a school to teach local Native Americans, but no records supporting this claim have ever been found (Dobyns 1976; Lockwood and Page 1930:21-23).

By the 1820s, the local Native American population was dying out and the mission was largely abandoned. An 1843 description of the mission indicates the chapel was falling down and the convento was having problems with its roof (McCarty 1997). The chapel fell into ruins between 1862 and 1880. The construction of Leopoldo Carrillo's house on the southern side of Mission Lane in the late 1860s included the removal of roofing timbers from the convento, hastening the destruction of that building. The convento became a popular picnic location in the 1890s, and it was often photographed. The pictures showed the gradual collapse of the structure, which may have been accelerated by the 1887 earthquake.

No effort was made to save the mission, and treasure hunters scoured the ruins in search of mythical Jesuit gold; this continued into the 1920s. By the 1950s, only a single wall of the convento stood, and this was lost in the 1950s when the City of Tucson began using an adjacent clay and sand mining pit as a sanitary landfill. A few residents of the community tried to save the mission, but there was no interest among local politicians. University of Arizona archaeologists conducted some excavations between 1949 and 1956, recovering human burials and mapping the chapel and convento. Afterward, large portions of the mission were bulldozed to provide fill for the landfill. A 1967 project conducted by the Pioneers Society (today, the Arizona Historical Society) revealed that the foundations of the granary had survived. A road construction project in the mid-1980s was originally designed to reroute Mission Road past the mission (Hard and Doelle 1978). The outcry by historic preservationists and Menlo Park residents led the City of Tucson to abandon the project. When the Rio Nuevo Archaeology project began, a few stones from the western compound wall foundation were the only visible sign of the mission.

The Tucson Presidio

Captain Hugo O'Conor selected the location for the Tucson Presidio on 20 August 1775—an area on the terrace on the eastern side of the Santa Cruz River. The following year, the soldiers stationed at the Tubac Presidio moved north. A temporary wooden palisade was constructed, but completion of the fort was slowed by fiscal mismanagement. An attack by Apaches in May 1782, during which the fort was nearly overwhelmed, led to the completion of an enclosing adobe wall by the following year (Officer 1989).

The Tucson Presidio was intended to close off the northern frontier from Apache attacks and prevent other European powers from claiming the region. The fortress was manned by about 100 soldiers; an additional 300 retired soldiers, civilians, and family members lived in the community. The soldiers worked in the nearby agricultural fields and watched over herds of horses and cattle. Every few months, they participated in campaigns against the Apaches. These campaigns decreased in the 1790s, when a policy of pacifying the Apaches led a number of groups to establish camp near the presidio (Officer 1989).

The 1810s saw increased political unrest in Mexico, and Tucson soldiers were sent to fight rebels. However, Mexico achieved independence in 1821, and although the Tucson Presidio continued to operate, funding levels were dramatically cut. An increase in Apache raiding led to the abandonment of neighboring communities, and Tucson became very isolated. During the passage of the Mormon Battalion in 1846 and 49ers heading to California in 1849 and 1850, frequent mention was made of the poor state of local residents. The Gadsden Purchase of 1853 led to the turnover of southern Arizona to the United States in 1854, but Mexican soldiers stayed on until the first American soldiers arrived in March 1856 (Officer 1989).

Afterward, the Tucson Presidio's adobe walls were rapidly dismantled as the village increased in size and the fortress was no longer needed. The last standing presidio-occupation building was torn down in 1911, and the last piece of the wall was removed in 1918. Efforts to mark the location of the wall began shortly after, and the first archaeological work was conducted in 1929, as the domed Pima County Courthouse was constructed. City Engineer Donald Page recovered adobe bricks from the western wall and placed some in a display. In December 1954, University of Arizona archaeologists excavated the northeastern corner of the fort (Olson 1985).

Portions of the presidio cemetery were excavated in the late 1960s to early 1970s, as part of the Tucson Urban Renewal project. Work resumed in 1991, with a ground-penetrating radar study which attempted to locate adobe walls. Workers returned to the cemetery after human remains were located during a gasline installation, removing 20 burials (Thiel et al. 1995). The following year, test excavations located the eastern wall of the presidio within the courtyard of the Pima County Courthouse (Thiel et al. 1995). Work beneath the western lawn of City Hall located the western wall of the presidio in 1998 and 1999 (Thiel 2004).

THE TUCSON PRESSED BRICK COMPANY

The Tucson Pressed Brick Company (TPBCo) was founded in 1894, by Quintus Monier—a French immigrant to the United States, a noted architect, and a well-respected member of New Mexico's Catholic community in Santa Fe (Diehl and Diehl 1996). Monier moved to Tucson in 1894, at the invitation of Bishop Bourgade, to design and build the St. Augustine Cathedral, which was completed in 1896.

As the cathedral was completed, the need and demand for high-quality and modern-looking (brick or cut stone) construction materials became apparent to Monier, and his brickyard quickly became one of the chief industrial suppliers in southern Arizona. Monier supplied bricks for projects as distant as Bisbee, Arizona. He was the supplier and contractor for a number of important buildings, including many on the University of Arizona campus and other architecturally distinctive buildings—many of which, such as the St. Mary's Sanatorium and the Eagle Flour Mill, were destroyed as a result of 1960s urban renewal projects. In 1910, Monier's brickyard was incorporated as the Tucson Pressed Brick Company; the company name refers to a means of brick manufacture using hydraulically driven presses known to produce exceptionally high-quality bricks, and brickyards often stamped their maker's marks on their premier products.

The TPBCo—along with its shorter-lived competitors, the Grabe Brick Company (GBCo) and the Louis DeVry brickyard (LD&Co)—provided the means to modernize construction in Tucson. Following the passage of Tucson City Ordinance No. 265, signed by Mayor Charles Slack in 1907, the use of brick, concrete, or stone was required in all new building foundations. Every major construction project on the University of Arizona campus required enormous quantities of bricks, and most of the campus buildings constructed before 1961 were supplied by the TPBCo under the ownership of Quintus Monier or one of the subsequent owners (Albert Steinfeld, John Sundt, and the Sundt Corporation). The brickyards also supplied much of Tucson's residential construction material through 1961.

The TPBCo and its forerunner, "Monier's brickyard," operated on the parcel from 1894 through 1961. The brick company buildings were later dismantled and the area vacated.

Archaeological testing of the parcel in 1995 resulted in the discovery of a portion of the brick factory (Thiel 1995a). Excavations the following year uncovered portions of the complex, including several kilns, a transformer house, and a dry pan, elevator, and engine room (Diehl and Diehl 1996).

SUMMARY

Tucson has a long history of human occupation, with use of the Tucson Basin stretching as far back as the Paleoindian period. Previous archaeological work in the Rio Nuevo project areas has documented Early Agricultural, Hohokam, Spanish, Mexican, and American Territorial and Statehood period features. The 2000-2003 excavations resulted in the discovery of hundreds of additional features, which are described in Chapter 4 (this volume).

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CHAPTER 4

FEATURE DESCRIPTIONS: PART 1. SAN AGUSTÍN MISSION LOCUS, THE CLEARWATER SITE, AZ BB:13:6 (ASM)

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Archaeological work conducted during the Rio Nuevo Archaeology project resulted in the discovery of hundreds of features—areas in which human activities took place. Descriptions of excavated features and summarized data on unexcavated features are presented in this chapter. Descriptions of human burials found during the project are provided in Chapter 18 (this volume).

Work during this project was conducted at four different archaeological sites. The San Agustín Mission, Mission Gardens, Brickyard, and Congress Street loci were located at the Clearwater site, AZ BB:13:6 (ASM), on the western side of the Santa Cruz River. AZ BB:13:481 (ASM) is the site number assigned to the Prehistoric, Protohistoric, and Historic era canals, ditches, and a spillway, also located on the western side of the Santa Cruz River. The Tucson Presidio has been designated AZ BB:13:13 (ASM), and the site includes both prehistoric- and historic-era features. Finally, a portion of a historic-era residential block on the northern side of Clark Street and east of the Interstate 10 (I-10) frontage road was designated AZ BB:13:735 (ASM).

The feature descriptions in this chapter are grouped by locus, except for canals, which are described in Part 6 and which are grouped by time period. All site numbers in this chapter are Arizona State Museum (ASM) numbers. Radiocarbon dates are reported in both uncalibrated radiocarbon years before present (b.p.), and in calibrated calendar years at the 1-sigma range of probability. Excavated and unexcavated features are listed, by site/locus and time period, in Table 4.1.

Archaeological work at the San Agustín Mission locus, Clearwater site, AZ BB:13:6 (ASM), located features dating to the Early Agricultural, Hohokam, Protohistoric, Spanish, American Territorial, and American Statehood periods (Table 4.1).

A variety of prehistoric features were discovered at the San Agustín Mission locus, most dating to the Cienega phase (800 B.C.-A.D. 50) of the Early Agricultural period (Figure 4.1).

PREHISTORIC PIT STRUCTURES

Feature 2, Pit Structure

General Description

This structure was discovered while manually excavating a 1-m by 2-m control unit (Unit 3) along the southern side of Mission Lane. Beyond the limits of this unit, which was excavated to the floor of the structure, no further excavation was completed.

During excavation of Unit 3, this structure became visible as a distinct feature based on the presence of its burned fill and plastered floor. Due to the limited amount of excavation, its dimensions and orientation could not be determined. No internal features were identified, and the function of the structure is unknown.

Internal Features

No internal features were identified.

Internal Strata and Artifact Contents

Approximately 0.28 m of burned house fill was removed from above the structure floor. This consisted of a clayey silt with moderate amounts of burned daub and charcoal (flecks and chunks). Artifacts recovered from this fill included sherds, flaked stone, shell, animal bone, ground stone, and 17 pieces of fire-cracked rock. Seven sherds were located on the floor.

Table 4.1. Summary list of excavated and unexcavated features found during the Rio Nuevo Archaeology project, by site/locus and time period.

A. Excavated Features.

Site/Time Period/Stratum	Feature Type (Count)	Feature Number
Clearwater Site, AZ BB:13:6 (ASM)		
San Agustín Mission Locus		
Cienega	Pithouse (22)	7, 15, 17, 28, 29, 32, 57, 62, 65, 88, 97, 100, 112, 121, 122, 126, 128, 151, 182, 191, 211, 218
	Inhumation (2)	159, 190
	Small pit (23)	66, 67, 68, 69, 71, 72, 73, 74, 75, 77, 78, 79, 80, 81, 82, 105, 107, 110, 113, 125, 180, 183, 184
	Large pit (1)	195
	Roasting pit (5)	18, 20, 76, 115, 216
	Hearth (1)	89
Hohokam	Possible pit (1)	21
	Pithouse (1)	2
	Inhumation (2)	36, 38
	Secondary cremation (2)	39, 90
	Bell pit (1)	13
Prehistoric	Inhumation (3)	24, 35, 160
	Small pit (4)	30, 45, 63, 70
	Bell pit (1)	31
	Hearth (1)	89
Spanish	Wall (2)	1, 179
	Masonry/Adobe structure (granary) (1)	6
	Trash concentration (3)	64, 161, 166
	Large pit (3)	177, 178, 203
	Roasting pit (1)	193
American Territorial	Well (1)	4
	Fenceline (1)	5
	Large pit (2)	52, 87
	Small pit (1)	61
Clearwater Site, AZ BB:13:6 (ASM)		
Mission Gardens Locus		
Early Agricultural	Inhumation (3)	3045, 3048, 3345
Early Ceramic	Pithouse (2)	3014, 3038
Hohokam	Pithouse (1)	3005
	Inhumation (7)	3019, 3025, 3057, 3080, 3097, 3346, 3347
	Primary cremation (1)	3002
	Secondary cremation (3)	3041, 3071, 3101

Table 4.1. A. Continued.

Site/Time Period/Stratum	Feature Type (Count)	Feature Number
Clearwater Site, AZ BB:13:6 (ASM) (continued)		
Mission Gardens Locus (continued)		
Hohokam (continued)	Bell pit (1)	3044
	Hearth (1)	3072
	Large pit (2)	3001, 3067
	Small pit (5)	3012, 3016, 3058, 3082, 3344
Spanish	Wall (3)	3000, 3026, 3098
American Territorial/American Statehood	Masonry/Adobe structure (2)	3028, 3083
	Wall foundation (2)	3095, 3096
	Bell pit (1)	3024
	Well (1)	3006
Clearwater Site, AZ BB:13:6 (ASM)		
Congress Street Locus		
Block 1 Stratum 502 Early Ceramic or Hohokam	Pithouse (2)	510, 546
	Bell pit (1)	547
	Roasting pit (1)	545
Hohokam	Pithouse (1)	308
Block 2 Stratum 502 Cienega	Pithouse (1)	511
	Roasting pit (2)	538, 559
	Small pit (3)	539, 540, 541
Block 3 Stratum 502 Cienega	Small pit (1)	542
Modern	Small pit (1)	543
Block 4 Stratum 502 Cienega	Small pit (1)	544
Block 5 Stratum 504	Pithouse (8)	516, 580, 581, 608, 629, 3359, 3364, 3371
	Bell pit (1)	631
	Roasting pit (1)	632
	Small pit (31)	579, 584, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 609, 610, 611, 612, 613, 615, 616, 619, 622, 623, 624, 625, 626, 628, 3360, 3362, 3370, 3375, 3381
	Extramural surface (2)	627, 3414
Stratum 503	Roasting pit (4)	558, 572, 3373, 9218
	Small pit (10)	554, 560, 571, 575, 588, 589, 630, 3368, 3369, 3374
	Large pit (1)	570
Stratum 502 Cienega	Small pit (1)	3363

Table 4.1. A. Continued.

Site/Time Period/Stratum	Feature Type (Count)	Feature Number
Clearwater Site, AZ BB:13:6 (ASM) (continued)		
Congress Street Locus (continued)		
Stratum 502 Early Ceramic or Hohokam	Bell pit (1)	3361
Block 7 Early Ceramic or Hohokam	Inhumation (1)	573
Block 8 Early Agricultural	Inhumation (1)	574
Trench 62 Early Agricultural	Inhumation (1)	618
Trench 201 Stratum 504	Pithouse (1)	506
Other Early Agricultural	Inhumation (2)	603, 605
Prehistoric	Inhumation (1)	591
	Small pit (9)	548, 560, 563, 570, 571, 575, 576, 578, 579
Modern	Large pit (1)	633
Clearwater Site, AZ BB:13:6 (ASM)		
Brickyard Locus		
Cienega	Pithouse (22)	3220, 3245, 3260, 3262, 3264, 3270, 3273, 3274, 3290, 3294, 3296, 3300, 3306, 3308, 3312, 3323, 3325, 3327, 3332, 9168, 9357, 9372
	Large pit (1)	3334
	Small pit (30)	3221, 3222, 3223, 3225, 3229, 3237, 3238, 3240, 3241, 3243, 3244, 3248, 3252, 3253, 3261, 3263, 3266, 3284, 3285, 3288, 3289, 3295, 3318, 3320, 3326, 3328, 3329, 3331, 3336, 3358
	Roasting pit (2)	3249, 3313
	Slab-lined pit (1)	3316
	Bell pit (2)	3242, 3272
	Inhumation (4)	3267, 3268, 3330, 3357
	Extramural surface (1)	3317
Early Ceramic	Roasting pit (1)	3287
Hohokam	Pithouse (2)	3293, 9376
American Territorial/Modern	Adobe wall (1)	3200
	Masonry/Adobe structure (1)	3256
	Kiln (1)	3204
	Small pit (2)	3259, 3309
	Masonry storage bin (2)	3209, 3214
	Well (1)	3207
	Wall foundation (2)	3211, 3212
	Railroad track (1)	3213
	Historic other (12)	3201, 3202, 3203, 3205, 3206, 3208, 3210, 3215, 3216, 3217, 3302, 9355

Table 4.1. A. Continued.

Site/Time Period/Stratum	Feature Number (Count)	Feature Type
Tucson Presidio Site, AZ BB:13:13 (ASM)		
Tucson Museum of Art/Fish-Stevens-Duffield House		
Spanish	Structure (4)	316, 320, 331, 332
	Adobe wall (1)	300
	Posthole (7)	309, 315, 318, 324, 325, 326, 328
	Small pit (3)	305, 317, 321
	Large pit (1)	327
	House floor (1)	319
American Territorial/American Statehood	Structure (1)	314
	House floor (3)	301, 306, 307
	Adobe structure wall (2)	302, 329
	Structure foundation (1)	330
	Small pit (5)	308, 310, 311, 312, 313
	Posthole (4)	303, 304, 322, 323
Tucson Presidio Site, AZ BB:13:13 (ASM)		
Tucson Presidio		
Early Agricultural	Pithouse (1)	430
Hohokam	Pithouse (3)	350, 406, 417
	Small pit (2)	412, 416
	Roasting pit (2)	405, 434
	Borrow pit (1)	380 [Pioneer]
Spanish	Adobe wall (7)	351, 374, 377, 399, 400, 403, 443
	Large pit (4)	373, 409, 420, 441
	Small pit (3)	422, 423, 427
	Extramural surface (1)	418
	Posthole (5)	410, 425, 429, 431, 433
	Historic other (4)	386, 404, 424, 428
American Territorial	Adobe wall (1)	389
	Small pit (21)	354, 357, 358, 363, 364, 365, 366, 371, 372, 381, 382, 383, 395, 396, 398, 402, 407, 414, 421, 435, 442
	Large pit (5)	356, 359, 376, 385, 437
	Privy (2)	360, 408
	Hearth (2)	361, 394
	Posthole (8)	367, 369, 388, 391, 392, 393, 397, 436
	Ramada (2)	368, 378
	Fenceline (2)	375, 401
	Animal burial (2)	370, 439
	Utility trench (1)	352
	Historic other (6)	353, 384, 387, 390, 432, 438

Table 4.1. A. Continued.

Site/Time Period/Stratum	Feature Number (Count)	Feature Type
Canals, AZ BB:13:481 (ASM)		
Canals at the San Agustín Mission Locus, Clearwater Site, AZ BB:13:6 (ASM)		
Early Agricultural	Canals (2)	53, 127
Hohokam	Canals (1)	137
Historic	Canals (2)	3, 9
Canals at the Mission Gardens Locus, Clearwater Site, AZ BB:13:6 (ASM)		
Prehistoric	Canals (4)	200, 202, 210, 212
Protohistoric	Canals (4)	201, 204, 205, 207
Historic	Canals (4)	206, 208, 209, 211
Canals at the Congress Street Locus, Clearwater Site, AZ BB:13:6 (ASM)		
Early Agricultural	Canals (4)	139, 140, 141, 152
Hohokam	Canals (8)	142, 143, 144, 146, 149, 151, 154, 156
Historic	Canals (7?)	138, 145?, 147, 148, 150, 153?, 155
Features Southeast of Interstate 10 and Congress Street, AZ BB:13:735 (ASM) and AZ BB:13:NW (ASM)		
American Territorial/Modern	Masonry/Adobe structure (2)	7, 8
	Roasting pit (1)	3
	Large pit or depression (3)	1, 2, 4
	Historic other (1)	5
	Posthole (1)	6

Table 4.1. Continued.

B. Unexcavated Features.

Feature Type (Count)	Feature Number
Clearwater Site, AZ BB:13:6 (ASM)	
San Agustín Mission Locus	
Pithouse (14)	19, 22, 25, 33, 96, 132, 133, 162, 163, 185, 189, 192, 206, 209
Possible pithouse (8)	8, 27, 34, 42, 120, 150, 196, 207
Small pit (70)	10, 11, 12, 14, 37, 40, 41, 43, 45, 46, 47, 48, 49, 54, 55, 56, 58, 59, 83, 84, 85, 86, 91, 92, 93, 94, 95, 99, 101, 102, 103, 104, 106, 108, 109, 111, 114, 117, 118, 119, 129, 134, 136, 139, 140, 149, 152, 153, 154, 155, 156, 164, 169, 170, 171, 172, 174, 194, 197, 198, 199, 200, 201, 202, 204, 205, 210, 212, 213, 214
Roasting pit (9)	135, 138, 165, 167, 168, 208, 215, 217, 219

Table 4.1. B. Continued.

Feature Type (Count)	Feature Number
Clearwater Site, AZ BB:13:6 (ASM) (continued)	
San Agustín Mission Locus (continued)	
Bell pit (2)	26, 131
Possible well (1)	23
Historic outhouse (1)	116
Mission burial (13)	141, 142, 143, 144, 145, 146, 147, 148, 157, 158, 173, 175, 176
Clearwater Site, AZ BB:13:6 (ASM)	
Mission Gardens Locus	
Pithouse (6)	3029, 3042, 3061, 3074, 3109, 3110
Possible pithouse (6)	3004, 3032, 3060, 3062, 3108, 3417
Large pit (3)	3059, 3079, 3094
Small pit (34)	3003, 3008, 3013, 3015, 3017, 3020, 3021, 3022, 3023, 3033, 3034, 3035, 3039, 3040, 3043, 3046, 3047, 3052, 3053, 3064, 3065, 3066, 3068, 3069, 3070, 3075, 3076, 3077, 3078, 3084, 3099, 3104, 3107, 3112
Possible pit (1)	3011
Roasting pit (8)	3007, 3009, 3010, 3018, 3050, 3055, 3056, 3081
Historic pit (1)	3063
Bell pit (4)	3073, 3103, 3106, 3111
Hearth (1)	3051
Other (2)	3027, 3105
Clearwater Site, AZ BB:13:6 (ASM)	
Congress Street Locus	
Pithouse (5)	371, 519, 521, 529, 577
Possible pithouse (8)	512, 515, 517, 524, 527, 528, 550, 602
Small pits (24)	500, 501, 502, 507, 522, 525, 526, 530, 531, 532, 533, 551, 552, 553, 555, 556, 557, 561, 567, 568, 569, 582, 587, 590
Bell pit (3)	520, 562, 606
Roasting pit (5)	369, 503, 508, 509, 549
Trash concentration (3)	518, 534, 586
Outhouse (1)	585
Well (1)	607
Extramural surface (1)	627
Clearwater Site, AZ BB:13:6 (ASM)	
Brickyard Locus	
Pithouse (3)	3399, 3412, 3413
Possible pithouse (5)	3246, 3247, 3298, 3385, 3408

Table 4.1. B. Continued.

Feature Type (Count)	Feature Number
Clearwater Site, AZ BB:13:6 (ASM) (continued)	
Brickyard Locus (continued)	
Large pit (8)	3250, 3278, 3279, 3286, 3310, 3342, 3393, 3407
Small pit (71)	3224, 3226, 3227, 3228, 3230, 3231, 3232, 3233, 3234, 3235, 3236, 3239, 3251, 3265, 3269, 3277, 3280, 3281, 3282, 3297, 3299, 3301, 3305, 3307, 3311, 3314, 3315, 3319, 3321, 3322, 3324, 3333, 3335, 3337, 3338, 3339, 3340, 3343, 3351, 3352, 3365, 3366, 3367, 3372, 3376, 3377, 3378, 3379, 3380, 3382, 3383, 3384, 3386, 3387, 3388, 3389, 3390, 3391, 3392, 3395, 3397, 3398, 3400, 3401, 3402, 3403, 3404, 3405, 3409, 3410, 3416
Bell pit (2)	3394, 3415
Roasting pit (7)	3275, 3276, 3283, 3304, 3313, 3355, 3406
Possible well (1)	3396
Historic large pit (3)	3303, 3348, 3350
Historic small pit (7)	3254, 3255, 3257, 3258, 3341, 3349, 3411
Historic other (2)	3353, 3354

Construction and Remodeling Evidence

Except for the presence of a prepared floor, little else is known about the construction of this pit structure. Neither the location of the pit walls, nor a posthole pattern were exposed during the excavations. The daub that was observed in the fill, however, suggests that a superstructure of wattle-and-daub construction was originally present. No evidence of remodeling was present.

Stratigraphic Relationships

Feature 2 was constructed into a floodplain alluvium. No underlying features, overlying features, or intrusive features were visible within the excavated area of the pit structure.

Abandonment and Postabandonment

The burning that was visible within the feature fill and on the floor of Feature 2 indicates that the pit structure at least partially burned. Due to the limited excavation of the pit structure, however, it is unclear if this burning occurred prior to abandonment or after abandonment. It is also unclear if the seven sherds that were located on the structure floor are part of a floor assemblage, or if they were trash that was deposited into the structure.

Date

The presence of ceramic sherds on the floor of the house suggests it dates to the Early Ceramic or Hohokam periods, roughly spanning from A.D. 50 to 1450. The lack of decorated ceramics prevents a more refined date.

Feature 7, Pit Structure

General Description

This pit structure was initially discovered by mechanical trenching (Trenches 101 and 104), and was subsequently exposed by mechanical stripping (Figure 4.2). Only those portions of the structure that extended north of Trench 104 and east of Trench 101 were then excavated by hand.

This round pit structure measured 3.15 m east-west and approximately 2.70 m north-south. Except for 13 postholes that encircled the floor area, no other internal features were identified. Due to the disturbance caused by mechanical trenching and the incomplete excavation of the structure, only a partial posthole pattern was uncovered. Therefore, no orientation could be discerned. Feature 7 was probably used for habitation and burned sometime after its abandonment.

Figure 4.1. Prehistoric features at the San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

Figure 4.2. Features 7 and 29, Cienega phase pithouses, San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

Internal Features

All the postholes found during excavation were located adjacent to the structure walls. They measured between 8 cm and 12 cm in diameter, and were between 2 cm and 12 cm deep. No artifacts were recovered from these postholes, although three contained the remains of charred posts.

Internal Strata and Artifact Contents

Approximately 0.69 m of stratified fill were removed from the mechanically stripped surface to the pit structure floor. The upper 0.44 m consisted of alluvially deposited silt and clay, while the lower 0.25 m was composed of trash and collapsed superstructure. Burned roof and wall material, such as burned daub and charcoal, were present throughout the cultural fill, but increased dramatically in the 0.05-0.10 m above the structure floor. The floor itself was oxidized in small patches across its entire surface.

The fill contained 171 pieces of fire-cracked rock, flaked stone, animal bone (some of which was worked), ochre, ground stone, and one polisher. In addition to the burned daub, charcoal, and ash present throughout the lower feature fill, other charred structural debris, such as burned reeds and matting, was observed within the layer of collapsed superstructure. Artifacts with a floor context were few, consisting of one mano, a core, and two pieces of fire-cracked rock.

Construction and Remodeling Evidence

This pit structure was constructed by excavation into a floodplain alluvium. Neither the floor nor walls had prepared surfaces, and these were defined only by the break between cultural fill and the natural alluvium. Based on the location of the internal postholes, the walls of the structure appear to have been built within the excavated pit. The abundant amount of charcoal, daub, and other charred structural debris suggests a superstructure constructed of wattle-and-daub. No roof supports were identified, although, based on the small size of the structure, they may not have been necessary.

Stratigraphic Relationships

A later pit structure, Feature 29, intrudes the northeastern portion of this feature. Like Feature 7, it was also cut into the same alluvial stratum but to a shallower depth. The construction of Feature 29 appears to have only affected the upper fill of Feature 7, and likely occurred long after Feature 7 was abandoned.

Abandonment and Postabandonment

Feature 7 appears to have burned after it was cleaned out and abandoned. No intact floor assemblage was discovered, and only three artifacts were found on floor. Three burned posts were preserved in situ, and the absence of other posts suggests there may have been scavenging prior to the structure burning. After burning, the structure filled with trash and alluvial sediments.

Date

Based upon its architectural style, the structure dates to the Early Agricultural period.

Feature 15, Pit Structure

General Description

This feature was discovered during mechanical trenching (Trench 102), and was subsequently exposed by mechanical stripping (Figure 4.3). The entire feature, except a small portion removed by the trench, was excavated by hand.

This round structure measured 3.55 m north-south and 3.30 m east-west. It contained two small intramural pits and 64 interior postholes. Its orientation could not be determined, and there were no visible gaps in the posthole pattern to suggest the location of an entry. The structure was probably used for habitation and household storage until it was consumed by fire.

Internal Features

The two intramural pits, Features 15.01 and 15.10, were superimposed and located near the southern wall of the structure. The remaining internal features were comprised of postholes, most of which were closely spaced along the floor perimeter. Some of these—Features 15.02-15.09—contained artifacts and were assigned subfeature numbers.

Feature 15.01 was a small basin-shaped pit that measured 0.42 m long, 0.35 m wide, and 0.18 m deep. It was intrusive into Feature 15.10, another small pit located to the north. Feature 15.01 probably served a storage function. Unlike Feature 15.10, it was filled with the same type of sediment visible in the floor fill of Feature 15, and was in use when the structure burned. Its fill consisted of clayey silt (mottled with charcoal and daub) that contained pieces of flaked stone and one piece of fire-cracked rock.

Feature 15.10 was also a basin-shaped pit that measured 0.32 m long, 0.26 m wide, and 0.07 m deep. Its fill was composed of silty clay that, unlike Feature 15.10, contained little charcoal and no daub. It was probably sealed and then intruded by Feature 15.01. Except one piece of fire-cracked rock, no other artifacts were recovered.

As mentioned, 64 postholes were discovered within the pit structure. These ranged in size from 0.07 m to 0.21 m in diameter, and were from 0.07 m to 0.30 m deep. Most of the postholes were located adjacent to the structure walls, and were within two concentric rows. A few others were located within the interior area of the structure, and may have been used as roof supports. Four of these interior posts (TT, LL, KK, and FF) were larger and deeper than all the other postholes located in the feature. In comparison, these ranged from 0.21 m to 0.28 m in diameter, and were from 0.15 m to 0.36 m deep.

Internal Strata and Artifact Contents

Although the average wall height was 0.20 m, up to 0.54 m of stratified fill was removed from Feature 15. The uppermost fill consisted of alluvial-deposited clay and silt with few artifacts and little evidence of burning. In contrast, the lower fill, which was composed of burned structural material, contained large amounts of charcoal and burned daub. Most of the artifacts recovered from the structure came from this lower level and did not appear to be the result of trash disposal.

Artifacts recovered from the feature fill included flaked stone debitage, 2 projectile points, 3 biface fragments, 2 polishers, animal bone, hematite, sherds, ground stone, a bone awl, and a lump of fired clay. A variety of artifacts with a floor context were also recovered: 1 mano, 2 hammerstones, a ground stone disk, 2 ground stone fragments, 1 handstone, 1 bone awl, 5 pieces of flaked stone, and 3 fire-cracked rocks.

Figure 4.3. Feature 15, a Cienega phase pithouse, San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

Construction and Remodeling Evidence

This pit structure and all its interior features were excavated into a floodplain alluvium. Based on the presence of burned daub in its fill, the superstructure was likely constructed of wattle-and-daub. Based on the location of its interior postholes, the structure probably had walls constructed within the house pit and supported by a row of posts along the perimeter of the floor. Its roof may have been supported by a combination of these wall posts and at least four posts located within the interior area of the structure. There was no evidence of plaster preparation of the structure's walls, floor, or internal features.

Feature 15 exhibited multiple evidence of remodeling and/or maintenance. The presence of two concentric rows of postholes suggested a major shift in wall location, probably to increase the size of the structure. Eight of these perimeter wall postholes were superimposed, and probably represent adjustments of individual post locations to stabilize the walls or roof.

One final piece of evidence was the superpositioning of the two small intramural pits, Features 15.01 and 15.10. After Feature 15.10 was sealed, Feature 15.01 was excavated into the same general area as a replacement. This may have coincided with the shift in wall location.

Stratigraphic Relationships

This feature was excavated into a floodplain alluvium. No other features were located in its immediate vicinity, although a cluster of similar structures was located 5-10 m to the north.

Abandonment and Postabandonment

Based on the degree of burning within its fill, as well as the nature of its floor assemblage, Feature 15 appears to have burned while still in use. A variety of functional tools were located on the floor, suggesting an unexpected abandonment. Deposits of trash were not identified, and there does not appear to be any postabandonment reuse. After the structure burned and collapsed, it was filled with alluvial sediments.

Date

A radiocarbon date of 1650±40 b.p. uncalibrated (Beta-190710) (A.D. 380-430 calibrated, at 1 sigma of probability) was obtained from maize, although the architectural style and the types of artifacts recovered suggest the house dates to the Early Agricultural period.

Feature 17, Pit Structure

General Description

This possible pit structure was discovered while re-excavating a control unit that was originally excavated in 1986. This unit had been placed over Feature 9, a historic-era canal, and Feature 17 became visible at its base. The structure was then tested by hand, within the limits of the canal, in a 2.0-m by 0.6-m excavation unit.

Due to the limited amount of excavation within this structure, information about its dimensions, orientation, construction, and function is largely unknown. Excavation exposed only a small portion of its floor, and none of its walls or internal features. The presence of some charred material in its fill suggests the structure may have at least partially burned.

Internal Features

No internal features were identified within the structure.

Internal Strata and Artifact Contents

Within the boundaries of the 2.0-m by 0.6-m excavation unit, approximately 0.2 m of stratified fill was removed. The upper 0.07 m consisted of a naturally deposited alluvial sediment with small amounts of charcoal and daub. Below this, the fill became darker and exhibited a higher level of burning. This included an increase in the amounts of charcoal, daub, and fire-cracked rock. This lower fill also contained all the artifacts recovered from the feature.

The few artifacts recovered from the structure included two pieces of flaked stone, a bifacial scraper made of quartz, and 18 pieces of fire-cracked rock. No artifacts with a floor context were uncovered.

Construction and Remodeling Evidence

The limited amount of excavation within Feature 17 provided little information about its construction. The structure, like surrounding features, was excavated into a floodplain alluvium. The exposed portion of its floor surface had no evidence for preparation and was defined only by the break between cultural fill and the natural alluvium. The presence of daub in the fill might represent a superstructure of wattle-and-daub construction. There was no evidence of remodeling.

Stratigraphic Relationships

This structure was affected by construction of at least two later features. First, a roasting pit, Feature 115, intruded the eastern edge of the excavation unit and cut through the floor of the structure. Second, a historic canal, Feature 9, was constructed over the feature and limited its excavation.

Numerous other features, including pits and pithouses, were located nearby. All of these structures were round with interior posts along the perimeter of the floor. Feature 17 may have shared a similar configuration.

Abandonment and Postabandonment

Little evidence about the type of abandonment that occurred within this structure was uncovered. However, based on the nature of its fill, the structure probably burned. The lack of a distinct layer of collapsed superstructure suggests this burning occurred after abandonment. There was no evidence of postabandonment reuse.

Date

The structure dates to the Early Agricultural period, based on its architectural style.

Feature 28, Pit Structure

General Description

This structure was discovered by mechanical trenching (Trench 107) and then subsequently partially exposed by mechanical stripping. A 1-m by 2-m control unit was placed off the trench, within the southern portion of the feature. It was manually excavated to the structure floor.

Because this feature was only partially exposed during stripping, its exact dimensions are unknown. Based on the feature stain visible in the trench profile, it likely had a diameter of at least 4 m. The orientation of the structure is unknown, and only one internal feature, a possible hearth, was identified. The presence of this hearth suggests a habitation function.

Internal Features

Only one internal feature, a hearth, was exposed. This hearth was nearly completely removed by trenching, and was only visible as an oxidized remnant on the structure floor. None of its fill or dimensions remained.

Internal Strata and Artifact Contents

Approximately 0.15 m of fill were removed from the mechanically stripped surface to the pit structure floor. The fill consisted of light brown silt that was probably deposited as part of a single flooding episode. It contained a small amount of charcoal, some daub, flaked stone, animal bone, ground stone, sherds, and a biface fragment. Only one artifact, a piece of flaked stone, was recovered from the floor.

Construction and Remodeling Evidence

Due to the limited amount of excavation of the pit structure, evidence for construction or possible remodeling of this structure was not exposed. If Feature 28 was similar to nearby structures, it was likely round, with walls constructed within the house pit. The exposed portion of the floor had no preparation, and it was defined only by the break between alluvial sediment and lower feature fill, Feature 185.

Stratigraphic Relationships

Feature 28 is intrusive into another structure, Feature 185, located directly beneath it. Like surrounding features, both were excavated into a floodplain alluvium.

Abandonment and Postabandonment

No evidence was present that would suggest burning within this structure, or of any postabandonment reuse. In the small area of Feature 28 that was excavated, the structure appeared to have been cleaned out and abandoned. It was later filled with alluvial deposits.

Date

Radiocarbon dating of mesquite that was recovered from the feature provided a date of 450±40 b.p. uncalibrated (Beta-190712) (A.D. 1430-1460 calibrated, at 1 sigma of probability). This date is spurious, however, probably reflecting rodent burrowing into the feature, introducing mission-occupation plant remains. Based on its architectural style, the pit structure almost certainly dates to the Early Agricultural period.

Feature 29, Pit Structure

General Description

This structure was exposed by mechanical stripping north of Trench 104 (Figure 4.4; see also Figure 4.2). The structure was then completely excavated by hand.

This round structure, which measured 2.61 m east-west and 2.57 m north-south, contained a small hearth, Feature 29.01, and 34 interior postholes. A possible entry was defined by a small gap (circa 0.55 m wide) in the posthole pattern along its northern edge. However, this possible entry was also located directly above an underlying feature, Feature 8, whose fill may have obscured the visibility of postholes in the area. Therefore, the orientation of Feature 29 could not be definitively identified. The presence of a small hearth suggests use of the structure as a habitation feature.

Figure 4.4. Feature 29, a Cienega phase pithouse, San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

Internal Features

In addition to postholes, a small hearth, Feature 29.01, was the only other intramural feature located within the structure. It was located near the southeastern wall of the pit structure.

Feature 29.01 was a shallow hearth that measured 0.38 m long, 0.31 m wide, and 0.06 m deep. It had a basin-shaped profile, and both its base and sides were oxidized. Other than the presence of larger amounts of charcoal and ash, its fill consisted of sediment similar to that present in the structure. The 34 postholes identified within this structure were all located along the floor perimeter and functioned as wall supports. They measured between 8 cm and 15 cm in diameter, and were between 8 cm and 14 cm deep. Four of these postholes were superpositioned and likely represent the readjustment of individual post locations.

Internal Strata and Artifact Contents

The 0.11 m of fill removed from this structure consisted of naturally deposited silt and clay laid down as part of a single flooding episode. Stratigraphy within this fill was not visible, and charcoal and burned daub was present throughout. Artifacts recovered from the fill consisted of Hohokam sherds, one possible Early Agricultural period sherd, flaked stone, animal bone, ground stone, a partial ceramic pipe, and a core. Artifacts with a floor context consisted of two pieces of ground stone, one of which was stained with ochre, and two concentrations of fire-cracked rock.

Construction and Remodeling Evidence

The walls of Feature 29 were probably constructed within the house pit, supported by a concentric row of posts along the floor perimeter. The structure was relatively small, and the roof was likely supported by these wall posts. Small pieces of burned daub were observed throughout the feature fill, and probably represent a superstructure constructed of wattle-and-daub. No preparation was visible on any of the pit structure's surfaces or internal features, and other than the superpositioning of four perimeter postholes, there was no other evidence of remodeling. These postholes were likely shifted to stabilize the wall or roof.

Stratigraphic Relationships

This structure was not only constructed into an alluvial floodplain, but into two other features as well. First, it intrudes into the northern portion of Feature 7, another small pit structure located to the south. Second, it was constructed over another undefined feature, Feature 8, located to the north. It was in this area that a gap in the posthole pattern was noted.

Abandonment and Postabandonment

In relation to its size, the charcoal and burned daub observed within Feature 29 were not sufficient to indicate the structure burned. Additionally, few artifacts with a floor context were exposed, and none were complete or still functional. The structure appears to have been mostly cleaned out and abandoned. It was not reused, and was eventually filled by alluvium.

Date

The structure dates to the Early Agricultural period, based on its architectural style.

Feature 32, Pit Structure

General Description

This small pit structure was discovered during mechanical stripping, and then almost completely excavated by hand (Figure 4.5). A small portion of the structure extended beyond the stripped block and could not be excavated. This irregularly shaped (off-round) structure measured 2.25 m east-west and approximately 1.95 m north-south. It contained one large bell-shaped storage pit, Feature 32.01, and two possible postholes. No formal entry was identified, and the orientation of the structure could not be determined. Based on its small size, irregular shape, and large storage pit, this structure was probably used for storage before it was ultimately cleaned out and abandoned.

Internal Features

Only one definite internal feature was identified within Feature 32. This was a large bell-shaped pit, Feature 32.01, located near the southern wall of the structure. The pit consumed a large portion of the floor and was probably the central focus of the structure.

Feature 32.01 had a top length of 1.09 m, a top width of 1.02 m, a basal length of 1.06 m, a basal width of 1.01 m, and a depth of 0.29 m. Its fill consisted of brown silty clay with abundant charcoal, some ash, and 48 pieces of fire-cracked rock. Artifacts recovered from the fill included flaked stone, ground stone, animal bone, and sherds. It probably functioned as a central storage pit.

Only two possible postholes were identified. These were nearly the same size and ranged from 11-12 cm in diameter, and were 9 cm deep. The postholes were located near the structure walls, and if true postholes, might have served as wall supports.

Internal Strata and Artifact Contents

An average 0.16 m of feature fill was excavated from the mechanically stripped surface to the pit structure floor. This fill consisted of naturally deposited clay and silt with charcoal flecking throughout. Artifacts recovered from this fill included sherds, flaked stone, ground stone, animal bone, and 25 pieces of fire-cracked rock. A few artifacts with a floor context were also recovered—one ground stone fragment and four pieces of fire-cracked rock.

Construction and Remodeling Evidence

Only two possible postholes were identified within the structure. These were located near the structure walls and may represent interior wall supports for a house-in-pit. None of the structure surfaces were prepared in any way, and there was no evidence of remodeling.

Stratigraphic Relationships

Feature 32 was constructed by excavation into a floodplain alluvium and filled with alluvial deposits. No underlying, overlying, or intrusive features were identified in the vicinity. It was located west of two larger habitation structures, Features 7 and 29.

Abandonment and Postabandonment

This structure exhibited little to no evidence of burning, and appeared to have been cleaned out prior to abandonment. Virtually no evidence of its construction or superstructure was preserved, and it may have been an insubstantial and briefly used storage structure. The small number of artifacts recovered from the fill suggests minimal trash-filling before the feature ultimately filled with alluvium.

Figure 4.5. Feature 32, a Cienega phase pithouse, San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

Date

Feature 32 dates to the Early Agricultural period, based on its architectural style.

Feature 57, Pit Structure

General Description

This pit structure was discovered during mechanical stripping west of Trench 101 (Figure 4.6). It was then completely excavated by hand. The round pit structure, that measured 3.15 m north-south and 3.05 m east-west, contained one possible hearth, Feature 57.01, and 43 interior postholes. Its entry could not be identified, and the orientation is unknown. The presence

Figure 4.6. Feature 57, a Cienega phase pithouse, San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

of a small hearth and the lack of storage pits suggests a habitation function prior to abandonment.

Internal Features

One small hearth, Feature 57.01, and 46 postholes were the only internal features identified within Feature 57. Feature 57.01 was located near the center of the structure, while the majority of the postholes were located along the floor perimeter. Some of these postholes contained artifacts and were assigned subfeature numbers.

Feature 57.01 was a shallow hearth that measured 30 cm long, 22 cm wide, and 6 cm deep. It was defined by a highly oxidized rim and had fill similar to that of the structure. It contained no visible artifacts (all the fill was collected for a flotation sample) and was highly disturbed by rodent activity that cut through its base and sides.

Most of the 46 excavated postholes—three of which were possible postholes—were located adjacent to the structure walls. Five others (NN, OO, 57.03, 57.04, and 57.02) were located within the interior area of the structure and probably served as roof supports. While the wall postholes ranged in diameter from 8 cm to 15 cm, and were between 6 cm and 15 cm deep, the interior postholes ranged from 14-18 cm in diameter, and were between 13 cm and 25 cm deep.

Internal Strata and Artifact Contents

Approximately 0.16 m of homogenous fill were excavated from the mechanically stripped surface to the pit structure floor. This fill consisted of alluvial sediments that were likely deposited as part of a single flooding episode. It contained some charcoal and daub flecking, but, overall, exhibited little evidence of burning. A significant amount of historic/modern disturbance was recognized in the upper feature fill, due to the presence of a large number of historic ceramics and cow bone fragments. The lower fill was more intact, with a visible increase in prehistoric artifacts, especially flaked stone.

Artifacts recovered from the fill included sherds, animal bone, flaked stone, a biface fragment, and 56 pieces of fire-cracked rock. Many of the artifacts recovered from the lower feature fill may be the result of minimal trash-filling after the structure was abandoned. Few artifacts with a floor context were collected—1 core, 1 piece of flaked stone, and 10 pieces of fire-cracked rock.

Construction and Remodeling Evidence

The placement of the postholes in Feature 57 suggests walls constructed within the house pit, supported by a concentric row of posts along the floor perimeter. The roof was likely supported by a combination of these wall posts and by five larger posts located within the interior area of the structure. None of the interior surfaces were prepared, and evidence of the superstructure was not preserved. Evidence of maintenance may be visible along the southern wall, where two small postholes were located just outside the posthole row. These were identified as possible postholes, but may be additional supports to stabilize either the walls or roof.

Stratigraphic Relationships

This structure, like surrounding structures, was constructed into a floodplain alluvium. No features were identified overlying, underlying, or intruding into this feature.

Abandonment and Postabandonment

Because Feature 57 contained no floor assemblage and exhibited little evidence of burning, it was probably cleaned out and abandoned. It was subsequently minimally filled with trash before ultimately filling with flood deposits.

Date

Based on its architectural style, the structure dates to the Early Agricultural period.

Feature 62, Pit Structure

General Description

This pit structure was discovered during mechanical trenching (Trench 109), and was later exposed by mechanical stripping. A 1-m by 2-m control unit was placed off the trench, within the southern portion of the feature, and hand-excavated to the floor. Finally, the rest of the structure was completely excavated by hand.

This round structure, which measured 2.26 m long and 3.03 m wide, contained a small pit, Feature 62.01; a hearth, Feature 62.02; and seven interior postholes. The location of its entry was not identified, and the orientation could not be determined. Feature 62 was highly disturbed by historic-era activities in the area, including clay mining in the 1940s, and the creation of a landfill in the 1950s. These disturbances removed most of the walls and fill. Based on the presence of a hearth and a small central storage pit, the structure was probably used for habitation and limited household storage.

Internal Features

Seven postholes were located within this structure. Two were situated along the western wall, and likely represent wall supports. Five others were randomly placed within the interior area of the structure and could represent roof supports. These postholes ranged between 8 cm and 16 cm in diameter, and were from 2-11 cm deep.

Feature 62.01 was a small basin-shaped pit that measured 0.97 m long, 0.51 m wide, and 0.18 m deep. It was filled with a silty clay with flaked stone, animal bone, charcoal, and nine pieces of fire-cracked rock. This fill was similar to the fill of the structure, and the pit was likely in use when the structure was abandoned. The pit exhibited no evidence of burning, and although shallow, may have functioned as a centrally located storage pit.

Feature 62.02 was a small, irregularly shaped hearth that measured 0.23 m long, 0.22 m wide, and 0.04 m deep. The hearth contained a distinct fill probably associated with its final use; it consisted solely of charcoal. The hearth was located in the southern half of the structure, south of Feature 62.01. Feature 62.02, which had an oxidized base, was impacted by clay mining. No artifacts were recovered.

Internal Strata and Artifact Contents

After mechanical stripping, approximately 0.04 m of fill was removed from the structure. This consisted of naturally deposited sandy loam with 1 small sherd, 1 piece of flaked stone, 15 pieces of fire-cracked rock, and some charcoal flecking. The upper portion of the structure appears to have been removed by clay mining and landfill clearing. Therefore, nothing is known about how the upper fill accumulated. No artifacts with a floor context were recovered.

Construction and Remodeling Evidence

Although the pit walls and parts of the floor were removed during mechanical stripping, a fragmentary posthole pattern was preserved. The location of these postholes indicates that the walls were constructed within the house pit. The presence of a few internal postholes suggests the roof may have been supported by a combination of internal roof and wall posts. The nature of the superstructure is unknown, and there was no evidence of remodeling.

Stratigraphic Relationships

This structure was constructed by excavation into a floodplain alluvium and is intruded by a large pit, Feature 217. Feature 62 is located south of another circular pit structure, Feature 207, and north of several extramural pits, Features 215, 138, and 139.

Abandonment and Postabandonment

Due to both historic disturbances and mechanical stripping, little of the fill or boundaries of the structure were preserved. A floor assemblage was not discovered, and the structure did not appear burned. This implies the structure was cleaned out at the time of abandonment. It then filled with naturally deposited sediments.

Date

The structure dates to the Early Agricultural period, based on its architectural style.

Feature 65, Pit Structure

General Description

This pit structure was discovered during the reexcavation of a waterline trench, and then exposed by mechanical stripping (Figure 4.7). The entire structure was excavated by hand.

The round pit structure measured 2.7 m north-south, 2.5 m east-west, and contained a large central storage pit and approximately 38 postholes. Although a few gaps were visible within its posthole pattern, none could be definitively identified as an entry location, and orientation of the structure could

Figure 4.7. Feature 65, a Cienega phase pithouse with a fired central pit, San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

not be determined. The pit structure exhibited multiple lines of evidence of remodeling and repair, and it was probably utilized over an extended period of time. Its small size and the presence of a central storage pit suggested that it served a storage function before it was abandoned and catastrophically burned.

Internal Features

A large bell-shaped pit, Feature 65.01, was located near the center of the structure; however, the majority of the 38 interior postholes were located adjacent to the walls, in two concentric rows.

Feature 65.01 was a large bell-shaped pit probably associated with the earliest period of occupation within the structure. At some point during this occupation, the pit was deliberately sealed as part of the remodeling. When in use, it would have monopolized the majority of the available floor area. It had a top length of 1.30 m, a top width of 1.10 m, a basal length of 1.34 m, a basal width of 1.12 m, and was 0.39 m deep.

The pit was filled with cultural sediments with large amounts of charcoal, some daub, and trash. Artifacts recovered from its fill included sherds, flaked stone, ground stone, animal bone, and 42 pieces of fire-cracked rock. It exhibited very good preservation, and all of its sides were heavily oxidized, which preserved digging stick indentations. However, this oxidation extended only to the pit sides, and none were observed on the pit base. Despite the oxidation, the pit was probably used for storage and was originally the central focus of the structure. Its sides may have been deliberately burned to create a more impenetrable surface to protect stored materials.

The postholes located within the structure ranged from 8 cm to 15 cm in diameter, and were between 5 cm and 18 cm deep. Many of these postholes were superimposed, and a few were cut into Feature 65.01. Feature 65.02, which was classified as a posthole area, was probably the location of a number of overlapping postholes. This superpositioning made individual boundaries difficult to identify.

Internal Strata and Artifact Contents

Between the mechanically stripped surface and the structure floor, approximately 0.41 m of feature fill was removed. Abundant amounts of charcoal, oxidation, ash, and burned daub were present throughout this fill, and increased dramatically just above the oxidized floor. The feature fill was stratified into two layers that consisted of undifferentiated trash in the upper 0.34 m, and burned roof and wall material in the lower 0.07 m.

Overall, a small number of artifacts—including sherds, flaked stone, animal bone, ground stone, and ochre—were recovered from the feature fill. The few artifacts that were recovered from a floor context consisted of a quartz crystal, 1 piece of flaked stone, 1 piece of fire-cracked ground stone, a ground stone artifact, and 8 pieces of fire-cracked rock. Tiny flecks of ochre were also visible on the floor surface, although their extremely small size made them impossible to collect.

Construction and Remodeling Evidence

The walls of Feature 65 were preserved to at least 0.41 m above the floor and exhibited continuous oxidation. The placement of a double row of postholes along the floor perimeter suggests the walls were constructed within the house pit and eventually remodeled. No individual roof supports were identified, but, based on the small size of the structure, they may not have been necessary. A significant amount of burned daub was observed within the fill and likely represents a wattle-and-daub superstructure. None of the interior surfaces were prepared in any way, but they were defined by the break between burned fill and oxidized alluvium.

This structure experienced numerous episodes of remodeling over its long period of use. The presence of two concentric rows of wall postholes suggests the placement of the walls shifted. Further, many of these wall postholes were superimposed and likely represent individual shifts in post locations. Another sign of remodeling was the sealing of Feature 65.01. In this case, the floor was extended over the pit to create a larger floor surface.

Stratigraphic Relationships

This pit structure was constructed by excavation into a floodplain alluvium. It was located within a dense cluster of Cienega phase pits that included Features 66-69.

Abandonment and Postabandonment

The presence of only a few artifacts on the floor suggests catastrophic burning occurred after Feature 65 had been cleaned out and abandoned. The lack of a distinct layer of collapsed superstructure with large samples of charred structural material, such as burned posts or beams, may suggest scavenging of these materials prior to burning. The majority of artifacts recovered from this feature were likely the result of trash deposition that occurred after abandonment.

Date

Maize recovered from Feature 65.01 was dated to 2430±50 b.p. uncalibrated (Beta-193152) (760-410 B.C. calibrated, at 1 sigma of probability). This indicates the structure dates to the Early Cienega phase of the Early Agricultural period.

Feature 88, Pit Structure

General Description

This pit structure was discovered during the re-excavation of a waterline trench, and was then exposed by mechanical stripping. Only that portion of the feature extending north of the trench, approximately half the structure, was subsequently excavated by hand. The round structure measured an estimated 3.2 m north-south and 3.7 m east-west. It contained a small hearth and at least eight interior postholes. The structure was only partially excavated, and the location of an entry was not identified. Based on the presence of a hearth, the structure was probably used for habitation before it was ultimately cleaned out and abandoned.

Internal Features

The eight identified postholes were all wall supports located along the floor perimeter. They ranged between 12 cm and 17 cm in diameter, and were from 5-14 cm deep.

Feature 88.01 was a shallow hearth located near the center of the structure. It measured 0.20 m long, 0.17 m wide, and 0.03 m deep. Its fill was similar to the fill of the structure, and the feature was probably in use when the structure was abandoned. Oxidation was visible across its surface, and it contained no artifacts.

Internal Strata and Artifact Contents

Approximately 0.05 m of naturally deposited silt and clay composed the fill of Feature 88. It displayed no stratification and contained some minor charcoal flecking, two pieces of fire-cracked rock, sherds, and flaked stone.

Construction and Remodeling Evidence

Based on the preserved posthole pattern, the structure walls were likely constructed within the excavated house pit and were supported by a number of small posts located along the floor perimeter. Distinct roof supports were not identified, making it likely that the roof was supported by the wall posts. The structure had no prepared surfaces and exhibited no evidence of remodeling. Construction material was not preserved, and the nature of the superstructure is unknown.

Stratigraphic Relationships

Like surrounding features, this pit structure was excavated into a floodplain alluvium. It intruded into a smaller structure, Feature 122, located directly beneath its eastern half.

Abandonment and Postabandonment

Feature 88 appears to have been cleaned out and then abandoned. It contained few artifacts and no evidence of burning or postabandonment reuse. After abandonment, it eventually became filled with alluvially deposited sediments that may have transported the small amount of cultural material found in the fill.

Date

The structure dates to the Early Agricultural period, based on its architectural style.

Feature 97, Pit Structure

General Description

This pit structure was discovered during mechanical stripping east of the mission wall (Figure 4.8). It was then completely excavated by hand. The round structure, which measured 4.55 m north-south and 3.75 m east-west, might represent two overlapping structures. Along its north-south axis, the feature appeared to be very elongated, and it was suggested that this portion represented a separate, intrusive pit structure. Therefore, while the excavated north-south dimension was 4.55 m, the actual distance is likely closer to 3.75 m, making the structure more circular. The excavated area contained 47 postholes and a small hearth, although the location of an entry could not be identified. The presence of a hearth and the lack of internal pits suggested a habitation function for this structure.

Internal Features

A small, irregularly shaped hearth, Feature 97.01, was located near the center of the structure. It contained a distinct hearth fill that consisted of oxidized sandy silt, with patches of white ash and occasional flecks of charcoal. Artifact density was low and consisted of one piece of flaked stone and a piece of animal bone. The hearth, which measured 0.45 m long, 0.34 m wide, and 0.06 m deep, had oxidized sidewalls.

Most of the 47 postholes were located near the pit walls, in two concentric posthole rows. Eight others were more randomly placed within the interior area, and could represent roof supports. Some of the postholes contained artifacts and were assigned subfeature numbers (97.02-97.07). Most of the postholes were between 5 cm and 17 cm in diameter, and were from 4-24 cm deep. A few others (postholes A, B, and C) were slightly larger, ranging from 17 cm to 36 cm in diameter, and between 13-18 cm deep. Five of the excavated postholes (LL, MM, NN, 97.06, and 97.07) were located within the small area that could belong to the separate pit structure that overlaps the northern portion of Feature 97.

Internal Strata and Artifact Contents

Approximately 0.16 m of homogenous fill was removed from the mechanically stripped surface to the pit structure floor. This consisted of alluvial silt and clay, deposited as part of a single flooding episode. It contained light amounts of charcoal flecking, daub flecking, and oxidation. Artifacts recovered from this fill included flaked stone, animal bone, fire-cracked ground stone fragments, sherds, two cores, a bone awl fragment, a ground stone fragment, a mano, a polisher, glass, Chinese porcelain, and at least 182 pieces of fire-cracked rock. One core and 21 pieces of fire-cracked were located on the structure floor.

Construction and Remodeling Evidence

Based on the location of the excavated postholes, the walls of Feature 97 were located within the house pit and were supported by a row of posts along the floor perimeter. The roof was likely supported by both of these wall posts and by a few randomly placed postholes within the interior area of the structure. None of the interior surfaces exhibited preparation, and the nature of the superstructure is largely unknown.

The structure appears to have undergone some extensive remodeling. First, the presence of two posthole rows suggests a shift in the location of the walls. Second, a few postholes were located just outside the posthole rows, likely representing shifts in post locations. These shifts may have been necessary to stabilize the walls or roof.

Stratigraphic Relationships

Feature 97 was constructed into a floodplain alluvium, and was intruded by at least three later features.

Figure 4.8. Feature 97, a Cienega phase pithouse, San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

It may be intruded by a pit structure (which did not receive a feature number) located directly north. It is intruded by a burial, Feature 159, which cuts into both structures. Finally, its northeastern edge was cut by yet another pit structure, Feature 96.

Abandonment and Postabandonment

This structure appears to have been cleaned out prior to abandonment. There was no floor assemblage preserved, and no evidence that the structure burned. Eventually, the structure became filled with alluvial sediment from a flooding episode. There was no evidence for postabandonment reuse.

Date

Based on its architectural style, the structure dates to the Early Agricultural period.

Feature 100, Pit Structure

General Description

This pit structure was discovered during mechanical stripping east of the mission wall (Figure 4.9). Unfortunately, a small portion of the structure was located directly beneath the wall and could not be exposed; therefore, the structure was only partially excavated by hand.

Because the outline of this structure was not completely exposed, its exact dimensions are unknown. It did, however, have a minimum diameter of at least 4.17 m and was approximately 0.17 m deep. The excavated area contained a hearth, a small pit, and 19 interior postholes. Despite the presence of a few gaps in the posthole pattern, the location of an entry could not be definitively identified. The structure was probably used for habitation and limited household storage before it was cleaned out and abandoned.

Internal Features

In addition to postholes, two other internal features were present in the structure. A small hearth, Feature 100.01, was located near the center of the structure, and a small pit, Feature 100.02, was located adjacent to the eastern wall. All 19 interior postholes were located near the walls and would have served as wall and roof supports. They measured between 12 cm and 21 cm in diameter, and were between 7-14 cm deep.

Feature 100.01 was a shallow hearth that measured 0.35 m long, 0.22 m wide, and 0.03 m deep. It was defined on the floor surface as a highly oxidized, basin-shaped depression. Its fill, which consisted of silt and ash, was distinct and may represent the final use of the hearth. No artifacts were recovered.

Feature 100.02 was a small basin-shaped pit that measured 0.55 m long, 0.42 m wide, and 0.12 m deep. It was filled with a sediment similar to that in the structure, and was likely in use when the structure was abandoned. Its fill consisted of light brown silt with charcoal flecking and some animal bone. The pit exhibited no evidence of burning, and was probably used for storage.

Internal Strata and Artifact Contents

This pit structure, like a few surrounding structures, was filled with an alluvial silt deposited as part of a distinct flooding episode. It exhibited no stratigraphy and contained charcoal flecking, occasional pieces of daub, a projectile point, a stone scraper, animal bone, unidentified sherds, at least one incipient plain ware sherd, shell, a bone awl fragment, ground stone, and 55 pieces of fire-cracked rock. No artifacts with a floor context were recovered.

Construction and Remodeling Evidence

Based on the location of its 19 interior postholes, Feature 100 appears to have been constructed within the excavated house pit. No evidence of individual roof supports was identified, and the roof was likely supported by the wall posts. Some daub was visible

Figure 4.9. Feature 100, a Cienega phase pithouse, San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

within the feature fill and might suggest a wattle-and-daub construction. None of the surfaces were prepared in any way. The overlapping of a few postholes indicates shifts in individual post locations and may represent some maintenance or repair.

Stratigraphic Relationships

The westernmost portion of the structure was located under the western part of the mission wall. No other overlying, underlying, or intrusive features were identified. This structure is located near other structures of similar size and shape, as well as near numerous extramural pits.

Figure 4.10. Feature 112, a Cienega phase pithouse, and Feature 110, a small pit, San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

Abandonment and Postabandonment

Artifacts were scarce throughout the feature, and the structure was probably cleaned out at the time of abandonment. After this abandonment, it filled with flood deposits. There was no evidence of postabandonment reuse.

Date

Feature 100 dates to the Early Agricultural period, based on its architectural style.

Feature 112, Pit Structure

General Description

This pit structure was discovered by mechanical stripping east of the exposed mission wall (Figure 4.10). It was subsequently completely excavated by hand. The round structure, which measured 3.0 m north-south and 2.9 m east-west, contained a shallow hearth and 34 interior postholes. Its orientation could not be determined, and there were no obvious gaps in the posthole pattern to suggest an entry location. The structure appeared to have been mostly cleaned out prior to a catastrophic burn. Due to the presence of a hearth and the lack of intramural pits, it probably served a habitation function.

Internal Features

A small hearth, Feature 112.01, and 34 postholes were the only internal features. Most of the postholes were located adjacent to the structure walls and along the floor perimeter. Three others were located within the interior area of the structure and could represent roof supports. All the postholes ranged in size from 8 cm to 13 cm in diameter, and were from 5-38 cm deep. Seven of these postholes contained the remains of charred posts and were assigned subfeature numbers, 112.02-112.08.

Feature 112.01 was a shallow hearth located against the western wall. It measured 0.85 m long, 0.67 m wide, and 0.05 m deep. It was filled with a soft white ash with no artifacts. The hearth was very informal and defined only as a highly oxidized depression on the pit structure floor.

Internal Strata and Artifact Contents

Approximately 0.40 m of stratified fill were removed from the mechanically stripped surface to the floor. The upper 0.34 m consisted of trash with abundant amounts of charcoal and burned daub. Below this, just above the structure floor, was a layer of collapsed superstructure with denser amounts of charcoal, burned daub, oxidized clay, and ash. On, and directly above, the floor itself, burned beam fragments were preserved and collected for species identification.

Artifacts recovered from the feature fill included flaked stone, animal bone (some of which were dog bones), ochre, an incipient plain ware sherd, freshwater shell, a lump of agate, a freshwater shell pendant, two pieces of fire-cracked ground stone, and more than 500 pieces of fire-cracked rock. Most of these artifacts, especially the fire-cracked rock, appeared to be the result of trash-filling from nearby features. A few artifacts with a floor context were also recovered: three manos, flaked stone, ochre, and two fire-cracked metate fragments. The two fire-cracked metate fragments were part of the same metate and were located on opposite sides of the structure.

Construction and Remodeling Evidence

Based on the location of the postholes, the walls of Feature 112 were probably constructed within the house pit and supported by a concentric row of posts along the floor perimeter. The roof was supported by a combination of these wall posts and three roof posts located within the interior area of the structure. Abundant amounts of burned daub, some with preserved plant impressions, were recovered, and the superstructure was likely of wattle-and-daub construction. None of the interior surfaces were prepared in any way, and no evidence of remodeling was present.

Stratigraphic Relationships

This pit structure was built into a floodplain alluvium and eventually filled with trash from surrounding features. It does not underlay, overlay, or intrude into any features. It was most closely located near four extramural pits—Features 110, 111, 113, and 114.

Abandonment and Postabandonment

The artifacts located on the floor of the structure did not appear to represent a true floor assemblage, but instead, trash left by the occupants at the time of abandonment. Soon after this abandonment, the structure burned, preserving posts in situ and beam fragments on the floor. The structure was then filled with trash from nearby features.

Date

Based on its architectural style, the structure dates to the Early Agricultural period.

Feature 121, Pit Structure

General Description

This pit structure was discovered during the re-excavation of an old waterline trench, and was then exposed by mechanical stripping (Figure 4.11). The portion extending north of the trench was manually excavated. The almost-round structure, which measured 3.2 m north-south and 2.6 m east-west, contained 34 postholes, a bell-shaped pit (Feature 121.31), and two floors. The location of an entry was not identified, and orientation of the structure could not be determined. Feature 121 was likely used for habitation and limited household storage until it was ultimately abandoned.

Internal Features

Most of the 34 identified postholes were positioned adjacent to the walls and were distributed between the two floors. The upper floor had a total of 26 postholes, three of which were located within the interior area of the structure. These were between 5 cm and 19 cm in diameter, and were from 2 cm to 18 cm deep. A few were assigned subfeature numbers (121.01, 121.02, and 121.04) because they contained artifacts. The lower floor contained eight postholes, all of which were perimeter wall posts. These ranged between 10 cm and 16 cm in diameter, and were from 4 cm to 20 cm deep.

Feature 121.03 was a bell-shaped pit that originated on the upper floor. It was only partially excavated, so its full dimensions are unknown. The pit contained a stratified fill that consisted of a silty clay in the uppermost fill and sandy clay in the lower fill. This fill contained charcoal, approximately 100 pieces of fire-cracked rock, and two projectile points. The pit did not appear burned and was likely used for storage.

Internal Strata and Artifact Contents

Approximately 0.21 m of fill were removed from the mechanically stripped surface to the upper floor. It contained no visible stratification and consisted of

Figure 4.11. Features 121 and 191, Cienega phase pithouses, San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

a silty clay with large amounts of charcoal and daub. Artifacts recovered from this fill included 62 pieces of fire-cracked rock, animal bone, flaked stone, and sherds. Artifacts located on the upper floor consisted of one piece of flaked stone and a burned deer bone fragment.

The fill between the two floors was composed of a lightly oxidized silty clay with a small amount of charcoal and daub. Only a few small flakes were recovered from this fill, and no artifacts were located on the lower floor.

Construction and Remodeling Evidence

Feature 121 was constructed by excavation into a floodplain alluvium. The location of its postholes, on both floor surfaces, indicates the walls were constructed within the excavated house pit. The roof was likely supported by both these wall posts and by three roof posts located within the interior area of the structure. Some burned construction material, including burned daub, was preserved within the upper feature fill and likely represents a superstructure of wattle-and-daub construction. None of the surfaces displayed evidence of preparation, but the upper floor was heavily oxidized.

At some point during its occupation, the lower floor surface was abandoned, and a new floor was constructed directly above it. Evidence for individual roof supports became visible on this new floor surface. Three postholes were located outside the posthole row and within the interior area of the structure.

Stratigraphic Relationships

Feature 121 was constructed over a smaller pit structure, Feature 191, and removed a small portion of that fill. This is a similar configuration to Features 88 and 122 to the east.

Abandonment and Postabandonment

This pit structure appears to have been occupied over an extended period of time, before it was finally cleaned out and abandoned. Sometime after this abandonment, the structure burned and filled with burned structural material and ultimately, with alluvial deposits. The lack of a distinct layer of collapsed superstructure might imply some scavenging prior to the burning.

Date

Based on its architectural style and associated artifacts, Feature 121 dates to the Early Agricultural period.

Feature 122, Pit Structure

General Description

This pit structure was discovered during the reexcavation of an old waterline trench and then exposed during mechanical stripping. It was intruded by Feature 88, a much larger structure, and was initially thought to be part of that feature. After Feature 88 was excavated, the portion of Feature 122 that extended north of the trench was excavated. Feature 122 was a small, off-round structure that measured approximately 2.05 m in diameter and contained at least six postholes (two of which were possible postholes). The location of its entry could not be identified, and the orientation of the structure was not determined. Based on the small size of the structure, it likely served a storage function before it was ultimately cleaned out and abandoned.

Internal Features

Six postholes were the only internal features exposed within the excavated area of the structure. Five of these were located along the floor perimeter and probably served as wall and roof supports. One posthole was located within the interior area of the structure and may have served as a roof support. These posts ranged between 7 cm and 14 cm in diameter, and were from 3 cm to 12 cm deep.

Internal Strata and Artifact Contents

Approximately 0.32 m of stratified fill was excavated from within this structure. It consisted of alluvially deposited silt and clay in the upper 0.25 m of fill, and burned structural material combined with natural sediments in the lower 0.07 m. Charcoal and burned daub were present throughout the feature fill, but increased dramatically in the fill just above the floor. In this lower fill, layers of charcoal, daub, and ash were indicative of intense burning.

Throughout the fill, the density of artifacts was low and consisted of flaked stone, animal bone, and eight pieces of fire-cracked rock. These artifacts did not appear to be the result of trash-filling and were probably associated with use of the structure. No artifacts with a floor context were recovered.

Construction and Remodeling Evidence

Based on the location of the wall postholes, Feature 122 was constructed within the excavated house pit. Its roof was probably supported by a combination of wall posts and at least one internal roof support post. The presence of large amounts of charcoal and burned daub suggests a superstructure of wattle-and-daub construction. None of the interior surfaces were prepared; these surfaces were defined only by the break between burned fill and the natural alluvium. There was no evidence of remodeling.

Stratigraphic Relationships

Feature 122 was constructed into a floodplain alluvium. It was intruded by a larger structure, Feature 88, which was constructed completely over it. Two other structures with a similar configuration are located to the west (Features 121 and 191).

Abandonment and Postabandonment

This pit structure contained no floor assemblage and appears to have been cleaned out prior to abandonment. After this abandonment, the structure burned and then filled with alluvial sediments. The lack of large samples of burned construction material, such as posts or beams, may suggest some scavenging prior to the burning.

Date

The structure dates to the Early Agricultural period, based on its architectural style.

Feature 126, Pit Structure

General Description

Feature 126 was discovered during mechanical stripping adjacent to the mission wall (Figure 4.12); it was subsequently completely excavated by hand. The round pit structure measured approximately 3.00 m north-south and 2.85 m east-west. It contained 30 postholes, 2 pits, and 2 floor surfaces, but due to multiple gaps in the posthole pattern, its orientation could not be determined. Based on the high level of remodeling, this structure was likely inhabited for an extended period of time and used for both storage and habitation.

Internal Features

As mentioned above, this structure contained two small pits, Features 126.03 and 126.04, and 30 postholes. Both pits originated on the lower floor and were located in the western portion of the structure. Most of the postholes were located along the floor perimeter. Some of these contained artifacts and were assigned subfeature numbers—126.01, 126.02, and 126.05.

Feature 126.03 was a small storage pit located near the center of the structure. It had a basin-shaped profile and measured 0.65 m long, 0.63 m wide, and 0.17 m deep. Its fill consisted of silty sand with abundant amounts of charcoal, four pieces of fire-cracked rock, and two pieces of flaked stone. This fill was unlike that of the structure, and the pit may have been sealed prior to abandonment of the lower floor.

Feature 126.04 was another small storage pit located along the western wall. It was also basin shaped, and it measured 0.48 m long, 0.45 m wide, and 0.14 m deep. Its fill consisted of silty clay with some charcoal and daub. The only artifact recovered was a pigment-stained mano located at the base of the pit. In contrast to Feature 126.03, its fill was similar to that of the structure, and the pit was probably used until the lower floor was abandoned.

Unfortunately, the presence of two floors was not immediately recognized in the western half of the structure; consequently, the upper floor was removed before it could be documented. Therefore, any posts originating from that floor surface were only identified on the lower floor surface, or not at all. Using the eastern half of the structure as a guide, the postholes on both floor surfaces appear to have followed the same general pattern and may have retained the same position on both floors.

Most of the postholes were located close to the pit walls and served as wall supports. A few others, most of which originated on the lower floor, were more randomly placed within the structure and may have served as roof supports. All the postholes ranged between 9 cm and 14 cm in diameter, and were from 6 cm to 20 cm deep.

Figure 4.12. Feature 126, a Cienega phase pithouse, San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

Internal Strata and Artifact Contents

Approximately 0.10 m of homogenous fill were removed from the mechanically stripped surface to the lower pit structure floor. Above each of the floor surfaces, the feature fill consisted of silty clay mottled with charcoal and daub. An average of 0.03 m of fill was excavated above the upper floor surface, and this contained a low artifact density that included flaked stone, animal bone, sherds, worked bone, a ground stone fragment, and approximately 12 pieces of fire-cracked rock. Between the two floors, roughly 0.06 m thick, the fill contained a low artifact density that included animal bone and at least six pieces of fire-cracked rock. Despite the lack of a clear stratum of collapsed superstructure, the fill above both floors appeared burned.

The upper floor surface had an impressive floor assemblage that consisted of two shaped stone bowls, a large pestle, and five pieces of fire-cracked rock. One of these stone bowls, SB 1, had an exterior surface that had been engraved in a crosshatch pattern, possibly to depict either a lizard or a tortoise. Also preserved on the upper floor surface was a charred post fragment that was collected for species identification. Artifacts recovered from the lower floor surface were less impressive, and included two pieces of flaked stone, a hammerstone, and one piece of fire-cracked rock.

Construction and Remodeling Evidence

Feature 126 was constructed by excavation into a floodplain alluvium. None of its interior surfaces were prepared in any way, and it was remodeled on more than one occasion. The presence of burned daub in the fills above both floors suggests a superstructure of wattle-and-daub construction. The structure was constructed within the excavated house pit and may have had a roof supported by a combination of wall posts and roof posts randomly placed within the interior area of the structure.

Evidence of remodeling was present throughout the structure. There were two distinct floor surfaces, each of which contained floor artifacts. Also, the lower floor contained two small pits that were ultimately sealed by construction of the upper floor. One of these pits, Feature 126.01, contained a fill distinct from that of the structure and may have been sealed prior to abandonment of the lower floor.

Stratigraphic Relationships

This feature was located south of Feature 112, a similar pit structure, and was surrounded by three extramural pits, Features 113, 114, and 136. Due to time restraints, some aspects of the relationship of this structure with other features were left unresolved. Parts of the eastern floor and walls of Feature 126 were cut into some type of lower feature fill and were difficult to identify. In this area, the walls are approximate. This lower fill might represent an undefined feature.

Abandonment and Postabandonment

At least two episodes of occupation were present within this structure, and were represented by the presence of two floors. The lower floor, based on the presence of two small pits, likely served a storage function. The limited number of artifacts on that floor surface indicates the structure was mostly cleaned out and abandoned. After this abandonment, the structure appears to have burned, perhaps intentionally, leaving some charcoal and burned daub in the fill. Sometime after burning of the structure, the structure was reoccupied and a new floor was constructed. The same post locations were probably utilized, with the addition of a few more.

The time that elapsed between the original construction and the remodeling of the structure was probably short, and construction materials may have been recycled. The floor assemblage located on the upper floor indicates an unexpected abandonment or deliberate placement of items before abandonment. Two of these artifacts, the stone bowls, were extremely rare and complete. The presence of a charred post, charcoal, and burned daub likely represents intense burning at the time of abandonment.

Date

Based on its architectural style and associated artifacts, Feature 126 dates to the Early Agricultural period.

Feature 128, Pit Structure

General Description

This structure was found during mechanical stripping west of Trench 102. It was then bisected, and its southern portion was completely excavated by hand.

Because this structure was not completely excavated, its full dimensions were not exposed. It had a minimum diameter of at least 3.5 m and was approximately 43 cm deep. Its orientation could not be determined, and five postholes were the only internal features identified. This structure was likely used for habitation before it was ultimately cleaned out and abandoned. At some point after this abandonment, the structure burned.

Internal Features

As mentioned, five postholes were the only internal features identified within the excavated portion of the pit structure. At least three of these postholes were wall supports located along the floor perimeter, while the other two postholes were likely roof supports located within the interior area of the pit structure. These postholes ranged between 11 cm and 15 cm in diameter, and were between 5 cm and 13 cm deep.

Internal Strata and Artifact Contents

This structure was filled with both alluvial and culturally deposited sediments. The upper 10 cm of fill consisted of naturally deposited silt with virtually no cultural material. Below this, approximately 20 cm thick, was a trash layer with moderate amounts of charcoal, daub, sherds, flaked stone, animal bone, and 45 pieces of fire-cracked rock. Located 13 cm above the floor was a layer of burned structural material with abundant amounts of charcoal, lumps of burned daub, and ash.

Artifacts recovered from the lowest layer of the collapsed superstructure consisted of flaked stone, animal bone, and 125 pieces of fire-cracked rock. These artifacts are probably not directly associated with the structure; they are likely trash deposited before the structure burned. Three pieces of fire-cracked rock were the only artifacts recovered from the floor.

Construction and Remodeling Evidence

This structure was constructed by excavation into a floodplain alluvium. The presence of burned daub in its fill suggests a superstructure of wattle-and-daub construction. The structure walls, based on the fragmentary posthole pattern, were probably constructed within the house pit. Its roof may have been supported by both the wall posts and by interior roof supports. Neither the floor nor walls were prepared in any way, and they were defined by the break between cultural fill and natural alluvium. No evidence of remodeling was present.

Stratigraphic Relationships

At least two other pit features were intrusive into this pit structure. Feature 212 removed a portion of the structure's western wall, while Feature 213 removed a small portion of the southern wall. Feature 128 was located directly northeast of another pit structure, Feature 211, that was defined only by its posthole pattern.

Abandonment and Postabandonment

Only a few pieces of fire-cracked rock were located on the floor surface, and the structure appears to have been cleaned prior to abandonment. After abandonment, the structure was filled with a minimal amount of trash before it ultimately burned. Although large amounts of burned structural material, such as burned daub, were preserved in the lower fill of the structure, the absence of large samples of collapsed superstructure might imply scavenging prior to burning. After burning, the structure filled with trash and then alluvial sediments.

Date

The structure dates to the Early Agricultural period, based on its architectural style.

Feature 151, Pit Structure

General Description

This pit structure was discovered during mechanical stripping east of Trench 101. The feature was then bisected, and its northern portion was manually excavated.

This round structure was cut by a large Hohokam canal, Feature 137, AZ BB:13:481 (ASM), that removed most of its eastern edge. Because of this, the dimensions of the structure are only approximate at 3.67 m long and 2.80 m wide. Within its excavated area, 13 postholes and a portion of a floor groove were exposed. The location of its entry was not identified, and orientation of the structure could not be determined. This feature likely functioned as a habitation structure before it was ultimately cleaned out and abandoned.

Internal Features

Thirteen interior postholes were uncovered within the excavated portion of the structure. All 13 postholes were located near the northern wall of the structure, and 10 were located within the floor groove. The postholes ranged from 12-15 cm in diameter, and were between 5-19 cm deep. The floor groove was approximately 21 cm wide and extended around most of the exposed northern wall.

Internal Strata and Artifact Contents

The 46 cm of fill removed from this structure consisted of both naturally and culturally deposited sediments. The uppermost fill, approximately 13 cm, was composed of alluvially deposited silt and clay with no artifacts, and was likely deposited during a flood episode. The lower 33 cm consisted of a trash fill with abundant amounts of charcoal and lumps of burned daub.

A moderate number of artifacts were recovered from the lower house fill. These included flaked stone, a burned corn fragment, a broken shell pendant, animal bone, a mano, 2 sherds, 3 fire-cracked ground stone fragments, and 33 pieces of fire-cracked rock. Only one artifact, a piece of flaked stone, was recovered from the floor.

Construction and Remodeling Evidence

Based on the location of the postholes, the walls of this structure were probably constructed within the house pit and were supported by a concentric row of posts situated within a floor groove. No individual roof supports were identified, and the roof may have also been supported by the wall posts. The presence of daub in the lower feature fill might imply a superstructure of wattle-and-daub construction. None of the interior surfaces were prepared in any way, and there was no evidence of remodeling.

Stratigraphic Relationships

This pit structure was constructed by excavation into a floodplain alluvium and is intruded along its eastern side by a large Hohokam canal, Feature 137, BB:13:481. It was most closely located near several extramural pits that included Features 40, 137, 160, and 183.

Abandonment and Postabandonment

Based on the presence of only one artifact on the floor, this structure was probably cleaned out prior to abandonment. The structure was then filled with trash from surrounding features, before eventually filling with alluvium.

Date

Based on its architectural style, the structure dates to the Early Agricultural period.

Feature 191, Pit Structure

General Description

Feature 191 was discovered during the re-excavation of a waterline trench, and then exposed by mechanical stripping (see Figure 4.11). It was located within the limits of another pit structure, Feature 121, and only the portion north of the trench was manually excavated.

This round structure had a diameter of 1.8 m. It contained 11 internal features that included 10 postholes and a small pit. Its entry could not be identified, and the orientation of the structure is unknown. Based on the small size and the presence of a pit, this structure was likely used for storage before it was ultimately cleaned out and abandoned.

Internal Features

All 10 of the structure's postholes were located along the floor perimeter and likely served as wall and roof supports. They ranged in diameter from 10 cm to 12 cm, and were between 3 cm and 10 cm deep. None of the postholes contained artifacts.

Feature 191.01 was a small storage pit that measured 0.75 m long, 0.67 m wide, and approximately 0.27 m deep. It had a basin-shaped profile and was located near the northwestern wall. The fill consisted of a silty clay with burned daub, burned animal bone, and four pieces of fire-cracked rock. A ground stone donut fragment was located directly on its base. This pit was likely the central focus of the structure.

Internal Strata and Artifact Contents

This structure was filled with approximately 6 cm of naturally deposited sands with flecks of charcoal and daub. No artifacts were recovered from the feature fill, and only one piece of flaked stone and some burned animal bone were recovered from the structure floor.

Construction and Remodeling Evidence

Based on its posthole pattern, Feature 191 had walls constructed within the house pit and supported by a row of posts along the floor perimeter. The structure was very small, and its roof was likely supported by the wall posts. None of the interior surfaces were prepared in any way, and the nature of the superstructure is unknown. There was some slight remodeling visible within the structure. Feature 191.01, which contained a fill unlike that of the structure, was probably sealed during occupation of the structure.

Stratigraphic Relationships

This structure was constructed by excavation into a floodplain alluvium. It was intruded by a larger structure, Feature 121, whose floor was constructed almost completely over it. It is located directly west of two other structures, Features 88 and 122, that share a similar configuration.

Abandonment and Postabandonment

This small structure contained virtually no floor assemblage and exhibited no evidence of burning. It was likely cleaned out and abandoned before eventually filling with naturally deposited sediments. There was no evidence of any postabandonment reuse.

Date

The structure dates to the Early Agricultural period, based on its architectural style.

Feature 211, Pit Structure

General Description

This pit structure was discovered during mechanical stripping west of Trench 102. It was not until after the floor surface had been mostly stripped away and a posthole pattern exposed that the structure was identified as a distinct feature. The structure was subsequently manually scraped to reveal any subfeatures.

The round pit structure measured approximately 3.15 m long and 3.05 m wide. It contained a small pit, 35 postholes, and a possible hearth remnant. The location of the entry was not identified, and the orientation of the structure could not be determined. The structure was likely used for both habitation and limited household storage.

Internal Features

In addition to a possible hearth remnant and a small pit, the structure contained a total of 35 postholes (two of which were possible postholes). Most of these postholes were located within a concentric row along the floor perimeter. A few others were located just outside of this row and may be the result of remodeling. On average, these posts ranged between 6-18 cm in diameter, and were from 3-10 cm deep.

Feature 211.01 was located near the center of the structure and, due to time constraints, was not excavated. On the surface, the stain of the pit measured approximately 70 cm long and 60 cm wide. A small patch of oxidation was noted in the northwestern portion of the structure and could represent the remnant of a hearth that was inadvertently removed during stripping.

Internal Strata and Artifact Contents

Because Feature 211 was mechanically stripped below its floor, the nature of its fill and artifacts is unknown. The exposed postholes, however, were silt filled.

Construction and Remodeling Evidence

Based on the location of its postholes, this structure appears to have been constructed within the house pit with walls supported by a row of posts along the floor perimeter. No individual roof supports were identified, and the superstructure was probably supported by the wall posts. The nature of the superstructure construction is unknown.

Some evidence of remodeling was visible within the posthole pattern. Some of the postholes slightly overlapped each other, suggesting individual shifts in post locations. Others were located just outside the posthole row and may indicate efforts to stabilize the walls or roof.

Stratigraphic Relationships

This pit structure, like surrounding features, was excavated into a floodplain alluvium. A small roasting pit, Feature 214, is located in its southern half. It is not clear, however, which feature intrudes the other. Feature 211 is located directly northwest of another pit structure, Feature 15, which is larger in size.

Abandonment and Postabandonment

Because this structure was so heavily disturbed, its type of abandonment is uncertain. There was no evidence of burning on any of the surfaces, and the structure may have been cleaned out and abandoned. No evidence of postabandonment reuse was preserved.

Date

Based on its architectural style, the structure dates to the Early Agricultural period.

Feature 218, Pit Structure

General Description

This pit structure was discovered during mechanical trenching (Trench 101), and then exposed by mechanical stripping (Figure 4.13). The southern half of Feature 218 was removed by a historic *acequia*

Figure 4.13. Feature 218, a Cienega phase pithouse, San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

(canal), Feature 9, BB:13:481, and only the northern half was completely excavated by hand.

Because the structure was only partially excavated and the entire feature stain could not be exposed due to the intrusive *acequia*, its dimensions could not be determined. Based on the size of the excavated portion, however, the structure likely had a diameter of at least 3.25 m. An entryway was not identified, and the orientation is unknown. The structure contained 16 postholes and one small pit. It likely served a primarily habitation function with some limited household storage.

Internal Features

In addition to 16 postholes, a small pit, Feature 218.01, was centrally located within the structure. This small pit measured 37 cm long, 36 cm wide, and 13 cm deep. It was filled with brown silt with a minimal amount of charcoal flecking and no artifacts. It did not appear burned and may have served a storage function.

Most of the postholes were located near the pit walls within a concentric row. A few others (postholes K-P) were located outside of this row and within the interior area of the structure. These probably represent roof supports but could also be evidence of remodeling. The postholes ranged between 9-15 cm in diameter, and were from 4-10 cm deep.

Internal Strata and Artifact Contents

About 19 cm of homogenous feature fill were removed from the mechanically stripped surface to the pit structure floor. This consisted of naturally deposited silt with small amounts of charcoal, and may be the result of a single flood episode. Few artifacts were recovered from this fill; these included flaked stone, sherds, animal bone, a core, and 37 pieces of fire-cracked rock. Only one partial mano was recovered from the floor.

Construction and Remodeling Evidence

Feature 218, like all surrounding structures, appears to have been a house-in-pit. The roof was probably supported by a combination of wall posts and roof posts within the interior of the structure. Construction materials were not preserved, and the nature of the superstructure is unknown. None of the interior surfaces were prepared. A few postholes were located just outside the posthole row and likely represent remodeling or maintenance. They were probably added to provide additional support to the walls or roof.

Stratigraphic Relationships

Feature 218 was constructed into a floodplain alluvium and was intruded by a historic *acequia*, Feature 9, BB:13:481, which removed most of its southern portion. It was also located within a cluster of similar structures that included Features 29, 57, and 151.

Abandonment and Postabandonment

Because only one partial mano was located on the pit structure floor and the structure did not burn, it was likely cleaned out and abandoned. It then filled with alluvial sediments.

Date

Based on its architectural style, the structure dates to the Early Agricultural period.

PREHISTORIC PITS

A total of 124 pits was found at the San Agustín Mission locus; a sample of 43 pits was excavated (see Table 4.1). Those beneath the former Mission Lane were the primary focus. A small number outside this area were also excavated, however. Of the prehistoric pits, all but Feature 13 probably date to the Early Agricultural period.

Feature 13, Bell-shaped Pit

Feature 13 was a bell-shaped pit identified during excavation of Trench 10. The backhoe removed the upper 45 cm of its fill, leaving only the lower 28 cm in place. This was excavated in two, 14-cm levels, by hand. The pit continued into both faces of Trench 10, but only that portion of the pit present in the trench was excavated. Because the pit was not fully excavated, its full dimensions are not known. It had an upper length of 1.30 m, an upper width of at least 0.70 m (the width of the trench), a basal length of at least 1.20 m, a basal width of at least 0.70 m (also the width of the trench), and a depth of 0.73 m. The fill was a light grayish-brown sandy loam that contained a moderate amount of charcoal flecking, very little gravel, and 11 pieces of fire-cracked rock.

The density of artifacts was moderate and consisted of Hohokam sherds, flaked stone, and animal bone; two flotation samples were also collected. The function of the pit is unknown, and it is intruded by Feature 9, BB:13:481, a historic-era canal.

Feature 20, Roasting Pit

Feature 20 was a small roasting pit originally identified during the 1987 testing of the project area. When Trench 19 was reopened, the classification of the pit was changed to a possible burial, based on the presence of some large human-like bone fragments visible in its profile. The pit was initially excavated as a burial, in one level, from the modern ground surface to the level at which the bone was present. The bone was determined not to be human, and the feature was subsequently classified as a roasting pit. The remaining pit fill was then screened though ¼-inch mesh.

The roasting pit had an oblong-shaped top, straight walls, and a nearly flat base. It was 1.03 m long, 0.78 m wide, and 0.20 m deep. The fill consisted of a moderately compacted, light brown, granular silt with abundant charcoal flecking and 150 pieces of fire-cracked rock. A moderate amount of artifacts was recovered, including animal bone, flaked stone, 2 cores, 1 hammerstone, an obsidian biface fragment, ground stone, and 7 sherds. The pit was intrusive into Feature 19, an Early Agricultural period pit structure, and Feature 20 also likely dates to that period.

Feature 30, Pit

Feature 30 was a small, circular pit with a basin-shaped profile. It was identified during excavation of Trench 104, and had a diameter of 78 cm and a depth of 10 cm. The pit was filled with heavily compacted, light brown sandy silt with some charcoal flecking and one piece of fire-cracked rock. The feature could not be completely excavated because a small portion was not exposed during backhoe scraping. Just over half the pit was excavated in one level.

Artifact density within the pit was low—three pieces of flaked stone and one small sherd. One flotation and one pollen sample were also collected. The function of the pit is unknown, and it probably dates to the Early Agricultural period.

Feature 31, Bell-shaped Pit

Feature 31 was a bell-shaped pit identified in Trench 106 (Figure 4.14). The backhoe cut into the top portion of the pit and removed its upper fill. Only the lower pit fill was left intact within the boundaries of the trench; this was excavated in one level.

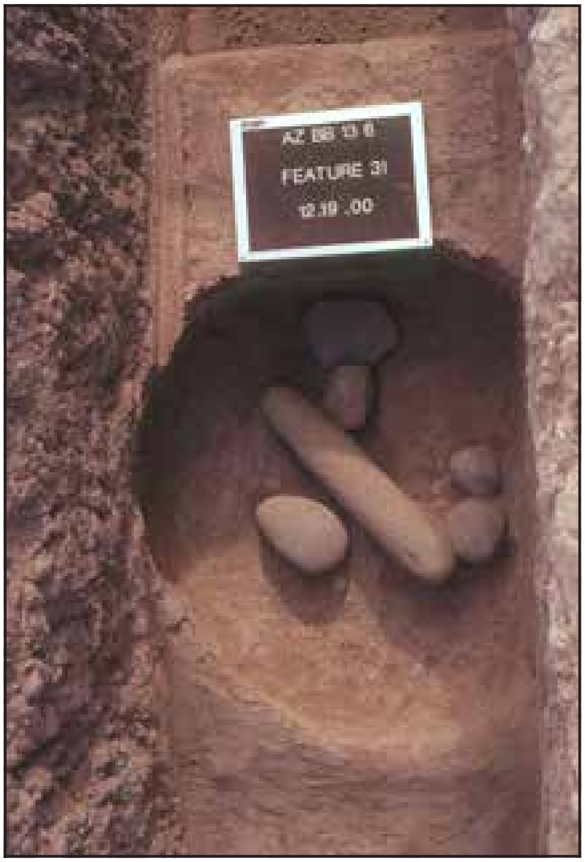

Figure 4.14. Feature 31, an Early Agricultural period pit containing a ground stone cache, San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

The feature was not completely excavated, and the portion of the pit extending into the western face of the trench was not sampled. Therefore, most of the dimensions of the pit, especially its top dimensions, are not known. It had a basal length of 82 cm, a basal width of at least 70 cm (the width of the trench), and a depth of approximately 97 cm. The pit was filled with moderately compacted silty clay with abundant amounts of burned daub (some with preserved plant impressions) and charcoal flecking.

Feature 31 contained an assemblage of a biface, one flaked stone, a mano, a handstone, two pecking stones, a large pestle, and a tested rock. Other artifacts recovered from the pit fill included 37 pieces of flaked stone, a biface tip, and one piece of freshwater shell. One flotation and one pollen sample were also collected. The pit dates to the Early Agricultural period, and was probably used for storage.

Feature 45, Pit

Feature 45 was a small, semicircular pit located west of Trench 102. It had a basin-shaped profile and had been cut into culturally deposited sediment. It was completely excavated in one level and had a length of 1.16 m, a width of 0.93 m, and a depth of 0.16 m. The pit was filled with a brown, mottled silt-clay, with a large amount of charcoal and some irregularly shaped lumps of oxidized soil.

A small number of artifacts were recovered from the pit and included flaked stone, sherds, and animal bone. Based on its location and originating depth, the pit probably dates to the Early Agricultural period. The function of the pit is not known, and no samples were collected from its fill. The pit is intruded by Feature 9, BB:13:481, a historic-era canal, that disturbs one-quarter of the northern edge of Feature 45.

Feature 63, Bell-shaped Pit

Feature 63 was a bell-shaped pit located on the northern edge of the pit cluster. During excavation, it was bisected, and its eastern half was excavated in one level. Because the pit was not fully excavated, its full dimensions are unknown. It was 1.04 m long, 0.82 m wide, and 0.41 m deep. Only one basal dimension of 0.81 m was exposed.

The pit fill had two distinct strata. The upper 10-20 cm consisted of moderately compacted, brown silty clay with a dense amount of charcoal and all the artifacts recovered from the feature. The lower 30-40 cm consisted of compacted, dark brown clay with occasional flecks of charcoal. The pit did not appear burned, and a total of 26 pieces of fire-cracked rock were collected. Artifact density was low, including sherds, flaked stone, ground stone, and a piece of micaceous schist. One flotation and one pollen sample were also collected. The pit was likely used for storage.

Feature 66, Pit

Feature 66 was a small, oblong-shaped pit with gently sloping sidewalls and a rounded base. The pit was bisected, and its western half was excavated in one level. Fill was a compacted, light brown, granular clayey silt with occasional flecks of charcoal and daub, as well as six pieces of fire-cracked rock. The pit was 0.65 m long, 1.11 m wide, and 0.06 m deep.

A few pieces of flaked stone were the only artifacts collected; one flotation sample was collected. The function of the pit is not known, although it is adjacent to Feature 65, an Early Agricultural pit structure located to the south. The excavated portion of the pit is very shallow, and the pit likely originated at a higher elevation.

Feature 67, Pit

Feature 67 was a small, circular pit with a basin-shaped profile. It was bisected, and the fill from its northern half was removed in one level. It had a diameter of 83 cm and was 14 cm deep.

The pit was filled with a moderately compacted, brown silty clay with a large amount of charcoal, oxidation, and nine pieces of fire-cracked rock. No artifacts were present, and only one piece of animal bone was recovered. A flotation and a pollen sample were collected. Although the fill of the pit appeared to be heavily burned, the pit itself was not. The pit was probably used as a storage pit that was later filled with trash.

Feature 68, Pit

Feature 68 was a small, circular pit approximately 0.81 m long, 0.79 m wide, and 0.05 m deep. It had sloping sidewalls, a rounded base, and like other pits in the area, was only partially excavated. The pit was bisected, and its southern half was sampled in one level. The fill consisted of a light brown, compacted silt with occasional flecks of charcoal. No artifacts were recovered from the feature, and its function is unknown.

Feature 69, Bell-shaped Pit

Feature 69 was a bell-shaped pit, also partially sampled. During excavation, it was bisected, and the southern half was excavated in three arbitrary levels. Because the pit was not totally excavated, its full dimensions are not known. The top of the feature had a length of 0.92 m and a minimum width of 0.70 m. The base of the pit had a maximum length of 1.36 m and a minimum width of 0.86 m. It was 1.55 m deep.

The pit fill had two strata. The upper 40 cm consisted of brown silty-sandy clay, while the rest of the fill was composed of a lighter brown silty sand. Large amounts of charcoal were present throughout the fill, as were 365 pieces of fire-cracked rock. A moderate number of artifacts were recovered, including flaked stone, animal bone, a canid tooth, a complete mano, one sherd, a biface, and shell. Multiple flotation samples were collected.

Although the fill appeared to be burned, the pit itself was not. Its original function is unknown, but it appears to be trash filled. Feature 69 overlaps with another pit, Feature 68, but it is unclear which feature intrudes the other.

Feature 70, Pit

Feature 70 was a small, oblong-shaped pit with a basin-shaped profile. It was completely excavated in one level, and one flotation sample was collected. An old waterline trench had cut into the feature and removed a portion of its southern edge; consequently, the exact dimensions of the pit are unknown. The pit had a minimum diameter of 57 cm and a depth of 13 cm. It was filled with a moderately compact, light brown silt with no charcoal. A small number of artifacts were recovered from the feature, including ceramics, flaked stone, and animal bone. The function of the pit is unknown.

Feature 71, Pit

Feature 71 was a small, circular pit 75 cm long, 60 cm wide, and 20 cm deep. It was filled with homogeneous brown sandy-silty clay that contained a large amount of charcoal flecking and 19 pieces of fire-cracked rock. It was completely excavated, and one flotation sample was collected.

Only one artifact, a small polisher, was recovered from the fill. The pit had sloping sidewalls and a rounded base that were both oxidized, and it probably functioned as a firepit. Feature 71 was disturbed by an old waterline trench that cut through its southern edge.

Feature 72, Pit

Feature 72 was a small, circular pit with a basin-shaped profile. During excavation, it was bisected, and its eastern half was excavated in one level. The pit was 94 cm long, 87 cm wide, and 7 cm deep. It was filled with a brown sandy silt with diffuse charcoal flecking. The pit did not appear burned, and no fire-cracked rocks were collected. A small number of artifacts were recovered, including one small sherd and two pieces of flaked stone; no samples were collected. The function of the pit is not known.

Feature 73, Pit

Feature 73 was a small, circular pit with a basin-shaped profile. It was completely excavated in one level and was 53 cm long, 48 cm wide, and 8 cm deep. It had a basal diameter of 35 cm. The pit was filled with brown silty clay with heavy charcoal, light caliche flecking, and five pieces of fire-cracked rock No artifacts were recovered, although one flotation sample was collected. The function of the pit is unknown.

Feature 74, Pit

Feature 74 was a small, oblong pit with a basin-shaped profile. It was completely excavated in one level, and was 76 cm long, 35 cm wide, and 3 cm deep. It was filled with a brown silty clay with a moderate-to-high density of charcoal. No artifacts were recovered from the pit, but a flotation sample was collected. The pit appeared to be a small shallow depression filled by either trash or sheetwash. The original function of the pit is unclear.

Feature 75, Pit

Feature 75 was a small, circular pit with a basin-shaped profile. It was completely excavated in one level, and one flotation sample was collected. It was 70 cm long, 68 cm wide, and 17 cm deep. The fill consisted of compact, brown silty clay with abundant charcoal and no artifacts. Its function was unknown.

Feature 76, Roasting Pit

Feature 76 was a small, partially excavated roasting pit with an elliptical top and a basin-shaped profile. During excavation, the pit was bisected, and its southern half was excavated in one level. The fill consisted of a granular, moderately compact, brown clayey silt with a moderate amount of charcoal, 51 pieces of fire-cracked rock, and occasional chunks of daub.

The pit was 1.10 m long, 0.95 m wide, and 0.13 m deep. A small number of artifacts were recovered and included flaked stone, four fire-cracked rocks, and ground stone fragments. One flotation sample was also collected. The function of Feature 76 is unknown.

Feature 77, Pit

Feature 77 was a small pit with a circular top and a basin-shaped profile. It was completely excavated in one level, and a flotation sample was collected from its fill. The pit was 76 cm long, 73 cm wide, 15 cm deep; it was filled with brown silty-clayey sand with a large amount of charcoal and 29 pieces of fire-cracked rock. A low density of artifacts was recovered and consisted only of flaked stone. Based on the large amounts of charcoal and fire-cracked rock located in its fill, Feature 77 may have functioned as a firepit.

Feature 78, Pit

Feature 78 was a small, circular pit with straight sidewalls, a flat base, and a slight shelf along its southern and eastern sides. During excavation, the pit was bisected, and its southern half was excavated in one level. The pit was filled with a grayish-brown, moderately compacted sandy-silty clay with a large amount of fire-cracked rock and charcoal. A thin band of light tan sand was directly above the base of the pit.

The pit was 1.20 m long, 1.00 m wide, 0.29 m deep, and had a minimum basal length of 0.95 m. A small number of artifacts was collected from its fill, including flaked stone, ground stone, and animal bone. The function of the pit is unknown. A historic-era canal, Feature 9, BB:13:481, was intrusive into the northern edge of the pit.

Feature 79, Pit

Feature 79 was a small, irregularly shaped pit, 80 cm long, 60 cm wide, and 8 cm deep. It was completely excavated in one level, and was filled with dark brown silty-sandy clay with a large amount of charcoal flecking and 30 pieces of fire-cracked rock. No artifacts were recovered; one flotation sample was collected. The function of the pit is unclear.

Feature 80, Pit

Feature 80 was a small, oval-shaped pit located on the eastern edge of the dense pit cluster between Trench 102 and Trench 103. It was totally excavated in one level, and a flotation sample was collected. The pit was 65 cm long, 50 cm wide, 14 cm deep, and had a basin-shaped profile. Fill was a mottled, moderately compacted, dark brown clay with a large amount of charcoal flecking, caliche threads, and 11 pieces of fire-cracked rock.

Only a few artifacts were recovered from the pit—a mano, a partial donut stone, flaked stone, and animal bone. Based on the types of artifacts recovered and its location, Feature 80 probably dates to the Early Agricultural period. Its function is unclear.

Feature 81, Pit

Feature 81 was a small, irregularly shaped pit with a subrectangular top and sloping sides. It was located between Trench 102 and Trench 103, west of at least three Early Agricultural period pit structures. The pit was completely excavated in one level, and a flotation sample was collected from the fill just above its base. Fill was a medium brown sandy silt with very little charcoal and no artifacts. The pit was 52 cm long, 41 cm wide, and 10 cm deep. Its function is unknown, but based on its location, it likely dates to the Early Agricultural period.

Feature 82, Pit

Feature 82 was a small pit with a circular top and a basin-shaped profile. It was located between Trench 102 and Trench 103, near at least two Early Agricultural pithouses. The entire pit was excavated in one level, and a flotation sample was collected. It was filled with a homogenous, medium brown sandy silt with very little charcoal and one piece of fire-cracked rock. The pit had a length of 37 cm, a width of 35 cm, and a depth of 9 cm. Only one artifact, a sherd, was recovered from its fill. The function of Feature 82 is unknown, but based on its location and its originating depth, it probably dates to the Early Agricultural period.

Feature 86, Pit

Feature 86 was a small pit with a circular top, nearly straight walls, and a flat base. It was located between Trench 102 and Trench 103, within the fill of Feature 121, an Early Agricultural period pithouse.

The pit was completely excavated as one unit, in one level. It was filled with a homogenous, medium brown sandy silt with a small amount of charcoal, eight pieces of fire-cracked rock, and some daub. It was 82 cm long, 77 cm wide, and 12 cm deep.

Artifact density within the pit was low and consisted of nine sherds and some animal bone. One flotation sample was also collected. The pit may have originated at a higher elevation, and only its base was preserved. It was surrounded by several other small pits that originated at a similar elevation. The pit likely dates to the Early Agricultural period, although its function is unclear.

Feature 105, Pit

Feature 105 was a small, circular pit located east of the exposed mission wall, within a small cluster of Early Agricultural period pits. It was completely excavated in one level, and a flotation sample was collected. Fill of Feature 105 consisted of a brown silty clay with a moderate amount of charcoal flecking and one piece of fire-cracked rock. The pit had a basin-shaped profile and was 70 cm long, 65 cm wide, and 8 cm deep. A few pieces of flaked stone were the only artifacts recovered. The function of the pit is unknown.

Feature 107, Pit

Feature 107 was a small, circular pit located east of the mission wall. It was completely excavated in one level, and was filled with a brown silty clay with some charcoal flecking, nine pieces of fire-cracked rock, and caliche deposits. The pit had a basin-shaped profile, a diameter of 64 cm, and a depth of 19 cm. Artifact density was low and consisted of animal bone, flaked stone, and one possible hammerstone. One flotation sample was collected. The pit likely dates to the Early Agricultural period, although its function is unknown.

Feature 110, Bell-shaped Pit

Feature 110 was a bell-shaped pit located east of the mission wall, between two Early Agricultural period pithouses, Features 100 and 112 (see Figure 4.11). The pit was completely excavated in one level, and was filled with light brown silt mottled with fine-grained sands. These were heavily compacted in the upper 30 cm of fill, but became more moderately compacted near the pit base. Twenty-five pieces of fire-cracked rock at least 5 cm in diameter, charcoal, and daub were present in the fill.

The pit had a top length of 1.00 m, a top width of 0.87 m, a basal length of 0.98 m, a basal width of 0.96 m, and was 0.53 m deep. A moderate number of artifacts was recovered, including sherds, flaked stone, shell, and animal bone. Near the base of the pit, approximately 50 pieces of fire-cracked rock, all smaller than 5 cm, were present. These may have been deliberately deposited into the pit as part of one dumping episode. Feature 110 likely functioned as a storage pit that eventually filled with trash. Based on its location, Feature 110 probably dates to the Early Agricultural period.

Feature 113, Bell-shaped Pit

Feature 113 was a bell-shaped pit located east of the exposed mission wall, between two Early Agricultural period pithouses, Features 112 and 126. During excavation, the pit was bisected, and its northern half was excavated in one level. Because it was not completely sampled, all of its dimensions are not precisely known. The pit had a top length of 1.00 m, a top width of at least 0.83 m, a basal length of 1.02 m, a basal width of at least 0.85 m, and it was 0.27 m deep.

The fill was composed of two separate strata. The upper fill consisted of redeposited cienega clay that was mottled with silts, while the fill just above the pit base consisted of a lens of fine-grained, tan-brown silts. A small number of artifacts were recovered and included flaked stone and animal bone. There was no burning visible within the feature, and it was probably used for storage. Based on its location, Feature 113 probably dates to the Early Agricultural period.

Feature 115, Roasting Pit

Feature 115 was a small, oval-shaped roasting pit located directly beneath Feature 3, BB:13:481, a historic-era canal. It was discovered at the base of a previous excavation unit that had been placed over Feature 3 in 1986. Because a portion of the southern edge of the pit was located under the southern wall of Feature 3, the pit could not be completely excavated. Only its exposed portion was sampled—in one level and as one unit.

Due to the partial excavation, the exact dimensions of the pit are not known. It had a basin-shaped profile, a maximum length of 89 cm, a width of at least 40 cm, and a depth of 17 cm. It was filled with dark reddish-brown clay that contained 51 pieces of fire-cracked rock and some charcoal. The margins of the pit were oxidized and stained by charcoal and ash.

Feature 115 is intrusive to the house fill of an Early Agricultural period structure, Feature 17, that was also located under Feature 3. A small number of artifacts was recovered and included flaked stone and one piece of fire-cracked ground stone. The pit probably dates to the Early Agricultural period, and its function is unknown.

Feature 125, Pit

Feature 125 was a small, irregularly shaped pit located between Trench 102 and Trench 103. It was intrusive into the fill of Feature 121, an Early Agricultural period pit structure. Feature 125 was completely excavated in one level, and a flotation sample was collected from its fill. Most of the feature was filled by three, large fire-affected pieces of vesicular basalt that were heavily dotted with caliche. It was also filled by a dark brown silty clay with five small pieces of fire-cracked rock, a chunk of daub, and no artifacts.

The outline of Feature 125 was distinct within the fill of Feature 121, due to its burned fill and oxidized rim. Along with Feature 121, the pit was cut by a waterline trench that removed its southern edge. The pit appeared heavily burned and was 54 cm long, 28 cm wide, and 13 cm deep. It likely dates to the Early Agricultural period, and probably functioned as a firepit.

Feature 180, Pit

Feature 180 was a small pit located between Trench 101 and Trench 102. It had an oval-shaped top, gently sloped sidewalls, and a flat base. Backhoe scraping in the area only exposed the northern half of the feature. This was excavated in one level, and a flotation sample was collected from the fill. Due to this partial excavation, the exact dimensions of the pit are not known. It was at least 55 cm long, 82 cm wide, and 14 cm deep. If completely exposed, the true diameter might have been closer to 80 cm. The pit fill consisted of loosely-to-moderately compacted, granular, brown clayey silt with sparse charcoal flecking and two pieces of fire-cracked rock. A few artifacts were recovered, including sherds, flaked stone, a piece of animal bone, and a freshwater snail shell.

The pit did not appear burned, and its original function is unknown. It might date to the Hohokam periods, as it had three large ceramics resting near its base, and it is located near another Hohokam feature, Feature 39. Both features originated at about the same depth.

Feature 183, Pit

Feature 183 was a small, oblong pit located between Trench 101 and Trench 102. It was intrusive into Feature 38, an earlier burial, and was initially thought to be part of that feature. After the surface stain of the two features was bisected and the eastern half excavated to sterile, the two features became distinct. In the resulting profile, human bone was visible to the west, under the base of Feature 183. Because the fill of the two features had been mixed during excavation, all artifacts recovered from Feature 183 were repatriated. The pit was filled with a heavily compacted silty clay with large amounts of charcoal and oxidation. It had a basin-shaped profile and was 95 cm long, approximately 75 cm wide, and approximately 25 cm deep. A few sherds were the only artifacts recovered from the fill. The pit had oxidized edges and probably functioned as a firepit. Based on artifact content, Feature 183 likely dates to the Hohokam occupation.

Feature 184, Pit

Feature 184 was a small, circular pit located between Trench 102 and Trench 103, within a dense cluster of Early Agricultural period pits. It was filled with a brown silty clay with charcoal flecking and eight pieces of fire-cracked rock. The pit was completely excavated in one level, and one flotation sample was collected from its fill. Feature 184 had a basin-shaped profile, a diameter of 46 cm, and a depth of 7 cm. No artifacts were recovered from the pit, and its function is unknown.

Feature 216, Pit

Feature 216 was a small, oval-shaped pit located northeast of the granary, within the fill of Feature 163, an Early Agricultural period pithouse. It was completely excavated in one level, and one flotation sample was collected from the fill. The pit had a basin-shaped profile and was 80 cm long, 68 cm wide, and 9 cm deep. The fill consisted of a grayish-brown sandy clay with a small amount of charcoal flecking and 135 pieces of fire-cracked rock. A small number of artifacts was recovered and consisted only of flaked stone.

Because the pit intruded Feature 163, the edges were difficult to identify. They were primarily defined by the placement of fire-cracked rock and charcoal-stained earth. The original function of the pit is unknown, although the large amount of fire-cracked rock and the lack of burning within the pit indicate it was later filled with trash. Based on its location, Feature 216 probably dates to the Early Agricultural period.

PROTOHISTORIC AND HISTORIC FEATURES

Historic-era features relate to the use of the area as a mission from circa A.D. 1700 to the 1820s, to the 1860s occupation by the Carrillo family, to the 1890s use of the area by Chinese gardeners. There was also a single American Statehood period outhouse pit, probably created by the Ochoa family who lived on the western side of Brickyard Lane. Mission-occupation features are shown on Figures 4.15 and 4.16; American Territorial period and American Statehood period features are illustrated on Figure 4.17.

Feature 1, Western and Southern Compound Walls

Feature 1 is the rock foundation of the western and southern walls that surrounded the mission complex (Figure 4.18; see also Figure 4.15). Approximately seven rocks were visible on the ground surface along the western wall when the project began. A series of excavation units were placed over the wall, excavated, and screened; a few units were excavated without screening. The area around the wall had been extensively disturbed, and a variety of modern, historic, and prehistoric artifacts were present in the sediment surrounding the foundation.

The foundation was intact for 94.7 m along the western side and 4.2 m along the southern side. The southwestern corner was present, but the northwestern corner had been removed by clay mining and landfill activities in the 1940s and 1950s. The 60-cm-wide foundation was between two and three rocks wide. The foundation was two rocks wide near the southwestern corner and the granary, and three rocks wide elsewhere. The rocks had been collected from A-Mountain and were of various sizes and shapes. Between one and two courses survived, averaging 18 cm in depth. No openings were apparent in the surviving portion.

The date for construction of the wall is not known, although it was likely built during the occupation of the mission, probably between the 1790s and 1820s. There is no documentary evidence to support this conclusion, however. It does not appear on the 1862 field map, but this might have been an oversight by the surveyor. The wall appears in photographs beginning in April 1880.

Feature 4, Well

Feature 4 was a well found on the southern side of Mission Lane during backhoe scraping (Figures 4.19-4.20). The well was completely excavated in halves to the base of the feature, revealing that the groundwater table was at approximately 2 m below the modern ground surface during the time of its use before about 1880 (see below).

The top of the well was 1.90 m long by 1.65 m wide; overall depth was 1.65 m. It was filled with layers of soft loamy silty sand and ash. Many of the several thousand artifacts found in the well were discarded as early as 1885 by the Chinese farmers who rented Leopoldo Carrillo's farm. The small number of datable artifacts suggests a filling date of between 1880 and 1900. The well was probably filled after the entrenching of the Santa Cruz River began in the late 1880s to early 1890s.

Feature 5, Fenceposts

Feature 5 was a set of three wooden posts discovered during excavation of Feature 4. Posts A and B were found within Feature 4 and clearly postdate the filling of the well in the 1890s. Post C was found nearby. Post A was a square post roughly 14 cm to a side; it had been placed in a 35-cm-diameter posthole. The post was held in place by 29 river cobbles and basalt pieces from A-Mountain, as well as a concrete chunk and a piece of brick. The rest of the posthole was filled with redeposited fill from Feature 4.

The posthole for Post B was 45 cm long and 25 cm wide. Within the hole, a rectangular post measuring 1.5 inches by 4.0 inches was held in place by six bricks and a basalt cobble. The rest of the posthole contained redeposited fill from Feature 4.

Post C was not excavated. Archaeologists uncovered and recorded the post, which was made from milled lumber and measured 24 cm long by 4 cm wide. It was held in place by at least two rocks, a brick, and a piece of concrete.

The function of the three posts is not known, although they were likely installed by residents of the Carrillo House, which was occupied into the 1940s.

Feature 6, Mission Granary

Feature 6 was the rock foundations of the mission granary (Figure 4.21; see also Figure 4.16). The foundation was discovered by examining photographs of the 1967 Arizona Historical Society excavations, lining up landmarks visible in the photographs with those present today, and then carefully

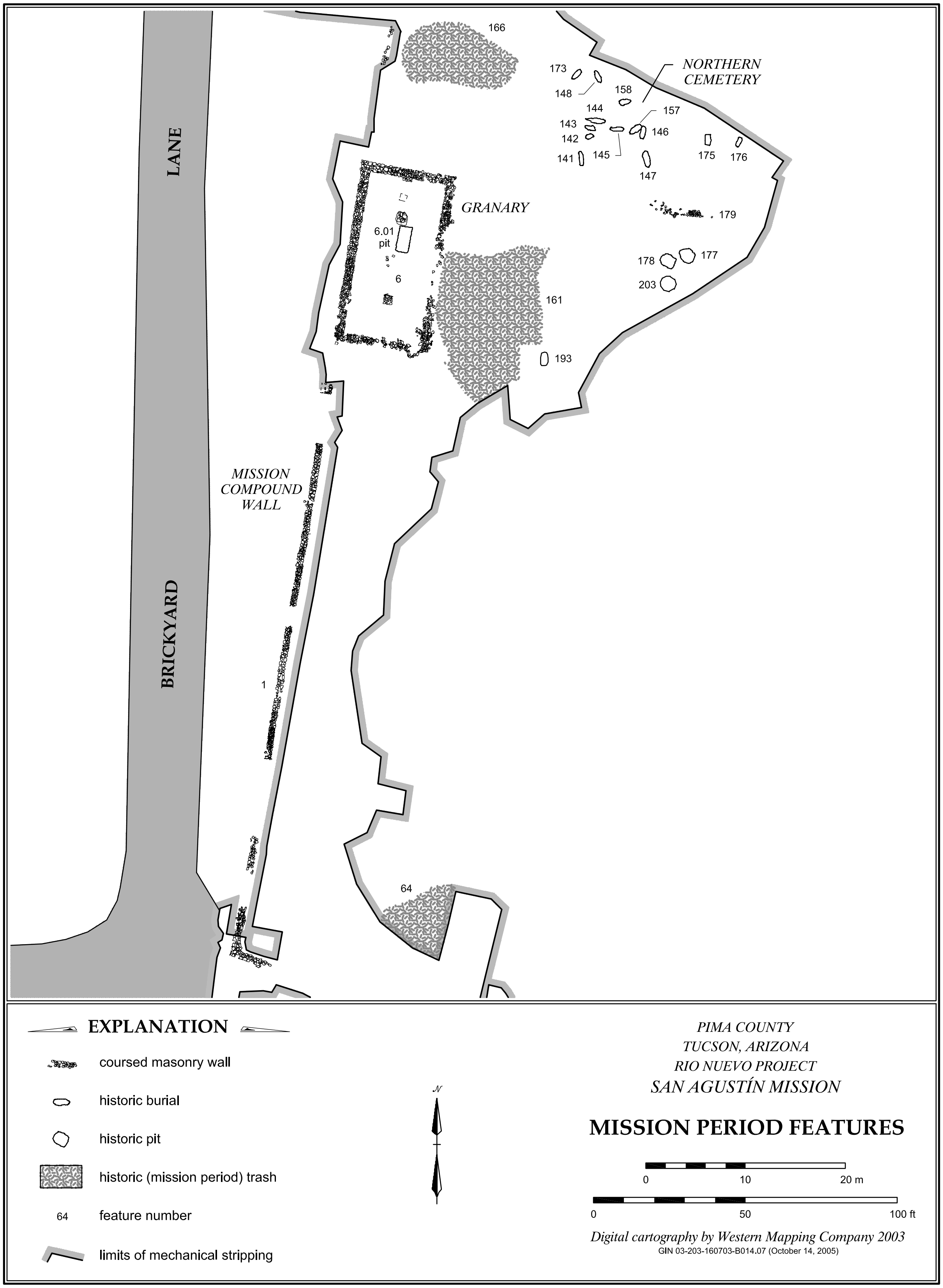

Figure 4.15. Mission-occupation features, San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

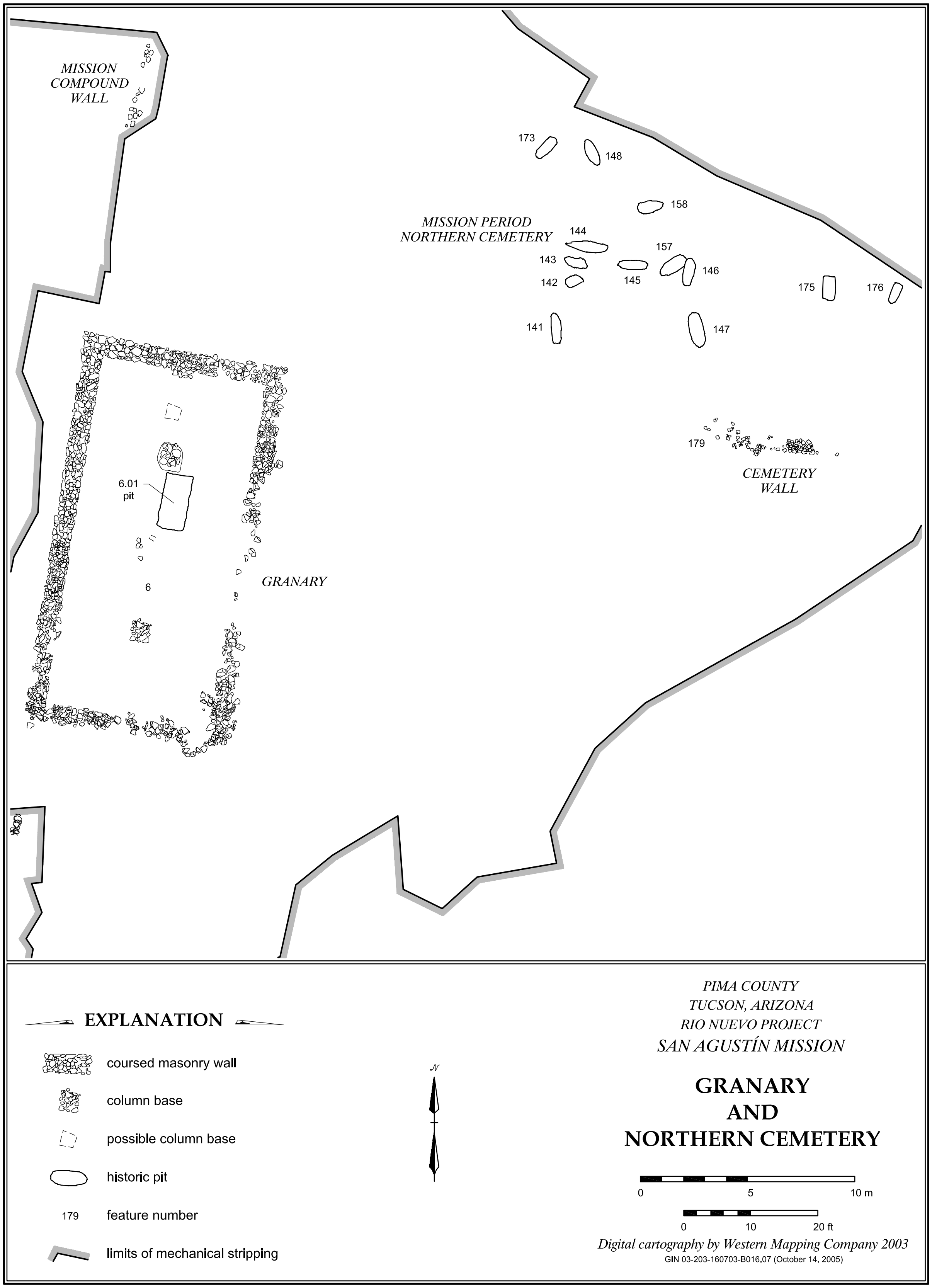

Figure 4.16. A close-up of the granary and the mission cemetery, San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

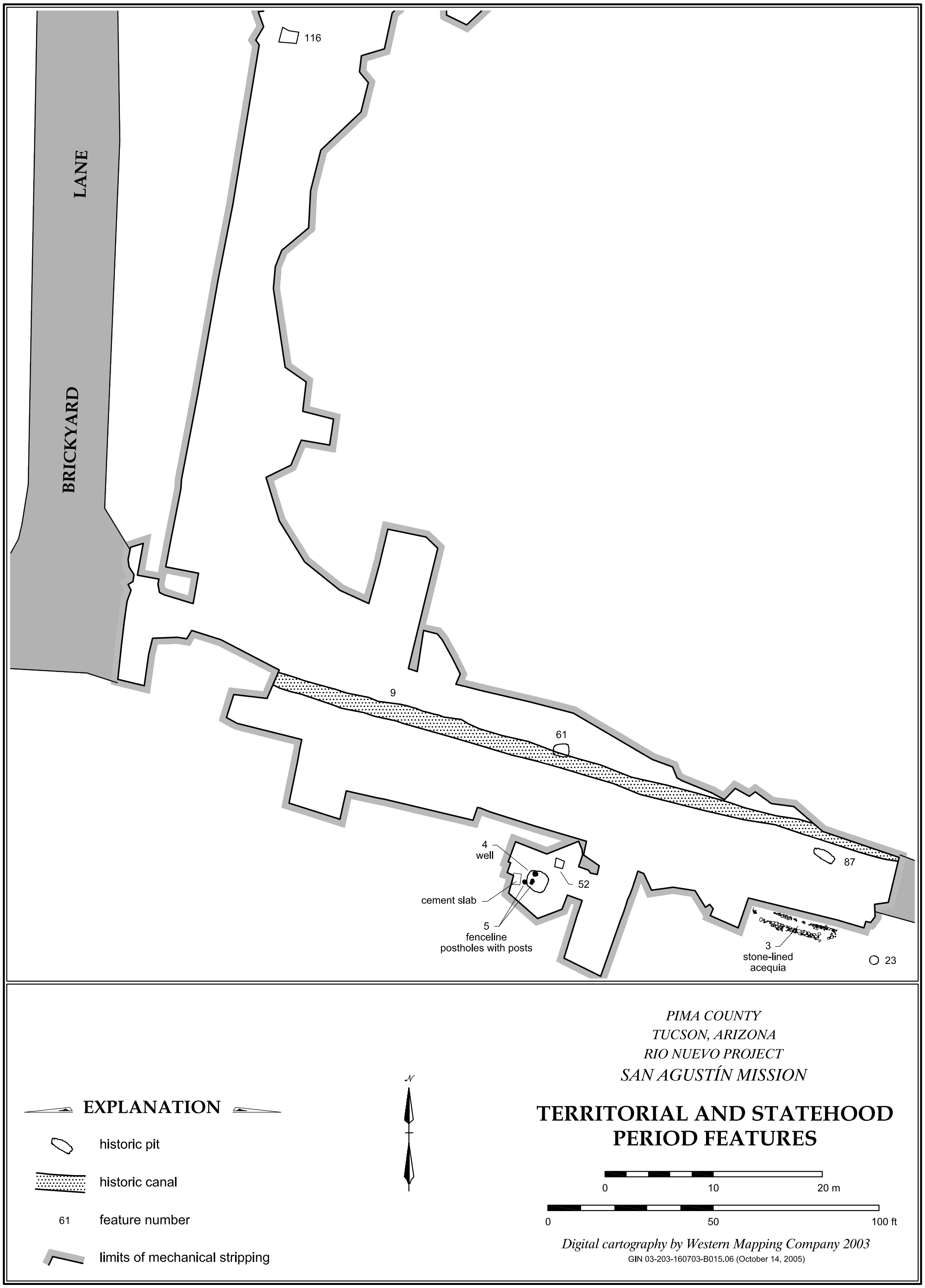

Figure 4.17. American Territorial period and American Statehood period features, San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

scraping the area with a wide backhoe blade to expose the rectangular foundation. Once uncovered, the area was cleared by hand, removing modern overburden from around the rocks and the interior area. The 1967 excavation included narrow backhoe trenches around the interior and exterior of the foundation, as well as the removal of fill from the center of the structure.

The foundations were built with rocks collected from the sides of A-Mountain. The rocks ranged in size from 5 cm to 25 cm in diameter, with larger rocks present along the northern wall. The upper portions of the foundation were probably removed by machine grading of the area, including during the 1967 excavation. As many as five column bases ran down the center of the building, north to south; however, two of the bases may have been removed in the 1967 excavation. Two complete column bases and a pilaster along the northern interior wall remained in place.

The granary was 16.6 m long, north-south, and 9.7 m wide, east-west. Individual foundation walls were roughly 90 cm wide. The complete column bases were square and measured 90 cm to each side. The pilaster base was 95 cm long by 35 cm wide. The foundation survived to an average depth of 22 cm below the tops of the upper rocks. The floor of the structure was missing and was probably made of dirt when the building was constructed.

Figure 4.18. A close-up of Feature 1, the foundation of the western mission compound wall, San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

Figure 4.19. Feature 4, San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM), a well filled by Chinese gardeners in the 1890s, partially excavated.

Feature 6.02, a shallow, burned rectangular pit, was present within the structure, located next to the northern complete pillar base. The pit was 2.63 m long, north-south, and 1.27 m wide, east-west. It was only 9 cm deep and was filled with moderately compact grayish-brown sandy silt. A moderate amount of charcoal chunks and flecks were in the fill. The base and sides of the pit were burned to a bright red color, indicating the pit was the location of a fire. The fill was screened and yielded 33 small Native American sherds, animal bone, three pieces of glass, and fragments of brick. Some of the material, such as the glass, appears to have been brought into the pit through a rodent burrow. It is unclear if the pit dates to the late Spanish period use of the granary. A more likely explanation is that the pit intruded into the granary.

Feature 23, Well

Feature 23 was a historic-era well discovered in Trench 3. The well was identified as a vertical shaft cutting down at least 1.2 m from the modern ground surface. The well was about 58 cm in diameter. The top of the feature was filled with modern debris; lenses of compact tan-to-brown sands, apparently washed in during a flooding event, were below this. No artifacts were visible in the shaft, and the feature was not excavated.

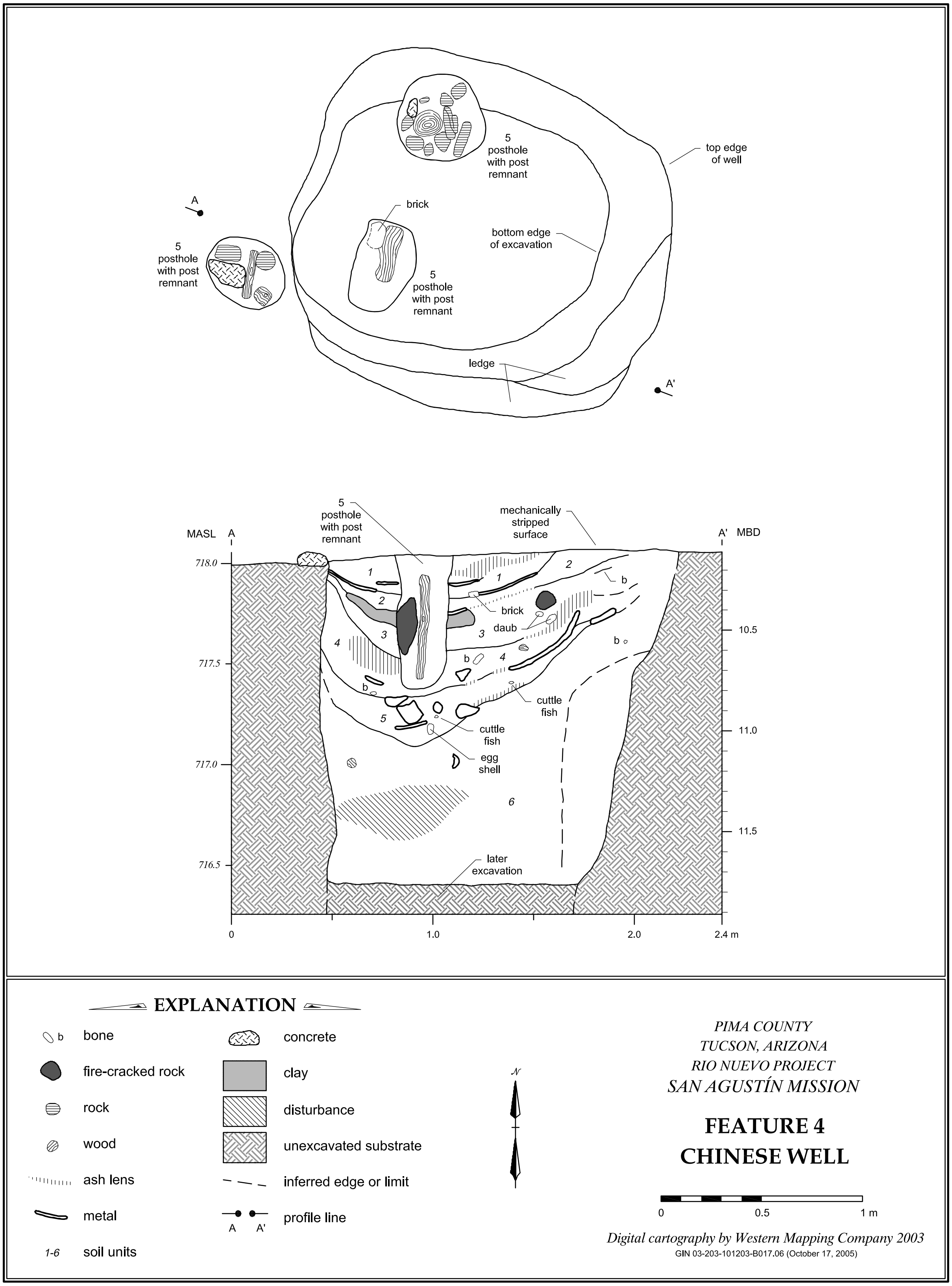

Figure 4.20. A profile of the upper 1.5 mof Feature 4, San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

Figure 4.21. The foundations of the Tucson Mission granary, San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

Feature 52, Probable Outhouse Pit

Feature 52 was a rectangular pit discovered during excavation of control Unit 103, which was located west of Trench 102. Feature 52 was completely excavated in two separate units. Unit 107, representing the portion of the feature discovered within Unit 103, was excavated in two levels. Unit 108, representing the rest of the feature, was excavated in three levels. The pit had gently sloping walls and a flat base. It was 1.35 m long, 0.95 m wide, and 0.50 m deep. Fill consisted of a brown, fine- to medium-grained sand with small-sized gravel, charcoal flecking, and one piece of fire-cracked rock.

A small number of artifacts was recovered and included Native American sherds, shell, animal bone, glass, historic ceramics (some of which were Chinese), and metal. Multiple flotation samples were also collected. The pit dates to the late 1800s and was likely used as a well or privy. It was located immediately north of a late nineteenth century well, Feature 4, that also contained predominantly Chinese artifacts.

Feature 61, Pit

Feature 61 was a small, irregularly shaped pit located between Trench 101 and Trench 102. It was rectangular near the top, but more circular near the base. This created a shelf approximately 30 cm below the opening of the pit. Feature 61 measured 0.80 m long, 1.08 m wide, and was 81 cm deep. Sidewalls sloped continuously inward to a rounded base.

The pit fill had three distinct strata. The upper 20-25 cm consisted of a moderately compacted, grayish-brown, sandy-silty clay. The next 10-20 cm was primarily composed of dense charcoal and ash. The lower 35-50 cm consisted of a brown sandy loam with small gravel. A moderate amount of charcoal was present throughout the fill, as well as 92 pieces of fire-cracked rock. The pit was bisected and excavated in two separate units, 126 and 133. Each unit was dug in three levels following the stratigraphy of the fill. A moderate number of artifacts was collected and included Native American sherds, flaked stone, shell, animal bone, glass, historic ceramics, metal, and one button. A sample of wood charcoal and multiple flotation samples were also collected.

Feature 61 appears to be a historic-era feature dating to approximately 1870. Its original function is not known, but it appeared to be trash filled. The southern portion of the pit was intruded by Feature 9, BB:13:481, a historic-era canal.

Feature 64, Mission Trash Midden

Feature 64 was a mission-occupation trash midden in the southwestern corner of the mission compound. The trash midden was discovered during backhoe scraping. It was initially pedestaled and later tested with two excavation units. The minimum size of the midden was 7 m by 5 m. The trash was approximately 20 cm deep. It consisted primarily of moderately compact, light brown clayey silt. Charcoal was present, mostly as small flecks. Artifacts recovered from the midden included Native American sherds, flaked stone, a Sobaipuri Piman projectile point, ground stone, glass, metal, shell, and animal bones. Most of the bone was from cattle. The presence of cattle bone and the absence of late Historic era artifacts indicated the feature dated to the mission occupation.

Feature 87, Pit

Feature 87 was a historic-era pit located between Trench 102 and Trench 103, near a small cluster of Early Agricultural period features. It was large, with an oblong-shaped top, nearly straight sides, and a flat base. During excavation, it was bisected, and the eastern half excavated in one screened level to a depth of 66 cm, approximately 90 cm above the base. At that point, screened excavation stopped, and a shovel probe was used to determine the pit depth. No further excavation was completed.

The pit was 1.94 m long, 0.85 m wide, and approximately 1.56 m deep. It was filled with a light yellowish-brown silty sand with 14 pieces of fire-cracked rock and some ash. Artifact density was low and consisted of Native American sherds and animal bone. Shovel impressions were visible in its sidewalls, and Feature 87 probably dates to the late nineteenth to mid-twentieth centuries. Although the function of the pit is not clear, its shape is similar to that of historic-era wells or outhouses.

Feature 161, Mission Trash Midden

Feature 161 was a mission-occupation trash midden located immediately east of the granary. The midden was discovered during backhoe scraping and was identified by the presence of cattle and horse bone, Native American sherds, and fire-cracked rock. The midden was about 15.5 m long, 10.5 m wide, and 0.31 m deep.

One 1-m by 2-m excavation unit was placed to recover a sample of mission artifacts. The midden consisted of compact light gray loam with a small amount of gravel and charcoal flecking. Artifacts collected from the unit included Native American sherds, animal bone, and flaked stone.

Feature 166, Mission Trash Midden

Feature 166 was a mission-occupation trash midden located north of the granary. The midden was discovered during backhoe scraping, identified by numerous pieces of cattle bone, daub, and Native American sherds. The trash covered an area approximately 9.5 m long, east-west, by 6.0 m wide, north-south, and it was approximately 20 cm thick. The northern side of the feature was truncated by clay mining in the 1940s to 1950s.

Four 1-m by 2-m excavation units were excavated to recover artifacts, animal bones, and plant remains. The midden was composed of a loose-to-moderately compact light brown sandy silt with a high artifact, daub, and fire-cracked rock content. Artifacts collected from the units consisted of historic-era and prehistoric Native American sherds, flaked stone debitage, a Sobaipuri Piman point, fragments of ground stone, glass, a piece of Mexican majolica, and cattle bones.

Feature 177, Mission Pit

Feature 177 was a large, mission-occupation pit located east of the granary. It had a circular top, sloping sides, and a flat bottom. The pit was 1.50 m long, 1.42 m wide, and was 18 cm deep. It was completely excavated in one level. Feature 177 was initially bisected, and its eastern half excavated first. After a profile was drawn, the western half was then excavated, and all artifacts were combined. One flotation sample was collected from each half, and one pollen sample was collected from the pit base.

The pit fill consisted of a moderately compact, light brown sandy silt with abundant charcoal, as well as many pockets of dense ash. A large number of artifacts was recovered, including animal bone, Native American sherds, flaked stone, glass, one projectile point, one piece of ground stone that was possibly hafted, a stone polisher, and several shaped adobe fragments. Feature 177 was located in a cluster of three mission-occupation pits that were all generally similar in size, shape, and artifact content.

This pit appeared to be trash filled, and most of the artifacts recovered clearly date to mission times. The majority of animal bones recovered were cow bone fragments, many of which were heavily burned. Other Protohistoric artifacts included a Sobaipuri projectile point, Piman ceramics, and shaped adobe tile or brick fragments.

Feature 178, Mission Pit

Feature 178 was another of the large, mission-occupation pits located east of the granary. It had a semirectangular top, a basin-shaped profile, and was completely excavated in two separate units. It was bisected, and the western half was sampled first. After a profile was drawn, the eastern half was excavated. One flotation sample was collected from each unit, and a pollen sample was collected from the pit base. The pit measured 1.53 m long, 1.26 m wide, and 33 cm deep.

The fill of the pit consisted of heavily burned, loosely-to-moderately compacted, brown sandy silt with a dense amount of charcoal flecks and chunks, pockets of ash, and decomposed adobe. A large number and variety of artifacts were recovered, many clearly dating to the mission. These included large amounts of cattle bone, many of which were burned, Piman ceramics, two fired adobe bricks, and three Sobaipuri Piman projectile points. Other artifacts included flaked stone, a worked ceramic disk, and burned clay.

Feature 178 is located within a cluster of three mission-occupation pits that are all very similar in size, shape, and artifact content. Although the fill of Feature 178 appeared heavily burned, the pit itself was not. The original function of the pit is unknown, although it was eventually filled with trash.

Feature 193, Mission Roasting Pit

Feature 193 was a rectangular-shaped, mission-occupation roasting pit located east of the granary (Figure 4.22). It was fairly isolated, located near only one other feature, an Early Agricultural period burial, Feature 190. Feature 193 was 1.25 m long, 0.71 m wide, and 19 cm deep. The pit was initially bisected, and the northern half was excavated first. After a profile was drawn, the southern half was excavated; artifacts and samples were combined.

The pit fill had four distinct strata, all of which were removed in one level. The upper 5 cm of fill consisted of brown silty sand that contained most of the artifacts recovered from the pit. Next was a layer of dense fire-cracked rock present across the entire pit. Below this was a 5- to 10-cm-thick stratum of an orange oxidized silty sand. Finally, a very dense lens of charcoal and ash was just above the pit base.

Feature 193 appears to have been heavily burned. Not only did the fill exhibit evidence of burning, but both the sides and base of the pit were oxidized and blackened by charcoal and ash. Some burned beam fragments were recovered in the southeastern corner of the pit, and were collected for species identification. These likely represent beams that were intentionally placed along the pit sides and burned within the interior of the pit. The overall density of artifacts was moderate, and many were clearly datable to mission times. These included a large number of cattle bones and Piman (O'odham) ceramics; other artifacts recovered consisted of flaked stone, animal bone, and a mano fragment. One flotation and one pollen sample were also collected.

Feature 203, Mission Pit

Feature 203 was a semirectangular-shaped pit located east of the granary. During excavation, the pit was bisected, and its western half was excavated first. After a profile was drawn, the eastern half was excavated, and all artifacts and samples were combined.

The pit had a basin-shaped profile and was 1.95 m long, 0.95 m wide, and 0.22 m deep. All the fill was removed in one level and consisted of light-to-medium brown silt with dense amounts of charcoal and ash. Some modern disturbance from the landfill to the east was also present. Tin can metal fragments and a few pieces of aluminum foil were found in the upper fill.

A large number and variety of artifacts were recovered, many of which are clearly datable to the mission occupation. These included Piman (O'odham) ceramics, three Sobaipuri Piman projectile points, a large number of cow bones, and fired adobe bricks. Other artifacts recovered included Native American sherds, flaked stone, a ceramic figurine fragment, glass, ground stone, and mortar.

Feature 203 was cut into a midden-like area, making its boundaries difficult to identify, and causing a slight overexcavation of the eastern edge. The feature was part of a cluster of three mission-occupation pits that were all similar in size, shape, and artifact content. The fill of the feature appeared heavily burned, although the pit itself was not. The original function of the pit is unknown, but it was later filled with trash.

SUMMARY

Archaeological work at the San Agustín Mission locus revealed a long history of occupation. Numerous pit structures, pits, inhumations, and canals dating to the Cienega phase (800 B.C.-A.D. 50) of the Early Agricultural period were documented. Similar features are also present on the western side of Brickyard Lane and further west and north along Spruce Street and beneath the former Tucson Pressed

Figure 4.22. Feature 193, a Protohistoric period roasting pit, San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

Brick Company (see Part 4 of this chapter). These features suggest the Santa Cruz River floodplain at the base of A-Mountain was the focus of extended use by the early farmers. The presence of numerous structures devoted to food storage and to habitation suggest at least some residents lived at the village year-round, although some residents probably regularly traveled to other parts of the Tucson Basin and the surrounding mountains to collect food and other resources.

The Hohokam later used the San Agustín Mission locus primarily for farming, as indicated by the presence of a large irrigation canal and only a small number of pit structures. A village site was likely located nearby, and when George Cattanach examined the floodplain area south of the mission in 1949-1950, he found large quantities of Hohokam pottery, perhaps indicative of a village site. Unfortunately, that area was destroyed by construction of a landfill.

Father Kino found a Piman (O'odham) village at the San Agustín Mission locus when he visited the area in the 1690s. No structures associated with this village were discovered during the current project. Remains of these shallow structures were probably destroyed by plowing and modern use of the area. Seven features found within the mission area contained artifacts discarded by the Piman (O'odham) residents of the mission. The artifacts and food remains offer important clues about the lives of these people.

Approximately 80 percent of the mission was destroyed by clay mining and use of the area as a landfill during the late nineteenth and twentieth centuries. The surviving portions include the western compound wall, the southwestern corner of the wall, the granary, and a portion of the northern cemetery, which was used by Native Americans. The chapel and convento areas were completely destroyed by the landfill, although floor plans, drawings, and photographs were made prior to their loss.

Nothing remains of Leopoldo Carrillo's house on the southern side of Mission Lane. However, one pit, Feature 61, dated to the late nineteenth century Carrillo occupation. A later well, Feature 4, contained trash discarded by the Chinese farmers who lived at the site in the 1880s through the early 1900s. A small number of other American Territorial to American Statehood period features were also documented.

CHAPTER 4

FEATURE DESCRIPTIONS: PART 2. MISSION GARDENS LOCUS, THE CLEARWATER SITE, AZ BB:13:6 (ASM)

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Archaeological work conducted during the Rio Nuevo Archaeology project resulted in the discovery of hundreds of features—areas in which human activities took place. Descriptions of excavated features and summarized data on unexcavated features are presented in this chapter. Descriptions of human burials found during the project are provided in Chapter 18 (this volume).

Work during this project was conducted at four different archaeological sites. The San Agustín Mission, Mission Gardens, Brickyard, and Congress Street loci were located at the Clearwater site, AZ BB:13:6 (ASM), on the western side of the Santa Cruz River. AZ BB:13:481 (ASM) were the Prehistoric, Protohistoric, and Historic era canals, ditches, and a spillway, also located on the western side of the Santa Cruz River. The Tucson Presidio has been designated AZ BB:13:13 (ASM), and the site includes both prehistoric- and historic-era features. Finally, a portion of a historic-era residential block on the northern side of Clark Street and east of the Interstate 10 (I-10) frontage road was designated AZ BB:13:735 (ASM).

The feature descriptions in this chapter are grouped by locus, except for canals, which are described in Part 6 and which are grouped by time period. All site numbers in this chapter are Arizona State Museum (ASM) numbers. Radiocarbon dates are reported in both uncalibrated radiocarbon years before present (b.p.), and in calibrated calendar years at the 1-sigma range of probability. Excavated and unexcavated features are listed, by site/locus and time period, in Table 4.1 (see Part 1 of this chapter).

Test trenching at the Mission Gardens locus, situated about 122 m west of the San Agustín Mission locus, revealed features dating to Early Agricultural, Early Ceramic, Hohokam, Spanish, American Territorial, and American Statehood periods. Locations of prehistoric and historic-era features in the garden area are shown on Figures 4.23 and 4.24.

PREHISTORIC FEATURES

Feature 3001, Pit

This large, irregularly shaped pit was found in the profile of Trench 300. It measured approximately 1.85 m in length, 1.25 m in width, and 0.44 m in diameter. The fill was compact tan silty clay with some charcoal flecking and small chunks of daub. The charcoal flecking increased with depth. Artifacts recovered from the fill included Native American sherds, two fragments of ground stone, some unworked animal bone, and pieces of flaked stone. Fire-cracked rock was also present throughout the fill.

The pit intruded on the fill of an underlying small pit, Feature 3082. The eastern edge of this pit was itself intruded on by a later borrow pit, Feature 3067. Feature 3001 is thought to be Hohokam in age.

Feature 3005, Possible Pit Structure

Description

This possible pit structure was discovered in the northern profile of Trench 300. After it was found, a 1-m by 2-m control unit was excavated into the fill of the feature. The remainder of the feature was not excavated; therefore, the overall length, width, and structure shape were unknown. No internal features were discovered. The entry was not identified and the orientation of the feature is unknown. A small area of oxidized floor plaster and small chunks of burned daub were found, suggesting the structure had burned. Only fire-cracked rock was found on the floor.

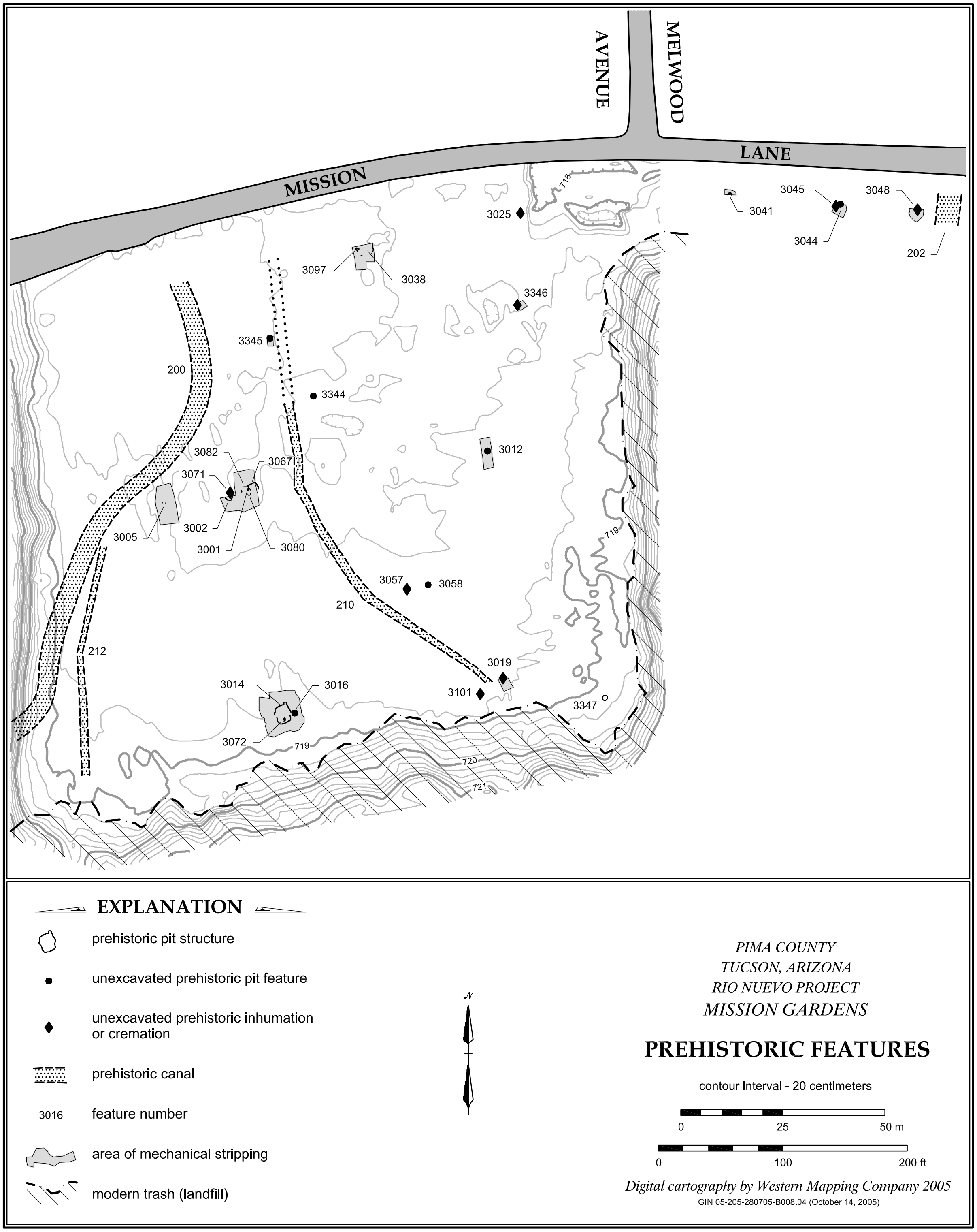

Figure 4.23. Prehistoric features located in the Mission Gardens locus, the Clearwater site, AZ BB:13:6 (ASM).

Internal Features

No internal features were discovered during the excavation of Feature 3005.

Internal Strata and Artifact Contents

Some 34 cm of fill were removed between the stripped surface and the floor of the pit structure.

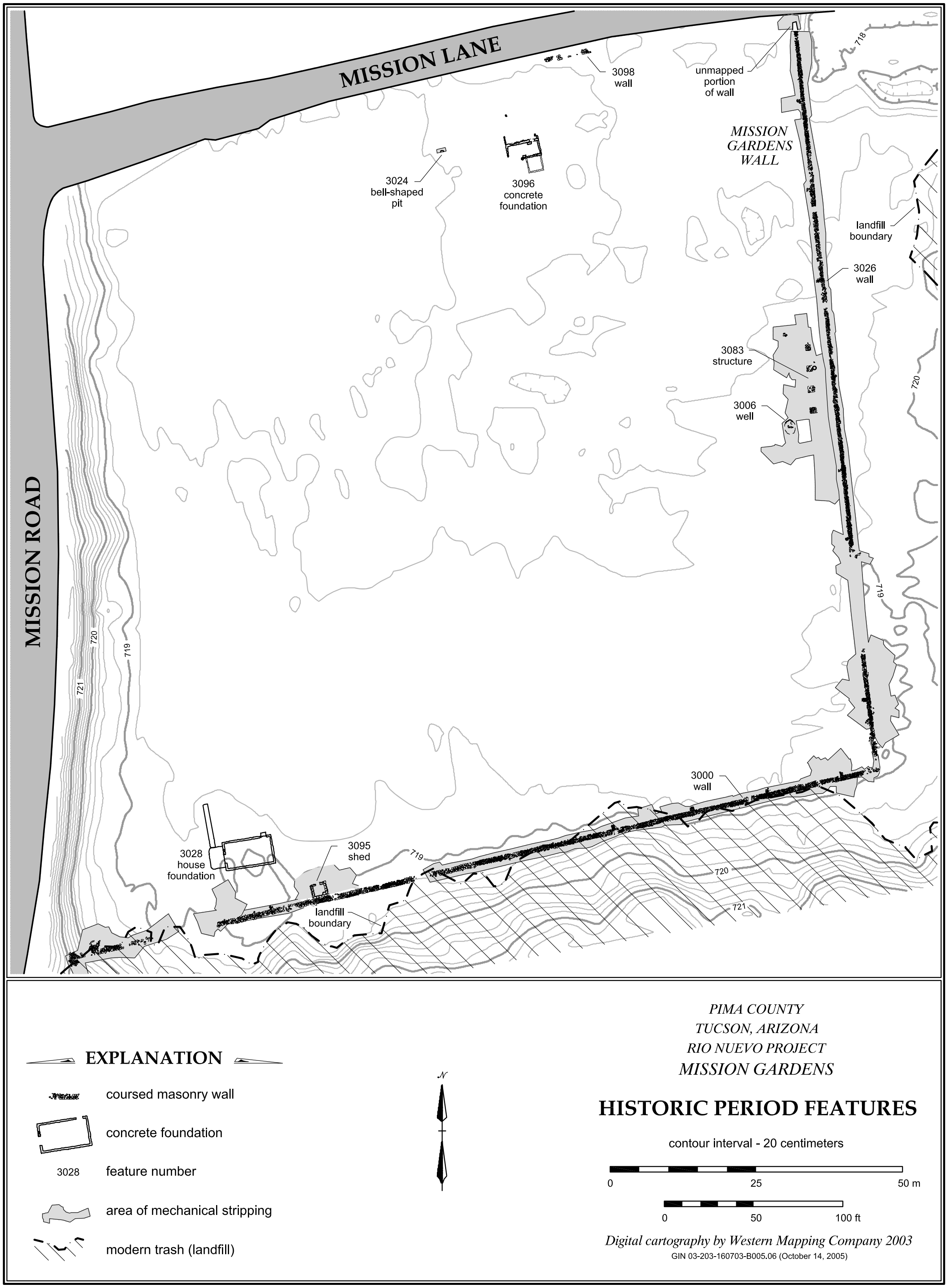

Figure 4.24. Historic era features located in the Mission Gardens locus, the Clearwater site, AZ BB:13:6 (ASM).

The fill was grayish-brown silty clay with large chunks of charcoal and small pieces of burned daub. Artifacts recovered from the fill included Native American sherds, a reworked projectile point, a fragment of ground stone, a worked ceramic disc, a possible ceramic figurine fragment, pieces of flaked stone, and some unworked animal bone.

Small pieces of fire-cracked rock were discovered on the floor of the pit structure.

Construction and Remodeling Evidence

Very little evidence for construction details of the structure was discovered. A small patch of oxidized floor plaster that measured 35 cm long by 22 cm wide suggested that the floor was originally plastered, and that the structure had probably burned. Small pieces of oxidized daub constituted the only evidence for a superstructure.

Stratigraphic Relationships

Feature 3005 was constructed into the floodplain alluvium. The nearest feature was a canal, Feature 201, AZ BB:13:481 (ASM), located about 5 m to the west. It was not intruded on by, nor did it intrude upon, any other features.

Abandonment and Postabandonment

Lack of floor artifacts suggested the structure might have been cleaned out prior to abandonment. The oxidized daub and floor plaster indicated the structure might have burned. After burning, alluvial and colluvial processes filled the foundation pit of the structure. Continuing natural processes then buried the filled foundation pit.

Date

The presence of decorated ceramics suggested the structure dated to the Hohokam occupation of the area.

Feature 3012, Pit

This small pit was discovered in the northern profile of a backhoe trench. It was roughly circular in shape and had straight sidewalls. The remaining portion of the pit was excavated and measured 74 cm in length, 36 cm in width, and 45 cm in depth.

The fill of the pit was gray clayey silt. Artifacts recovered from the fill included five Native American plain ware sherds and one possible ground stone. About 40 pieces of fire-cracked rock were also found in the fill, but were not collected. The pit likely dates to the Hohokam occupation of the area.

Feature 3014, Pit Structure

Description

This pit structure was originally discovered in both the northern and southern profiles of Trench 301 (Figure 4.25). A control unit was excavated down to the floor of the structure, and the remainder of the structure was excavated by hand. Two later canals, Features 203 and 204, BB:13:481, intruded and destroyed the western and eastern walls of the structure. A small hearth, Feature 3072, also intruded on the upper levels of the fill.

The structure measured approximately 4.35 m in length, 2.87 m in width, and 30 cm in depth. It appeared to be rectangular in shape. Four postholes, three possible postholes, and a hearth were discovered in the floor. No entry was identified, and the orientation of the structure could not be determined. A mano and four large pieces of fire-cracked rock were recovered from the floor, and the structure appeared to have burned.

Internal Features

Four postholes and three possible postholes were discovered. Two of the postholes, Features 3014.01

Figure 4.25. Feature 3014, an Early Ceramic period pithouse, Mission Gardens locus, the Clearwater site, AZ BB:13:6 (ASM).

and 3014.03, were centrally located in the structure, and ranged in size from 20-26 cm in length, 17-20 cm in width, and 14-24 cm in depth. A burned post fragment was removed and collected from Feature 3014.01.

Two postholes, Features A and B, and three possible postholes were arranged around the interior perimeter of the structure. They ranged in size from 10 cm to 17 cm in length, 10 cm to 16 cm in width, and 7 cm to 9 cm in depth. No artifacts were recovered from any of these postholes.

Feature 3014.02 was a hearth located near the center of the structure. It measured 25 cm in length, 22 cm in width, and 12 cm in depth. The upper margins of the hearth were oxidized. The base appeared to have been disturbed by bioturbation. No artifacts were recovered from the fill of the hearth.

Internal Strata and Artifact Contents

Approximately 30 cm of fill was removed between the stripped surface and the floor of the structure. The fill was brown clayey silt with abundant amounts of burned daub, charcoal, and charcoal flecking. The concentration of daub and charcoal increased with depth in the fill. Artifacts recovered from the fill included Native American sherds, pieces of flaked stone, fragments of ground stone, a biface, some unworked animal bone, a turquoise pendant fragment, and samples of red ochre, mica, and chalcedony.

A mano and four large pieces of fire-cracked rock were discovered on the floor of the structure.

Construction and Remodeling Evidence

When encountered, the walls of the structure were preserved to a height of roughly 17 cm above the floor. The eastern and western walls of the structure had been removed by intrusive canal Feature 203 and Feature 204, BB:13:481. The northern and southern walls were intact, but may have been slightly impacted by mechanical stripping. The walls of the structure showed no evidence of plaster. A small patch on the floor of the structure appeared to have been plastered, suggesting the entire floor may have originally been plastered.

The two centrally located postholes, Features 3014.01 and 3014.03, may have held roof support posts for the structure. The other two postholes, Features A and B, probably held wall support posts. The burned daub present in the fill of the structure suggested the superstructure was of wattle-and-daub construction.

No evidence existed to indicate reuse or remodeling of the structure.

Stratigraphic Relationships

This pit structure was constructed into the floodplain alluvium. Sometime after it had been abandoned and filled, two canals, Features 203 and 204, BB:13:481, were constructed through its eastern and western edges. Also after the structure was filled, a hearth, Feature 3072, was built in the upper levels of fill. The stratigraphic relationship between the canals and the hearth was unclear.

Abandonment and Postabandonment

The lack of artifacts on the floor of the structure suggested that it was cleaned out before it burned. Oxidized daub and charcoal present in the fill and the postholes suggested the superstructure was intact when the structure burned. After burning, alluvial and colluvial processes filled the foundation pit of the structure. These continuing natural processes then buried the filled pit. The canals and the hearth were constructed sometime after the structure had been buried.

Date

A maize sample from the structure was radiocarbon dated to 1760±40 b.p. (uncalibrated ^{14}C years), or A.D. 230-450 (calibrated calendar years at the 1-sigma range of probability), indicating the structure dates to the Agua Caliente phase of the Early Ceramic period.

Feature 3038, Pit Structure

Description

This possible pit structure was discovered in the northern profile of Trench 304 (Figure 4.26). A 1-m by 2-m control unit was excavated into the fill of the structure to identify the floor. The remainder of the feature was then excavated to identify the walls of the structure. However, only one small area of wall could be positively identified. The rest of the feature edge remained indistinct. An inhumation, Feature 3097, intruded on the western edge of the structure.

This pit structure was oval in shape, and measured about 4.34 m in length, 3.95 m in width, and 29 cm in depth. Three pits, a possible hearth area, and seven possible postholes were identified in the floor of the structure. No entry was discovered, and the orientation of the structure could not be determined. A single sherd was discovered on the floor. Oxidization of the floor and burned daub in the fill suggested the structure had burned.

Figure 4.26. Feature 3038, an Early Ceramic period pithouse, Mission Gardens locus, the Clearwater site, AZ BB:13:6 (ASM).

Internal Features

Seven possible postholes were discovered in the floor. All were arranged around the interior circumference of the structure. They ranged in size from 10-16 cm long, 10-15 cm wide, and 5-12 cm deep. Two of the postholes, Feature 3038.05 and Feature 3038.06, contained artifacts, while the other five, Features A to E, did not.

Feature 3038.01 was an irregularly shaped area of the floor that was highly oxidized. It measured 24 cm in length, 20 cm in width, 1 cm in depth, and was thought to represent a possible hearth for the structure. This area contained no fill and no artifacts.

Feature 3038.02 was an irregularly shaped pit that measured 95 cm long, 89 cm wide, and 18 cm deep. It was centrally located in the pit structure. The fill of the pit was oxidized, but the margins were not. Artifacts recovered from the pit included Native American sherds, a piece of unworked animal bone, and a possible hammerstone.

Feature 3038.03 was a small circular pit that measured 48 cm in length, 23 cm in width, and 23 cm in depth. Fill of this pit contained charcoal flecking and a few small pieces of unburned daub. A small reconstructable sherd was recovered from the base of the pit. The northern half of the feature was removed by the backhoe trench.

Feature 3038.04 was a small oval pit that measured 35 cm in length, 32 cm in width, and 12 cm in depth. A few sherds were recovered from the fill. A portion of this pit had been removed by the backhoe trench.

Internal Strata and Artifact Contents

Approximately 29 cm of fill was removed between the stripped surface and the floor of the pit structure. The upper 13 cm of fill was grayish-brown clay that contained small amounts of charcoal and burned daub. Artifacts recovered from this upper fill consisted of Native American sherds, some flaked stone, and one piece of burned human bone.

The lower 16 cm of fill was tan sandy silt with abundant quantities of charcoal, oxidized daub, and ash. The lowest 6 cm of this fill was very highly oxidized. Artifacts recovered included Native American sherds, some shell, a piece of burned human bone, a worked ceramic sherd, and some red ochre. Fire-cracked rock was present throughout the fill of Feature 3038. One sherd was discovered on the floor of the structure.

Construction and Remodeling Evidence

Only one small portion of the wall of the structure could be identified. Where it was preserved, it was roughly 17 cm above the floor. The presence of postholes and abundant quantities of daub suggested the pit structure had a superstructure, likely of wattle and daub. No evidence was found for a remodeling of the structure.

Stratigraphic Relationships

Feature 3038 was constructed into the floodplain alluvium. Sometime after the foundation pit had filled, an inhumation was placed into the fill of the western edge. No other features were found nearby.

Abandonment and Postabandonment

The lack of artifacts on the floor suggests the structure had been cleaned out prior to abandonment. The large amounts of oxidized daub indicated the superstructure was at least partially intact when the structure burned. After it burned, the foundation pit of the structure was reused as a trash pit. After being filled mostly with trash, the foundation pit was buried by alluvial and colluvial processes. These continuing natural processes then buried the filled foundation pit.

Date

A sample of columnar-celled seed coat (CCSC) provided a radiocarbon date of 1600±40 b.p. (uncalibrated ^{14}C years), or A.D. 410-530 (calibrated calendar years at the 1-sigma range of probability), indicating the structure dates to the Agua Caliente phase of the Early Ceramic period.

Feature 3044, Bell-shaped Pit

This bell-shaped pit was discovered in the southern face of a backhoe trench. It had a maximum diameter of 2.0 m and a basal diameter of 1.9 m. The pit was not entirely excavated to its base, because it extended below the bottom of the trench. However, it measured at least 22 cm deep. An inhumation, Feature 3045, was placed into the bell pit, possibly after the pit had already been partially filled. Excavation of the pit was conducted primarily to remove the inhumation.

The fill of the pit was brown clayey silt with some small pockets of sand. The concentration of sand in the fill became higher with depth. Artifacts recovered from the fill included Native American sherds and pieces of flaked stone. The feature dates to the Hohokam occupation of the area.

Feature 3058, Pit

This small pit was discovered in the northern profile of Trench 305 (Figure 4.27). It measured 87 cm in length, 54 cm in width, and 10 cm in depth. The fill of the pit was grayish-brown silty clay. Artifacts recovered from the fill included Native American sherds, a ground stone mano, and 20 slabs of tabular stone. The stone slabs were stacked in three layers on the bottom of the pit and appeared to have been cached for later use. They ranged from 14-19 cm long and 10-15 cm wide. The feature dates to the Hohokam occupation of the area.

Figure 4.27. Feature 3058, a Hohokam cache of ground stone hoes and preforms, Mission Gardens locus, the Clearwater site, AZ BB:13:6 (ASM).

Feature 3067, Borrow Pit

This large, irregularly shaped borrow pit was discovered during excavation of a pit structure, Feature 3001. It intruded on the western edge of the structure. The borrow pit measured approximately 2.9 m in length, 2.0 m in width, and 35 cm in depth. A small portion of the southern edge of this pit was removed by Trench 300.

Fill of the borrow pit was brown silty clay with some charcoal chunks and flecking. Small pieces of unburned daub were also present in the fill. Artifact density was very high, and included Native American sherds, pieces of flaked stone, shell, hammerstones, unworked animal bone, flaked stone tools, and both whole and fragmentary ground stone artifacts. Fire-cracked rock was abundant throughout the fill; approximately 692 pieces were discovered. The feature almost certainly dates to the Hohokam occupation of the area.

Feature 3072, Hearth

This small hearth was discovered during mechanical stripping of an area south of a pit structure, Feature 3014. It measured 29 cm in length, 24 cm in width, and 13 cm in depth. The margins and collar of the pit were oxidized and had small areas of intact, oxidized plaster. No evidence of a floor or walls was found near the hearth, suggesting it may have been an extramural feature.

The fill of the hearth was brownish-orange silty clay. A few small pieces of charcoal were noted, but the overall fill did not appear oxidized. The fill of the hearth was completely collected as a flotation sample; one Native American sherd was collected from the base of the hearth. The feature dates to the Early Ceramic period or Hohokam occupation of the area.

Feature 3081, Possible Roasting Pit

This possible roasting pit was discovered during mechanical stripping south of Trench 300. It was visible as a dark stain that measured 75 cm long and 70 cm wide. Several large pieces of fire-cracked rock were visible on the stripped surface of the stain. This feature was not excavated.

Feature 3082, Pit

This small pit was discovered during excavation of an overlying pit structure, Feature 3001. It was unclear how much of the upper portion of the pit was removed by the pit structure. The intact portion of the pit measured 40 cm in diameter and 12 cm in depth.

The fill was moderately compact, brown silty clay with caliche striations and some light charcoal flecking. Artifacts recovered from the fill included several Native American sherds and a few pieces of flaked stone debitage.

Feature 3099, Pit

This possible small pit was discovered during mechanical stripping of an area south of several historic structural elements, Feature 3083. Feature 3099 was not excavated, although the visible portion measured 82 cm in length and 80 cm in width. The fill appeared to consist of light tan silty sand with some small daub and charcoal chunks. Several mollusk shells were also visible in the fill of Feature 3099. The presence of the mollusk shells suggested the pit may have been related to a nearby canal, Feature 207, BB:13:481.

HISTORIC-ERA FEATURES

Feature 3000, South Mission Gardens Wall

Feature 3000 was the foundation of the southern wall of the Mission Gardens. The foundation was 116.4 m long and approximately 0.8 m to 1.0 m wide. It was constructed from large rocks collected from the side of A-Mountain. The foundation was between three and five rocks wide, with up to three courses of rock high. In some areas, small rocks were used as chinking between the larger rocks.

Five buttresses were present on the interior side of the wall (Table 4.2). Individual buttresses were between 70-80 cm wide and 60-70 cm long. The first buttress was 6.62 m west of the southwestern corner. The next three buttresses ranged from 12.98 m to 14.15 m apart. The last buttress was much farther to the west, at 60.10 m from the fourth buttress; however, this was probably caused by the loss of portions of the wall from bulldozing and removal of rocks.

A gate opening was present along the southern wall. The opening was 47 cm wide, from 22.65 m to 23.12 m west of the southwestern corner of the wall. Each side of the opening was composed of several rocks that were noticeably larger than the other rocks used to construct the foundation. The rocks protruded slightly into the interior of the wall, more so on the eastern side of the opening, perhaps indicating a buttress was present on each side.

There was no evidence for interior structures inside the wall dating to the Spanish or Mexican periods, and no Euro-American artifacts predating A.D. 1900 were found during excavation of the wall.

At the western end of the wall, the southwestern corner of the Mission Gardens wall was discovered. Only a 75-cm-long segment of the western wall was uncovered, and the rest of the western wall is lying beneath the embankment of present-day Mission Road.

Feature 3006, Historic-era Well

Feature 3006 was a historic-era well found a few meters southwest of a historic structure, Feature 3083. The well was found in a backhoe trench and a 1-m-square excavation unit was placed inside the interior of the well. The well appears to have been oval in plan view, and measured 2.4 m north-south, by 1.8 m east-west. Three strata were identified to 1.2 m below the modern ground surface. At that point, excavation terminated.

The top stratum was moderately compact grayish-brown silt, 60 cm thick. Artifacts recovered from this layer included pieces of metal, animal bone, glass, prehistoric sherds, and flaked stone. The second stratum was lightly compacted, dark brown, clayey sandy silt, 40 cm thick. Artifacts found in this layer

Table 4.2. Buttresses located along the southern wall of the Mission Gardens locus, the Clearwater site, AZ BB:13:6 (ASM).

Buttress	Meters West from Southeastern Corner (Centerpoint)
7	6.62
8	19.62
9	32.60
10	46.75
11	106.85

included oyster shells, animal bone, metal, glass, flaked stone, prehistoric sherds, and fire-cracked rocks. The third stratum was a mixture of loosely compact brown silty sand and very compact brown sandy silt. Five large rocks were present, filling much of the space. Artifact density was low and consisted primarily of prehistoric sherds, flaked stone, and a mano.

The fill of the well continued downward; however, this material was left in place.

Figure 4.28. Feature 3026, the foundations of the eastern gardens wall, Mission Gardens locus, the Clearwater site, AZ BB:13:6 (ASM).

Feature 3024, Bell-shaped Pit

Feature 3024 was a bell-shaped pit found a few meters south of the northern wall of the gardens. It was discovered after a backhoe trench cut through the pit, removing about half the feature. The top of the pit was 52 cm wide, and the base of the pit was 98 cm wide. The feature was 64 cm deep.

The pit was filled with soil layers. The top layer was loosely compacted gray-brown clayey silt with many artifacts. The middle layer was loosely compacted light brown sandy silt with less charcoal and ash than the preceding layer, but still containing many artifacts. The bottom layer was dark brown clayey silt with few artifacts but had many large pieces of charcoal. Prior to being filled, a fire had been built in the pit. The heat from the fire had reddened the soil across the entire pit edge, forming a 2- to 3-cm rind.

Artifacts found in the pit included fragments of a shoe, nails, a horseshoe, tin cans, and a piece of stove pipe. Many pieces of burned animal bone were present. Feature 3024 was probably a roasting pit for meat. It seems unlikely that this was a pit in which trash was burned, because most of the artifacts were unburned.

Feature 3026, East Mission Gardens Wall

Feature 3026 was the foundation of the eastern Mission Gardens wall (Figures 4.28-4.29). It was traced from just south of Mission Lane to the southeastern corner of the garden walls. It was at least 127.5 m long, and ranged in width from 0.8 m to 1.0 m. The foundation was between three and five rocks wide, with two to three courses of rock surviving in most areas. In some areas, small rocks were used as chinking between the larger rocks. The wall was generally constructed by using larger rocks at the base and smaller rocks along the top to create a flat surface for adobe bricks to be placed on.

Six buttresses were present on the interior side of the wall (Table 4.3). Other buttresses were probably removed when portions of the wall were mined for rocks. Individual buttresses were between 70 cm and 80 cm wide, and 35 cm and 75 cm long. The buttresses were spaced between 11.75 m and 15.75 m apart, in places where they were intact.

One structure was built along the wall during the Spanish or Mexican period. This building, Feature 3083, used the garden wall as its western wall.

Feature 3028, Historic Home

Feature 3028 was the concrete and rock foundation for a dwelling in the southwestern quarter of the garden. The house was probably constructed in the 1930s, and was probably in use until the early 1950s.

The house was 8.56 m long east-west, and 4.91 m wide north-south. The foundations of the structure were made from A-Mountain rock and concrete. Inside the rectangular foundation was a poured concrete floor. The house appears to have had only one room. A doorway was present next to the northeastern corner, with a small, 22-cm-long concrete door stoop. Immediately inside the door was an area of dimpling on the concrete floor that appears to be where a carpet was tacked down to the concrete floor. Linoleum was present along the western side of the house; in some cases, with fragmentary newspapers from the early 1950s lying below. A few slots and

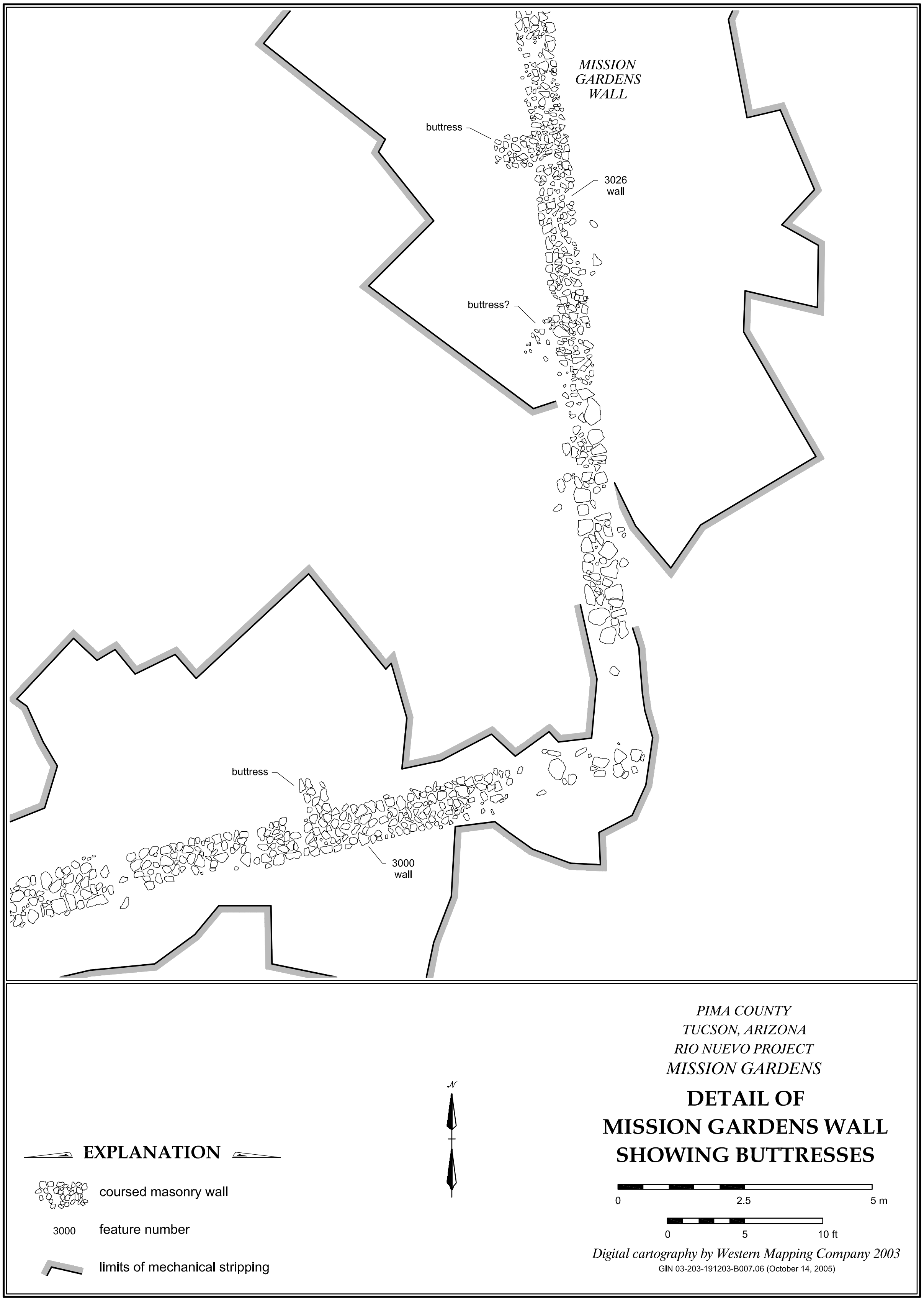

Figure 4.29. Map of the southeastern corner of the gardens walls, Mission Gardens locus, the Clearwater site, AZ BB:13:6 (ASM).

Table 4.3. Buttresses located along the eastern wall of the Mission Gardens locus, the Clearwater site, AZ BB:13:6 (ASM).

Buttress	Meters North from Southeastern Corner (Centerpoint)
1	11.75
2	27.00
3	42.75
4	75.50
5	87.25
6	114.88

square postholes present along the northern and eastern walls may represent the location of partition walls or shelves. Areas of red paint were also visible on the floor, as was a circular rust area in the southeastern corner, that may mark the location of a barrel or bucket.

A second doorway was present along the western side of the house. Immediately outside the doorway was a concrete floor, measuring 3.70 m by 2.45 m, that appears to represent an addition used for a porch. A sidewalk extends 12 m north from this addition.

The house appears to have been burned after abandonment. A thick layer of charcoal lay directly on the concrete floor.

Feature 3083, Historic Structure

Feature 3083 was a historic structure located along the eastern wall of the Mission Gardens (Figure 4.30). Four square rock column bases, an adobe brick, and a possible stone corner buttress were the physical remains of the dwelling. The structure is depicted on the 1862 Fergusson field map and is visible in photographs taken in the 1880s and 1890s.

The interior column bases were constructed of small A-Mountain basalt rocks. They measured 1.10 m by 0.80 m, 0.90 m by 1.00 m, 1.10 m by 1.05 m, and 1.10 m by 1.00 m. They were aligned in a north-south row, with individual columns roughly 2.45 m apart. The line of columns was 3.5 m west of the gardens wall. The line presumably represents the middle of the structure, and a beam would have originally run north-south down the center of the columns, with roof beams extending east-west from the central timbers to the adobe walls of the structure. The adobe walls were apparently built without substantial foundations. A cluster of rocks in the presumed northwestern corner of the room may be for an exterior buttress, or may be the remains of an interior corner fireplace. One partial adobe brick was found along the probable location of the northern wall.

The floor of the structure was unprepared. A variety of historic and prehistoric artifacts were visible on the floor after the plowzone was removed by scraping. A 1-m by 2-m excavation unit was placed along the western side of the structure. One arbitrary level was excavated into the very compact gray-tan silty sand floor, uncovering a small number of artifacts, most of which were prehistoric sherds, flaked stone, and fire-cracked rocks. Two pieces of metal, some glass fragments, and some pieces of plain and transfer-printed whiteware ceramics were also collected. The transfer-printed ceramics bore designs that were popular from the 1840s to the 1880s.

A historic-era well, Feature 3006, located several meters to the southwest, was probably in use when the house was occupied.

Feature 3095, Adobe Outbuilding

Feature 3095 was a small outbuilding located along the southern wall of Mission Gardens (Figure 4.31). The small structure was built from adobe bricks that measured 46 cm long, 30 cm wide, and at least 7 cm thick. Each wall was made from roughly five bricks, which had been reinforced after construction with a line of A-Mountain rocks along the exterior face. A doorway was present in the center of the northern wall, measuring 75 cm wide. The interior of the building was heavily burned, as was the floor, indicating the structure had been burned. No in situ artifacts were present; the items found inside were primarily 1950s trash that had drifted over from the nearby landfill. This outbuilding is associated with the dwelling, Feature 3028.

Feature 3096, Historic Structure

Feature 3096 was a historic foundation located along the northern side of the gardens. The feature is constructed from concrete blocks and concrete. The foundation measured 6.0 m by 5.7 m. It was mapped but not excavated.

Feature 3098, North Mission Gardens Wall

Feature 3098 was the rock foundation of the northern wall of the Mission Gardens. A small portion of the wall was visible immediately south of Mission Lane and was exposed and mapped. The wall was roughly 80 cm wide and was constructed of rocks collected from the side of A-Mountain. One buttress is visible, extending into the interior. Portions of the

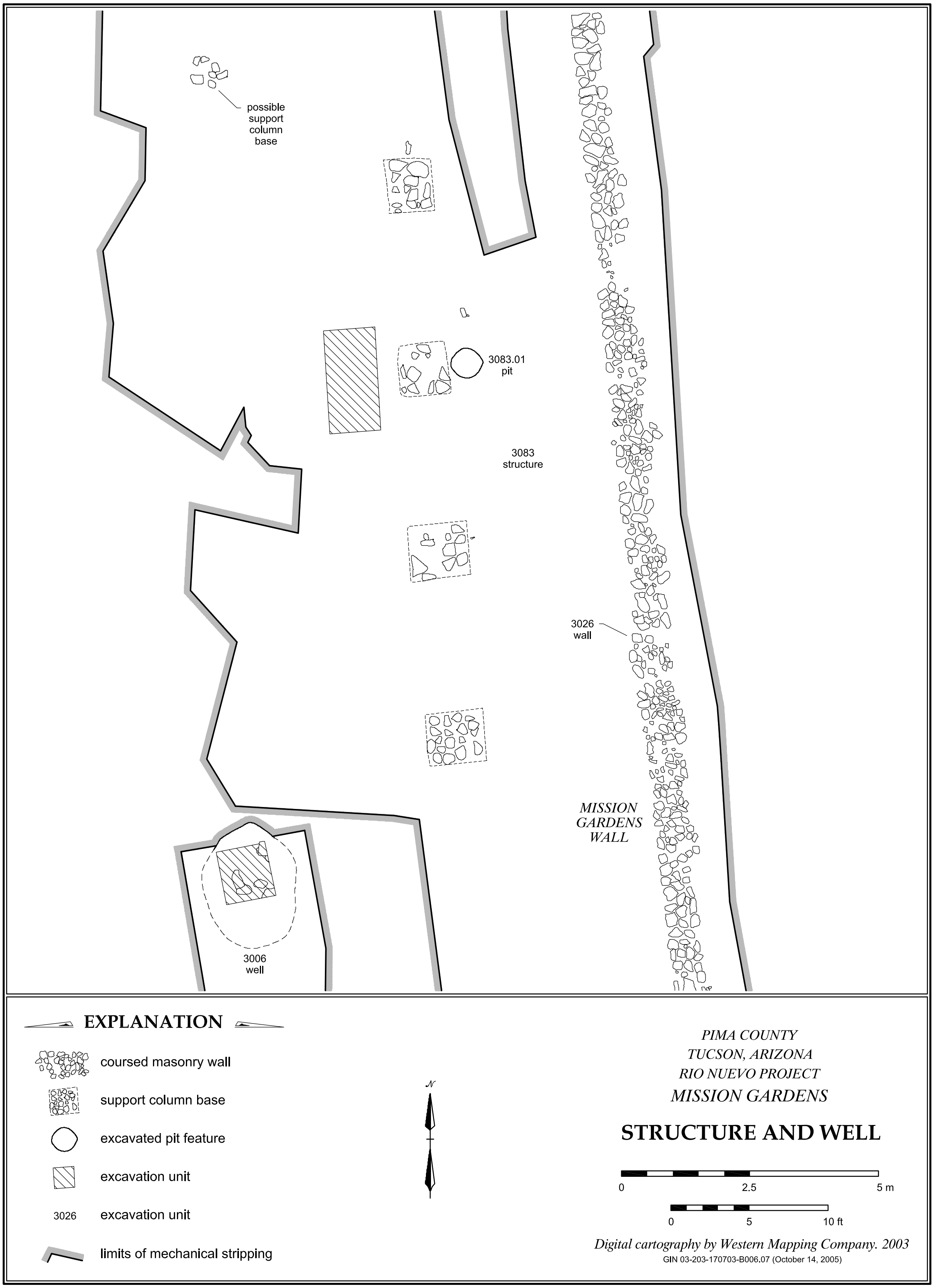

Figure 4.30. Map of Feature 3083, a structure built against the eastern gardens wall, Mission Gardens locus, the Clearwater site, AZ BB:13:6 (ASM).

Figure 4.31. Feature 3095, a Historic era outbuilding foundation, Mission Gardens locus, the Clearwater site, AZ BB:13:6 (ASM).

northern foundation wall are covered by Mission Lane and Mission Road. Placement of utility lines and a gas line have disturbed portions of the foundation, which is also being damaged by vehicular traffic along the side of the lane.

SUMMARY

In contrast to the San Agustín Mission locus, approximately 122 m to the east, few Early Agricultural period features were discovered during testing at the Mission Gardens locus. Several inhumation burials (described in Chapter 18, this volume) appear to be the only features from that timespan. A pair of Early Ceramic period pithouses, dating to the Agua Caliente phase, were a surprise, because relatively few sites in Tucson date to this time period. Later Hohokam features were more common and included burials, cremations, and pits. A large amount of Hohokam pottery was also present. Only one pit structure from this time period was found; however, given the wide spacing of the test trenches, many more pithouses are likely present. Previous descriptions of artifact distributions suggest this settlement extended to the south into the area destroyed by landfill activity.

No evidence for Protohistoric period O’odham use of the area was discovered. The walls of the gardens were probably built sometime between the 1790s and 1820s. The structure along the eastern side of the garden may also date to this timespan, or it may be slightly later, perhaps constructed in the 1840s, as suggested by some of the English transfer-print ceramics found inside the building. Several historic-era structures and other features were also uncovered.

Archaeological testing has revealed that numerous cultural features are preserved beneath the ground surface at the Mission Gardens. The planned use of this area as a demonstration or community garden will have to be carefully planned to avoid damaging these cultural resources.

CHAPTER 4

FEATURE DESCRIPTIONS: PART 3. CONGRESS STREET LOCUS, THE CLEARWATER SITE, AZ BB:13:6 (ASM)

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Archaeological work conducted during the Rio Nuevo Archaeology project resulted in the discovery of hundreds of features—areas in which human activities took place. Descriptions of excavated features and summarized data on unexcavated features are presented in this chapter. Descriptions of human burials found during the project are provided in Chapter 18 (this volume).

Work during this project was conducted at four different archaeological sites. The San Agustín Mission, Mission Gardens, Brickyard, and Congress Street loci were located at the Clearwater site, AZ BB:13:6 (ASM), on the western side of the Santa Cruz River. AZ BB:13:481 (ASM) were the Prehistoric, Protohistoric, and Historic era canals, ditches, and a spillway, also located on the western side of the Santa Cruz River. The Tucson Presidio has been designated AZ BB:13:13 (ASM), and the site includes both prehistoric- and historic-era features. Finally, a portion of a historic-era residential block on the northern side of Clark Street and east of the Interstate 10 (I-10) frontage road was designated AZ BB:13:735 (ASM).

The feature descriptions in this chapter are grouped by locus, except for canals, which are described in Part 6 and which are grouped by time period. All site numbers in this chapter are Arizona State Museum (ASM) numbers. Radiocarbon dates are reported in both uncalibrated radiocarbon years before present (b.p.), and in calibrated calendar years at the 1-sigma range of probability. Excavated and unexcavated features are listed, by site/locus and time period, in Table 4.1 (see Part 1 of this chapter).

Most of the excavated archaeological features from the Congress Street locus dated to the Prehistoric era (Figure 4.32). The oldest features date to the beginning of the unnamed phase of the Early Agricultural period (2100-1200 B.C.). An occupation dating to the Cienega phase (800 B.C.-A.D. 50) of the Early Agricultural period was also investigated. Finally, a few Hohokam features, including a pit structure dating to the Cañada del Oro phase (A.D. 750-850) of the Colonial period, were discovered.

PIT STRUCTURES

Feature 308, Pit Structure

General Description

Feature 308 was discovered during mechanical trenching (Trench 103), and then exposed by mechanical stripping. The larger portion of the structure south of the trench was subsequently excavated by hand. The small portion north of the trench was left unexcavated.

This feature was an unburned Hohokam occupation pit structure that measured 4.15 m north-south, and 4.58 m east-west. The structure was subrectangular in shape, with a south-facing, ramped entry that protruded from the center of the long axis. It originated in Stratum 502, and contained five floor features that consisted of two central support posts, a hearth, and two interior pits. Near the western wall, the floor of the structure rose slightly to form a small bench. The presence of a hearth and internal pits suggests this structure served both a habitation and storage functions.

Internal Features

As mentioned, the structure contained two postholes. Both postholes functioned as major support posts on the central axis of the structure. Posthole 308.04 measured 16 cm in diameter and 10 cm deep, while posthole 308.05 was 31 cm in diameter and 15 cm deep. These postholes provided the only evidence for roof construction.

An entryway was discovered in the center of the southern wall, along the long axis of the house. The entry was roughly U-shaped, and was constructed of ramped earth. It measured 70 cm in length, 53 cm in width, began on the floor of the structure, and continued to the south through sterile soil.

Feature 308.01 was a small unprepared hearth centered off the entryway in the southern end of the structure. It measured 22 cm in diameter and 16 cm in depth. Fill of the hearth was tan-gray silty clay, much like the fill of the structure. Pottery sherds and some flaked stone were recovered from the fill. The hearth had moderate oxidization on its margins.

Feature 308.02 was a large bell pit near the northern end of the structure. The center of the pit was bisected by the backhoe trench. From what remained, the pit appeared to measure 88 cm in diameter at its top, had a basal length of 1.59 m, and a basal width of 1.15 m. The pit was 1.36 m deep. Fill of the pit was tan silt. Artifacts recovered from the fill included sherds, some flaked stone, animal bone, a piece of ground stone, and some shell. Large rodent disturbances were visible in the base of the pit.

Feature 308.03 was a small pit situated in the western end of the feature. A small possible bench partially covered the western edge of the pit. The pit was 93 cm long, 77 cm wide, and 28 cm deep. The fill was tan-gray silty clay with some charcoal and ash. Artifacts recovered from the fill included sherds, pieces of flaked stone, animal bone, ground stone, and some shell. The presence of the bench above a portion of this pit may suggest that Feature 308.03 was intentionally closed during a remodeling of the structure.

Feature 308.06 was a possible hearth or burned posthole. It measured 19 cm in length, 17 cm in width, and 14 cm in depth. The fill was tan-gray silty clay with large amounts of charcoal. All the fill was removed as a flotation sample. Oxidization was visible on the margins of the feature and on the structure floor around the feature. This feature may have been a second hearth for the structure, or the remains of a burned posthole.

Internal Strata and Artifact Contents

Approximately 30 cm of fill was removed between the stripped surface and the floor of the structure. The fill of the structure was uniform tan-gray silty clay with pieces of charcoal and burned daub, as well as a few small ash lenses. The frequency of these inclusions increased with depth. Almost 150 pieces of fire-cracked rock over 5 cm in diameter were discovered, but not collected.

Artifacts recovered from the fill included abundant sherds, pieces of flaked stone, some animal bone, mica flakes, pieces of unworked shell, two projectile point fragments, a partial palette, an awl tip, a flaked stone core, and one piece of ground stone. An artifact assemblage was also found on the floor of the structure. The floor assemblage consisted of 4 hammerstones, 2 sherds, 2 flaked stone cores, 1 mano fragment, and a tabular knife. Four pieces of fire-cracked rock were also present on the floor, but these were not collected.

Construction and Remodeling Evidence

When encountered, the walls of the structure were 30 cm above the floor. The walls may have been slightly impacted by mechanical stripping. Neither the walls nor the floor of the structure appeared plastered or prepared in any way. The central location of the two large postholes suggested that they functioned as supports for the roof. The lack of other postholes in the floor indicated the structure was likely a true pithouse, with the walls of the foundation pit serving as the walls of the structure. However, no exterior postholes were found to support this conclusion.

No evidence was found for any remodeling of the structure.

Stratigraphic Relationships

The pit structure did not intrude, nor was it intruded by, any other feature. The foundation pit of the structure was cut into alluvial clays of the floodplain.

Abandonment and Postabandonment

Except the small quantities of burned daub, the structure did not appear to have burned. The lack of other construction debris suggested the superstructure may have been scavenged prior to abandonment. Although many artifacts were discovered on the floor of the structure, the lack of residual utility suggested the structure may have been cleaned out prior to abandonment.

After the structure was abandoned, the foundation pit of the structure was used as a dump for other trash. Alluvial and colluvial processes also contributed to the filling of the foundation pit. After it had filled, the foundation pit was covered by continuing natural processes.

Date

Based on the decorated sherds present, this pit structure dates to the Cañada del Oro phase (A.D. 750-850) of the Hohokam Colonial period.

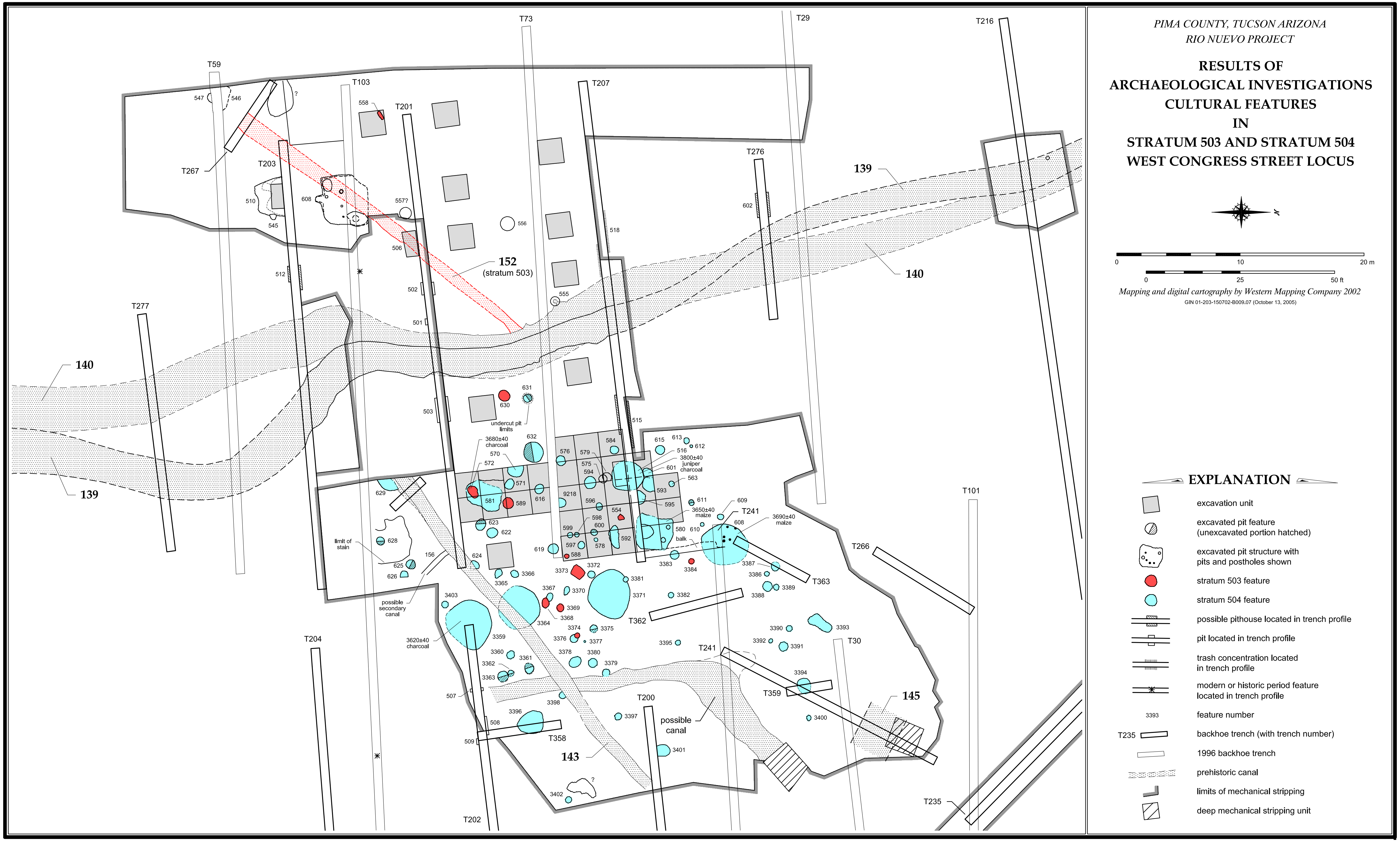

Figure 4.32. Prehistoric features located at the Congress Street locus, the Clearwater site, AZ BB:13:6 (ASM).

Feature 506, Possible Pit Structure

General Description

Feature 506 was discovered during mechanical trenching (Trench 201), and then manually excavated within the limits of a 1-m by 2-m control unit, Unit 197. This unit was excavated from the modern ground surface to the possible pit structure floor.

Feature 506 originated in Stratum 504, and was defined as a possible pit structure. Due to the limited amount of excavation, its dimensions and orientation could not be determined. The excavated area contained a poorly defined, uneven floor surface, but no internal features. As a possible structure, its function could not be identified, and it might only represent an occupational surface.

Internal Features

No internal features were identified.

Internal Strata and Artifact Contents

Approximately 30 cm of stratified fill was removed from within this feature. The upper 10 cm consisted of a naturally deposited sandy clay with a moderate amount of charcoal, burned daub, five pieces of flaked stone, and 20 pieces of fire-cracked rock. Below this, the fill was red sand with clay pockets, an abundant amount of charcoal, and burned daub.

Within this lower stratum there was also a dramatic increase in artifact density—33 pieces of flaked stone, 131 pieces of fire-cracked rock, 2 scrapers, and some animal bone were recovered. This lower fill is likely the result of trash-filling that occurred after abandonment of the structure. Eight pieces of fire-cracked rock were the only artifacts recovered from the floor.

Construction and Remodeling Evidence

A posthole pattern was not exposed within this structure, and the nature of its construction is unknown. However, the presence of large amounts of burned daub within the feature fill suggests a superstructure of wattle-and-daub construction. The floor surface exhibited no evidence of preparation and was defined by the break between cultural fill and a sterile Stratum 504. There was no evidence of remodeling.

Stratigraphic Relationships

Feature 506 did not appear to underlay, overlay, or intrude any other features. Due to the limited amount of mechanical stripping around the structure, however, its relationship to other features was not exposed.

Abandonment and Postabandonment

Within the excavated area of Feature 506, the absence of floor artifacts or a distinct layer of collapsed superstructure suggests that this possible structure was cleaned out prior to abandonment. After abandonment, the structure filled with trash from surrounding features, and ultimately, with naturally deposited sediments.

Date

Based on its context in Stratum 504, this feature dates to sometime between 4000-3700 b.p. (uncalibrated ^{14}C years), or circa 2500-2100 B.C., in calibrated calendar years.

Feature 510, Pit Structure

General Description

This pit structure was discovered in the southern profile of Trench 203. The trench cut the northern portion of the structure, destroying the northern wall. Upon discovery, a control unit was excavated down to the floor. After reaching the floor, the remainder of the house was excavated completely by hand. A roasting pit, Feature 545, intruded on the eastern edge of the structure.

This pit structure appeared to be roughly rectangular in shape and measured 3.3 m in length, 2.0 m in width, and 36 cm in depth. An oxidized portion of floor was discovered, and this was thought to be the hearth of the structure. An entry was discovered just off center in the southern wall of the structure. The entry was 70 cm long, 50 cm wide, and it faced toward the southeast. No artifacts were discovered on the floor, and the structure did not appear to have burned.

Internal Features

No postholes were discovered in the floor of Feature 510.

Feature 510.01 was an oxidized patch of floor thought to be a possible hearth. The oxidized area measured 50 cm in length, 30 cm in width, and had no depth. A small amount of ash was present in the center of the area, but no artifacts were recovered from it. The oxidized area was located just to the side of the entryway.

Internal Strata and Artifact Contents

Some 36 cm of fill was removed between the stripped surface and the floor of the structure. The fill was grayish-tan sandy silt with small charcoal flecking that increased with depth. Small pieces of unburned daub were also discovered in the fill. Artifacts recovered from the fill included sherds, pieces of flaked stone, ground stone fragments, and one piece of unworked animal bone. Fire-cracked rock was also abundant throughout the fill.

Construction and Remodeling Evidence

When discovered, the walls of this feature were found to rise at least 25 cm above the floor. They were probably impacted by erosion and construction of the overlying roasting pit, Feature 545. Neither the walls nor the floor of Feature 510 appeared plastered. A small area of the floor around the possible hearth area seemed to have been smoothed, although this was not apparent elsewhere in the structure. Except the small chunks of daub, no evidence for a superstructure was discovered.

Stratigraphic Relationships

This pit structure was built into the floodplain alluvium, and was filled primarily by natural deposition. A roasting pit, Feature 545, was constructed sometime after the foundation pit of the structure had been filled.

Abandonment and Postabandonment

The lack of artifacts on the floor suggested the structure had been cleaned out before it was abandoned. It also seemed likely that the superstructure had been scavenged sometime during or after abandonment. The structure did not appear to have burned. After the structure had been filled, continuing natural processes buried the foundation pit.

Date

Based on the stratigraphic context of this feature and the mixture of sherds present, it dates to either the Early Ceramic period or a Hohokam period.

Feature 511, Pit Structure

General Description

Feature 511 was discovered within Trench 205 and then exposed during mechanical stripping of Block 2. The entire structure was subsequently excavated by hand.

This round pit structure measured 4.40 m east-west by 3.65 m north-south; it contained nine postholes and six interior pits. The location of its entry was not identified, and the orientation of the structure could not be determined. This structure originated in Stratum 502, and probably represents a small fieldhouse utilized seasonally over an extended period of time. The presence of the six pits and the absence of a hearth suggests the structure may have been used primarily for storage, with perhaps some limited habitation.

Internal Features

All nine of the postholes likely functioned as perimeter wall and roof supports and were located within possibly two posthole rows. These posts ranged between 10 cm and 20 cm in diameter, and were from 6 cm to 20 cm deep.

Feature 511.01 was an irregularly shaped storage pit located in the center of the structure. It measured 1.8 m long, 1.3 m wide, and 28 cm deep; it had a basin-shaped profile. The fill was similar to that of the structure, and the pit was probably used until the structure was abandoned. This fill consisted of a very hard silty clay with large amounts of charcoal, seven pieces of flaked stone, a bone awl fragment, some animal bone, and 15 pieces of fire-cracked rock. It intruded into Features 511.03 and 511.06, which contained different fill types.

Feature 511.02 was an oval storage pit located near the eastern wall of the structure. It was 95 cm long, 55 cm wide, and 26 cm deep, with a basin-shaped profile. Fill was a hard silty clay with some charcoal but no artifacts. Like Feature 511.01, Feature 511.02 was probably in use when the structure was abandoned.

Feature 511.03 was a bell-shaped pit located in the center of the structure, within the limits of Feature 511.01. It was almost completely removed by construction of Features 511.01 and 511.05, and only its northern wall and bottom were preserved. The fill consisted of a hard clayey silt with some charcoal but no artifacts. It was likely used for storage and measured 80 cm long, 60 cm wide, and 26 cm deep.

Feature 511.04 was another small storage pit located near the eastern wall. It was elliptical in plan view, had a basin-shaped profile, and measured 45 cm long, 40 cm wide, and 41 cm deep. The fill consisted of a hard clayey silt with three pieces of flaked stone. It was intruded by Feature 511.02, and was likely contemporary with Feature 511.04.

Feature 511.05 was a small storage pit located near the center of the structure. It was circular in plan view, had straight walls, a flat bottom, and measured at least 40 cm in diameter and 17 cm deep. The eastern edge was removed by Feature 511.01, and it may have been sealed. The fill consisted of a hard silty clay with a moderate amount of charcoal but no artifacts.

Feature 511.06 was also a small storage pit located near the center of the structure, intruded by Feature 511.01. It was filled with a moderately hard silty clay with pockets of blocky clay, charcoal, flecks of daub, but no artifacts. It was circular in plan view, had a basin-shaped profile, and measured 60 cm in diameter and 24 cm deep.

Internal Strata and Artifact Contents

Approximately 25 cm of stratified fill was removed from the mechanically stripped surface to the pit structure floor. The uppermost stratum, some 8 cm thick, consisted of a hard cienega clay with burned daub, charcoal flecking, flaked stone, and animal bone. Below this, two distinct strata were situated side-by-side and represented separate filling episodes within the structure. The density of artifacts dropped dramatically in these strata.

The fill located in the center of the structure consisted of a hard silty clay with charcoal, flecks of daub, and three pieces of flaked stone. This fill was likely the result of a single flooding episode that rapidly filled the structure and destroyed a portion of the northwestern wall. Sitting at about the same elevation, but bordering the walls of the structure, was very hard cienega clay that may be the result of wall slumping. A thin layer of this stratum was also located just above the floor throughout the entire structure. This stratum contained charcoal and daub flecking, one piece of flaked stone, and one piece of animal bone. No artifacts with a floor context were recovered.

Construction and Remodeling Evidence

Based on the location of the excavated postholes, the walls of this structure were probably constructed within the house pit and were supported by a row of posts along the floor perimeter. Due to the small size of the structure, the roof may have also been supported by these wall posts. None of the interior surfaces were prepared in any way, and they were defined only by the break between feature fill and the natural alluvium. The daub found within the fill might suggest a superstructure of wattle-and-daub construction.

The structure has multiple signs of remodeling. First, there is the presence of possibly two concentric posthole rows, indicating a shift in wall location. Second is the superpositioning of all the interior pits. Features 511.01 and 511.02 appear to have been in use when the structure was abandoned, while Features 511.03, 511.04, 511.05, and 511.06 were used during previous occupations and were subsequently sealed.

Stratigraphic Relationships

Feature 511 was constructed by excavation into a floodplain alluvium and was not located near any other structure of a similar originating depth. It was surrounded by a number of small extramural pits, including Features 539 and 540. It was intruded by a large roasting pit along its southeastern wall that cut through the wall and floor.

Abandonment and Postabandonment

This structure appears to have been cleaned out prior to its final abandonment. No floor assemblage was preserved, and there was no evidence the structure burned. The structure was filled primarily with deposits from a single flood. There was no evidence of any postabandonment reuse.

Date

Based on its architectural style and stratigraphic context, this feature probably dates to the Cienega phase (800 B.C.-A.D. 50) of the Early Agricultural period.

Feature 516, Pit Structure

General Description

Feature 516 was discovered within Trench 207 and was initially tested in a 1-m by 2-m control unit, Unit 198, originating 90 cm below the modern ground surface. The area around the feature was subsequently mechanically stripped to the top of Stratum 503, and the structure was exposed during excavation of four 2-m by 2-m control units—Units 492, 493, 512, and 513—within Stripping Block 5. The entire structure was then excavated by hand (Figure 4.33).

This oval structure originated in Stratum 504, and measured 2.54 m north-south and 2.08 m east-west. It appears to have been of a simple, insubstantial construction and was preserved as a shallow basin-shaped depression with no internal features. The absence of these features made the location of an entry difficult to identify, and the orientation of the structure could not be determined. This feature probably functioned as a habitation structure utilized only temporarily as part of a seasonal occupation.

Figure 4.33. Feature 516, an Early Agricultural period pithouse in Stratum 504, the Congress Street locus, the Clearwater site, AZ BB:13:6 (ASM).

Internal Features

No internal features were identified.

Internal Strata and Artifact Contents

Feature 516 was filled with approximately 20 cm of a naturally deposited clayey silt with charcoal flecking, fire-cracked rock, flaked stone, ground stone, and one hammerstone. No artifacts were recovered from a floor context.

Construction and Remodeling Evidence

Because no postholes or structural materials were identified, the nature of the construction is unknown. None of its interior surfaces exhibited evidence of preparation, and they were defined only by the break between feature fill and the sterile substrate, Stratum 504.01. There was no evidence of remodeling.

Stratigraphic Relationships

Feature 516 was located within Stripping Block 5 and did not overlay, underlay, or intrude any features. Numerous extramural pits, including Features 601, 593, 595, 584, and 579, surrounded it. Two similar structures, Features 580 and 608, were located near Feature 516 to the east.

Abandonment and Postabandonment

This structure appears to have been cleaned out prior to abandonment. There was no floor assemblage preserved and no evidence that the structure burned. It does not appear to have been reused, and it ultimately filled with naturally deposited sediments.

Date

A piece of juniper charcoal collected from this structure provided a radiocarbon date of 3800±40 b.p. (uncalibrated ^{14}C years), or 2290-2150 B.C., in calibrated calendar years (at the 1-sigma range of probability), placing it in the unnamed phase of the Early Agricultural period.

Feature 546, Pit Structure

General Description

Feature 546 was discovered within Trench 59, and was subsequently exposed by mechanical stripping. The structure was then partially excavated by hand within the limits of a 1-m by 2-m control unit, Unit 212.

This subrectangular pit structure originated in Stratum 502, and measured an excavated 70 cm north-south and 2 m east-west. The structure was heavily disturbed by trenching, and its original dimensions and orientation could not be determined. No internal features were identified within its excavated area, and the structure was likely of a simple, insubstantial construction. This feature likely dates to a Hohokam period and probably functioned as a small habitation structure utilized temporarily as part of a seasonal occupation.

Internal Features

No internal features were identified.

Internal Strata and Artifact Contents

This structure was filled with approximately 14 cm of a naturally deposited silty clay with charcoal flecking, burned daub, sherds, three pieces of flaked stone, four pieces of fire-cracked rock, and some animal bone. No artifacts were recovered from a floor context.

Construction and Remodeling Evidence

The type of construction utilized for this structure could not be determined due to the lack of postholes. The presence of some burned daub in the fill suggests the superstructure may have been of wattle-and-daub construction. None of its interior surfaces exhibited any evidence of preparation, and there was no evidence of remodeling.

Stratigraphic Relationships

This pit structure was located within Stripping Block 1 and did not appear to underlay, overlay, or intrude any other features. Pit structure Feature 546 was located north of a large bell-shaped pit, Feature 547, and west of one other Hohokam pit structure, Feature 308.

Abandonment and Postabandonment

Because this structure lacked a floor assemblage and evidence of in situ burning, it was likely cleaned out prior to abandonment. It then filled with naturally deposited sediments similar to the surrounding substrate.

Date

Based on its stratigraphic context and associated pottery sherds, this feature dates to either the Early Ceramic period or a Hohokam period.

Feature 580, Pit Structure

General Description

Feature 580 was initially cut during mechanical trenching (Trench 207), and then exposed during the excavation of four 2-m by 2-m control units—Units 533, 553, 534, and 554—located within Stripping Block 5. The entire structure was subsequently excavated by hand (Figure 4.34).

This subrectangular pit structure originated in Stratum 504.01, and measured approximately 3.0 m north-south and 2.8 m east-west. It was defined as a large basin-shaped depression with three internal pits, but no postholes. The location of its entry could not be identified, and the orientation of the structure was undetermined. Based on its poor definition, this structure appears to have been of insubstantial construction and was likely inhabited temporarily as part of a seasonal occupation. The presence of three internal pits suggests its use for both storage and habitation.

Internal Features

Three intramural pits were discovered in the structure.

Feature 580.01 was an oblong storage pit located near the center of the structure. It had a basin-shaped profile and excavated dimensions of 1.2 m long, 85 cm wide, and about 28 cm deep. The fill consisted of sediment similar to Stratum 504.01, a reddish-brown sand with abundant charcoal, flaked stone, and some animal bone.

Feature 580.02 was a circular storage pit located near the northwestern corner of the pit structure. It had a basin-shaped profile and measured 42 cm in length, 36 cm in width, and 9 cm in depth. Like Feature 580.03, the fill of Feature 580.02 consisted of a hard sandy clay similar to the fill of the structure. It contained abundant charcoal flecking and one small piece of fire-cracked rock.

Feature 580.03 was another small storage pit located in the northeastern corner of the structure. It was circular in plan view, had a basin-shaped profile, measured 35 cm in diameter, and was 6 cm deep. The fill was similar to that of the structure and consisted of a hard sandy clay with charcoal flecking, but no artifacts.

Internal Strata and Artifact Contents

This structure was filled with roughly 10 cm of homogenous silty-sandy clay. This fill appeared to be naturally deposited sediment with a moderate amount of charcoal, some ash, daub, and 10 pieces of fire-cracked rock. No other artifacts were found in the fill or on the floor.

Figure 4.34. Feature 580, an Early Agricultural period pithouse, the Congress Street locus, the Clearwater site, AZ BB:13:6 (ASM).

Construction and Remodeling Evidence

Due to the lack of postholes, the construction style for this structure is unknown. The daub visible within the house fill might indicate a superstructure constructed of wattle-and-daub. None of the interior surfaces were prepared in any way, and there was no evidence of remodeling.

Stratigraphic Relationships

Feature 580 was located within Stripping Block 5 and did not underlay, overlay, or intrude any other features. It was surrounded by numerous extramural pits, including Features 595 and 592. It was also located within a cluster of three small structures that included Features 608 and 516.

Abandonment and Postabandonment

This structure appears to have been cleaned out prior to abandonment. It contained no floor assemblage and no evidence of in situ burning. It does not appear to have been reused, and it filled with naturally deposited sediment similar to the surrounding substrate.

Date

A sample of charred maize from intramural pit Feature 580.01 provided a radiocarbon date of 3690 ±40 b.p. (uncalibrated ^{14}C years), or 2140-2020 B.C. (calibrated calendar years at the 1-sigma range of probability). Another sample of maize from Feature 580.01 provided a radiocarbon date of 3650±40 b.p. (uncalibrated ^{14}C years), or 2120-1950 B.C. (calibrated calendar years at the 1-sigma range of probability).

Feature 581, Pit Structure

General Description

Feature 581 was discovered during excavation of six 2-m by 2-m control units—Units 486, 487, 488, 506, 507, and 508—within Stripping Block 5. The structure was then completely excavated by hand (Figure 4.35).

This oval pit structure originated in Stratum 504, and measured 2.85 m north-south and 2.20 m east-west. Like some of the other structures that originated in that stratum, Feature 581 was of insubstantial construction and was defined as a large basin-shaped depression with no internal features. Due to its poor definition, the orientation could not be determined. It likely functioned as a habitation structure utilized temporarily as part of a seasonal occupation.

Figure 4.35. Feature 581, an Early Agricultural period pithouse in Stratum 504, and Features 571 and 589, Early Agricultural period extramural pits in Stratum 503, the Congress Street locus, the Clearwater site, AZ BB:13:6 (ASM).

Internal Features

No internal features were identified.

Internal Strata and Artifact Contents

This structure was filled with approximately 17 cm of naturally deposited loose sand similar to Stratum 504.01. It contained charcoal flecking, 11 pieces of flaked stone, 49 pieces of fire-cracked rock, and some incipient plain ware pottery sherds. No artifacts with a floor context were recovered.

Construction and Remodeling Evidence

The nature of the construction could not be determined due to the lack of internal features. Neither the floor nor the walls exhibited any preparation, and there was no evidence of remodeling.

Stratigraphic Relationships

Feature 581 was constructed by excavation into strata 504 and 505. It was intruded by a large roasting pit, Feature 572, that cut into its southern half. It was most closely located near three extramural pits, Features 570, 571 and 589, that originated at about the same elevation.

Abandonment and Postabandonment

This structure, based on the lack of floor artifacts and burning, was probably cleaned out and abandoned. There was no evidence of postabandonment reuse, and the feature ultimately filled with naturally deposited sediments.

Date

Unidentified wood charcoal provided a radiocarbon date of 3680±40 b.p. (uncalibrated ^{14}C years), or 2130-2010 B.C. (calibrated calendar years at the 1-sigma range of probability).

Feature 608, Pit Structure

General Description

Feature 608 was originally cut by Trench 102, and was then partially exposed during excavation of control Unit 556 in Stripping Block 5. The area around the unit was subsequently re-stripped and only the western half of the feature was exposed. This was then completely excavated by hand (Figure 4.36)

This round pit structure originated in Stratum 504, and measured an excavated 3.60 m north-south and 1.45 m east-west. It appears to have been more substantially constructed than surrounding structures, with five postholes in its excavated area. The location of the entry could not be identified, and the orientation was undetermined. This feature likely functioned as a habitation structure occupied temporarily as part of a seasonal occupation.

Internal Features

Five postholes were identified within the excavated area of the structure. Two of these were located near the western pit wall and probably served as perimeter wall supports. The other three postholes were located near the center of the structure and could have functioned as roof supports. The postholes ranged between 10 cm and 15 cm in diameter, and were from 5 cm to 9 cm deep.

Internal Strata and Artifact Contents

Approximately 7 cm of homogenous fill was removed from the mechanically stripped surface to the pit structure floor. This consisted of a naturally deposited silty clay with minor charcoal flecking, two pieces of flaked stone, and six pieces of fire-cracked rock. No artifacts were recovered from a floor context.

Construction and Remodeling Evidence

Based on its exposed posthole pattern, this structure appears to have had walls constructed within the house pit and supported by a row of posts along the floor perimeter. The roof was likely supported by a combination of these wall posts and posts located within the interior area of the structure. Structural materials, such as daub, were not preserved, and the nature of the superstructure could not be determined. None of the interior surfaces were prepared in any way, and there was no evidence of remodeling.

Stratigraphic Relationships

This pit structure was located within Stripping Block 5, within a small cluster of structures that included Features 516 and 580. It was also in close proximity to three extramural pits, Features 609, 610, and 611. Feature 608 does not appear to underlay, overlay, or intrude any other features.

Figure 4.36. Feature 608, an Early Agricultural period pithouse, the Congress Street locus, the Clearwater site, AZ BB:13:6 (ASM).

Abandonment and Postabandonment

Based on the absence of floor artifacts, this structure appears to have been cleaned out and abandoned. It did not exhibit evidence of postabandonment reuse, and it ultimately filled with natural deposits similar to the surrounding substrate.

Date

Based on its stratigraphic context and proximity to radiocarbon-dated features, this pit structure probably dates near 2100 B.C.

Figure 4.37. Feature 629, an Early Agricultural period pithouse, the Congress Street locus, the Clearwater site, AZ BB:13:6 (ASM).

Feature 629, Pit Structure

General Description

Feature 629 was discovered during mechanical stripping of Block 5. This exposed only its eastern half, which was then completely excavated by hand (Figure 4.37).

This round pit structure originated in Stratum 504, and measured an excavated 1.2 m north-south and 95 cm east-west. It was a shallow, basin-shaped depression with no internal features or visible orientation. Like the other structures originating in that stratum, this structure was likely of insubstantial construction and inhabited temporarily as part of a seasonal occupation. It was likely utilized primarily as a habitation structure before it was ultimately cleaned out and abandoned.

Internal Features

No internal features were identified within pit structure Feature 629.

Internal Strata and Artifact Contents

Approximately 12 cm of homogenous fill was excavated from the mechanically stripped surface to the pit structure floor. This fill consisted of a naturally deposited reddish sand with abundant charcoal, five pieces of flaked stone, and 25 pieces of fire-cracked rock. No artifacts with a floor context were recovered.

Construction and Remodeling Evidence

Because of the lack of postholes and structural material, the nature of the construction could not be determined. None of the internal surfaces were prepared in any way, and there was no evidence of remodeling.

Stratigraphic Relationships

This pit structure was located within Stripping Block 5, in close proximity to three extramural pits, Features 625, 626, and 628. It was intruded by a large Hohokam canal, Feature 143, AZ BB:13:481 (ASM), that removed the northern portion.

Abandonment and Postabandonment

This structure appears to have been cleaned out prior to abandonment, based on the lack of floor artifacts and a distinct layer of collapsed superstructure. The presence of large amounts of charcoal might be due to either partial burning of the structure, or to some minimal trash-filling combined with natural deposition.

Date

Based on its stratigraphic context and proximity to radiocarbon-dated features, this pit structure probably dates near 2100 B.C.

Feature 3359, Pit Structure

Description

This feature was discovered during mechanical stripping; it was then completely excavated by hand (see Figure 4.32). Feature 3359 was slightly elliptical and measured 3.5 m north-south and 4.0 m east-west. No internal features were discovered in the floor. No entry was found, and the orientation of the structure could not be determined. This structure did not burn, and no artifacts were discovered on the floor.

Internal Features

No internal features were identified.

Internal Strata and Artifact Contents

About 10 cm of fill were excavated between the stripped surface and the floor of the structure. The fill consisted of coarse sands, mixed with some clay that appeared to have been brought in through bioturbation. The fill contained abundant charcoal and ash, but only a few small pieces of burned daub. Artifacts recovered from the fill consisted of 36 pieces of flaked stone, three unworked animal bones, a mano, a projectile point, and a biface. Twelve incipient plain ware sherds, as well as two additional possible sherds, were also collected. One of the sherds had a visible coil structure.

A scatter of fire-cracked rock was the only item discovered on the floor of the structure. No other artifacts were present.

Construction and Remodeling Evidence

When excavated, the walls were 10 cm above the floor of the structure. The walls may have been slightly truncated by mechanical stripping.

Little can be said about construction of this pit structure. No internal features were discovered, and possible construction debris was minimal. No evidence existed through which inferences about a possible superstructure could be made.

Neither the walls nor the floor of the structure appeared to have been plastered or prepared in any way.

Stratigraphic Relationships

This pit structure was constructed into a stratum of sand in the alluvial floodplain. It was not intruded on, nor did it intrude on any other feature. Feature 3359 was located in a cluster of other similar pit structures.

Abandonment and Postabandonment

This structure did not appear to have burned and was possibly cleaned out prior to abandonment. Sometime after abandonment, waterborne sands filled the structure. Alluvial clay deposition then covered the filled foundation pit.

Date

Unidentified wood charcoal provided a radiocarbon date of 3620±40 b.p. (uncalibrated ^{14}C years), or 2030-1920 B.C. (calibrated calendar years at the 1-sigma range of probability).

Feature 3364, Pit Structure

Description

This feature was discovered during mechanical stripping. After it was fully exposed, the structure was excavated completely by hand. It originated in Stratum 504. Feature 3364 was roughly circular, and measured approximately 3.42 m in diameter. No internal features were discovered in the floor of the structure. No entry was identified, and orientation of the pit structure could not be determined. A Hohokam canal, Feature 143, BB:13:481, intruded the southern half of the structure. The structure did not appear to have burned, and no artifacts were found on the floor.

Internal Features

No internal features were identified.

Internal Strata and Artifact Contents

Approximately 10 cm of fill were excavated between the stripped surface and the floor of the pit structure. Fill consisted of coarse sands with some areas of compacted clay. Some charcoal chunks and charcoal flecking were present throughout the fill. Artifacts recovered from the fill included a few pieces of flaked stone, some unworked animal bone, and a few incipient plain ware sherds.

No artifacts were discovered on the floor of the structure.

Construction and Remodeling Evidence

Very few of the construction details of the structure were preserved. No internal features were discovered. No daub or construction materials seemed to be present. The compacted clay in the fill may have represented poorly preserved construction materials. Both the walls and the floor of the structure were very poorly preserved, although what remained did not appear plastered or prepared in any way.

Stratigraphic Relationships

This structure was built into a stratum of sand on the alluvial floodplain. Sometime after the foundation pit of the structure was filled, an irrigation canal, Feature 143, BB:13:481, was constructed through the fill of the southern portion of Feature 3364. The structure itself did not intrude on any other feature. This pit structure was within a small cluster of other similar pit structures.

Abandonment and Postabandonment

The lack of oxidization and burned construction materials suggests this structure did not burn. It may have also been cleaned out prior to abandonment. Sometime after it was abandoned, the structure filled with alluvial sand. The filled foundation pit was then covered by alluvial clay deposition.

Date

Based on its stratigraphic context and the radiocarbon ages of nearby features, this pit structure probably dates to about 2100 B.C.

Feature 3371, Pit Structure

Description

This feature was discovered during mechanical stripping, after which it was completely excavated by hand. This pit structure originated in Stratum 504. A small pit, Feature 3381, intruded on the northern edge of the structure. Feature 3371 was slightly elliptical and measured 3.96 m east-west and 3.46 m north-south. A possible hearth was discovered in the floor of the pit structure. No entry was found, and the orientation of the structure could not be determined. The structure did not appear to have burned, and a possible de facto artifact assemblage was revealed on the floor of the structure.

Internal Features

No postholes were identified in the floor of the structure.

Feature 3371.01 was a possible hearth area in the floor, located just west of the center of the structure. It measured 60 cm in length and 53 cm in width, but had almost no depth. The area showed no real signs of oxidization, but rather, was a gray stain of ash and charcoal. No artifacts were recovered from the hearth area.

Internal Strata and Artifact Contents

Approximately 8 cm of fill was excavated between the stripped surface and the floor of the structure. The fill consisted of coarse sands that contained moderate amounts of charcoal and ash. Artifacts recovered from the fill consisted of some 18 pieces of flaked stone, 2 pieces of unworked animal bone, and 1 projectile point fragment.

A possible de facto artifact assemblage was discovered on the floor of the structure. The assemblage included 1 piece of flaked stone, 2 manos, 2 flaked stone cores, and a projectile point fragment. The two manos and one of the flaked stone cores were found clustered on the extreme northern edge of the structure.

Construction and Remodeling Evidence

Not many of the construction details of this structure were preserved. The walls of the structure were found to be about 6 cm above the floor, although they may have been truncated slightly by mechanical stripping. Neither the walls nor the floor had been preserved very well, and neither appeared to have been prepared or plastered in any way.

Stratigraphic Relationships

This pit structure was constructed into a stratum of alluvial sand on the floodplain. It did not intrude on any other feature. Sometime after it was abandoned, it filled by alluvial sand deposition. A small pit, Feature 3381, intruded on the northern edge of the structure after it had been filled. Both features were then covered by continuing alluvial and colluvial deposition.

Abandonment and Postabandonment

There is no evidence the structure burned, but the small floor assemblage suggested the structure may not have been cleaned out before it was abandoned. Sometime after it was abandoned, the foundation pit of this structure was filled and subsequently covered by continuing alluvial and colluvial processes.

Date

Based on its stratigraphic context and the radiocarbon ages of nearby features, this pit structure probably dates to about 2100 B.C.

PITS

Feature 538, Pit

Feature 538 was a small pit discovered during mechanical stripping of Block 2. This pit, which measured 55 cm in diameter and 9 cm deep, was circular in plan view with a basin-shaped profile. It was completely excavated in one level, and a flotation sample was collected from the fill. This fill consisted of a blocky, silty clay similar to the surrounding cienega clay, Stratum 502, into which it was excavated.

Other than approximately 20 pieces of fire-cracked rock (most of which were less than 5 cm in diameter), no other artifacts were recovered. The pit did not appear to be burned, although the presence of a large number of fire-cracked rocks suggested its use as a roasting pit. No temporally diagnostic artifacts were recovered, but the stratigraphic context suggests this feature dates to the Cienega phase (800 B.C.-A.D. 50) of the Early Agricultural period.

Feature 539, Pit

Feature 539 was also a small circular pit located in Stripping Block 2. It had a basin-shaped profile, and measured 50 cm in diameter and 25 cm deep. This pit was completely excavated in one level, and a flotation sample was collected from the fill. It originated in Stratum 502, and was filled with a similar clay with some silt, charcoal flecking, and burned daub. One piece of flaked stone and three pieces of fire-cracked rock were the only artifacts recovered. No evidence of burning was visible within the feature, and it may have served a storage function. Based on its stratigraphic context, this feature probably dates to the Cienega phase.

Feature 540, Pit

Feature 540 was another small pit located in Stripping Block 2. This pit, which was oblong in plan view with a conical profile, originated in Stratum 502 and measured 45 cm long, 35 cm wide, and 34 cm deep. The fill was completely excavated in one level and consisted of a hard clay-loam with charcoal flecking and staining. Other than a few fragments of animal bone, no other artifacts were recovered. One flotation sample was collected. This pit displayed no evidence of burning and may have been used for storage. Based on its stratigraphic context, this feature probably dates to the Cienega phase.

Feature 541, Pit

Feature 541 was a semicircular pit that measured 85 cm in diameter and 24 cm deep. This pit, which had sloping sidewalls and a rounded base, was located in Stripping Block 2 and originated in Stratum 502. The fill consisted of a hard silty clay with a large amount of charcoal and some oxidation, but no artifacts. Six pieces of fire-cracked rock were recovered, although all were smaller than 5 cm in diameter. The fill was completely removed in one level, and a flotation sample was collected. Although the fill appeared to be burned, the pit itself was not. It may have served a storage function. Based on its stratigraphic context, this feature probably dates to the Cienega phase.

Feature 542, Pit

Feature 542 was a small, oval-shaped pit located in Stripping Block 3. This pit had steep rounded walls, a rounded base, and measured 71 cm long, 60 cm wide, and 30 cm deep. It originated in Stratum 502, and only its northern half was excavated. The fill from this portion consisted primarily of a dense layer of charcoal mixed with alluvium. From this, 10 pieces of fire-cracked rock, four of which were ground stone fragments, and a flotation sample were collected. The fill below this resembled Stratum 502, except it contained a few flecks of charcoal, oxidation, and one piece of fire-cracked rock. Although the pit itself was not burned, the abundant amounts of charcoal and fire-cracked rock located in its upper fill suggested it likely functioned as a roasting pit. Based on its stratigraphic context, this feature probably dates to the Cienega phase.

Feature 543, Modern Pit

Feature 543 was a modern pit located in Stripping Block 3. This pit, that originated in Stratum 501, was initially approached as a prehistoric feature and was bisected. During the course of excavation, modern materials such as styrofoam and cut wood were recovered, and the feature was then abandoned. This pit was irregularly shaped in plan view and measured 98 cm long and 44 cm wide. Approximately 9 cm of its fill, a sandy clay, was removed. No artifacts or samples were collected.

Feature 544, Pit

Feature 544 was a small pit with a circular top, straight walls, and a rounded base. It was located in Stripping Block 4 and measured 70 cm long, 68 cm wide, and 29 cm deep. This pit, which originated in Stratum 502, was completely excavated in one level, and a flotation sample was collected from its fill. Its fill consisted of a hard clay-loam with a dense amount of charcoal and some burned daub. Artifact density was relatively high, and 20 pieces of flaked stone, some animal bone, nine pieces of fire-cracked rock, and a possible fire-cracked ground stone fragment were recovered. This pit displayed no evidence of burning, and it may have originally been used for storage. Based on its stratigraphic context, this feature probably dates to the Cienega phase.

Feature 545, Roasting Pit

Feature 545 was a small roasting pit located in Stripping Block 1. This pit, that measured 50 cm in diameter and 23 cm deep, was circular in plan view with a basin-shaped profile. It was completely excavated in one level, and both a flotation and a pollen sample were collected. It originated in Stratum 502, and was filled with a tan sandy clay with ash, charcoal, 11 pieces of fire-cracked rock, and a fire-cracked ground stone fragment. The pit itself was unburned, although the dense amounts of charcoal, ash, and fire-cracked rock present in the fill suggested its use as a roasting pit. This pit was intrusive into Feature 510, a pit structure. Based on its stratigraphic relationship with Feature 510, Feature 545 dates to either the Early Ceramic period or a Hohokam period.

Feature 547, Bell-shaped Pit

Feature 547 was a bell-shaped pit discovered during excavation of Trench 59 within Stripping Block 1. The trench removed most of the northern portion of the pit, and the fill that remained was excavated stratigraphically as part of one unit. The pit had a top diameter of at least 55 cm, a basal diameter of at least 70 cm, and it was 76 cm deep. Feature 457 originated in Stratum 502, and cut through, in three stratigraphic levels, into Stratum 504. A flotation sample and a pollen sample were collected from each stratigraphic level.

The upper 23 cm of fill consisted of a silty clay with charcoal, 5 sherds, 2 pieces of flaked stone, 1 piece of fire-cracked rock, and a ground stone fragment. Below this, approximately 45 cm thick, was a brown sandy clay with a dense amount of charcoal, sherds, flaked stone, animal bone, a flaked stone tool, and one piece of fire-cracked rock. The 12 cm of fill located above the pit base was similar to that of the previous level. It consisted of a silty-sandy clay that, in contrast, had a lower density of charcoal and artifacts. One small piece of flaked stone was located on the base of the pit. This pit displayed no evidence of burning and was likely a trash-filled storage pit. Based on the types of sherds present, this feature almost certainly dates to a Hohokam period.

Feature 548, Pit

Feature 548 was a small pit initially discovered in Trench 220. It was intrusive into Feature 529, a pit structure, and was exposed in plan during excavation of a 2-m by 2-m control unit placed over that structure. This pit originated in Stratum 503, and became visible as a discrete feature due to its circular arrangement of fire-cracked basalt situated around the opening. This pit was circular in plan view, had a basin-shaped profile, and measured 60 cm in diameter and 19 cm deep. It was completely excavated in one level, and both a flotation and a pollen sample were collected. The fill consisted of dark gray sand with charcoal, daub, and 17 pieces of fire-cracked rock. Although the pit itself exhibited no evidence of burning, the large amounts of fire-cracked rock and charcoal suggested that it functioned as a roasting pit. Based on its stratigraphic context, this feature probably dates to around 1500 B.C.

Feature 554, Pit

Feature 554 was a small, shallow pit discovered while excavating a 2-m by 2-m control unit, Unit 532, in Stripping Block 5. It was irregularly shaped and measured 55 cm long, 45 cm wide, and 4 cm deep. The pit originated in Stratum 503, and was completely excavated in one level. Because the pit was shallow, all the fill was collected as a flotation sample. This fill consisted of a sediment similar to that of Stratum 503, but with more charcoal flecking and 10 pieces of fire-cracked rock. Its function is unknown. Based on its stratigraphic context, this feature likely dates to about 1500 B.C.

Feature 558, Roasting Pit

Feature 558 was a small roasting pit discovered while excavating a 2-m by 2-m control unit, Unit 338, in Stripping Block 5. It originated in Stratum 503, and was oblong in plan view with straight walls and a flat base. This pit measured 74 cm long, 27 cm wide, 6 cm deep, and it was completely excavated in one level. Because the pit was very shallow, nearly all the fill was collected as a flotation sample. The fill consisted of a hard silty clay with charcoal flecking, ash, two pieces of flaked stone, some animal bone, a core, and 21 pieces of fire-cracked rock. The pit itself was heavily burned, with both an oxidized base and sidewalls. Based on its stratigraphic context, this feature probably dates to roughly 1500 B.C.

Feature 559, Roasting Pit

Feature 559 was a large roasting pit located in Stripping Block 2. This pit was discovered during excavation of Feature 511, a circular pit structure originating in Stratum 502. Feature 559 was intrusive into the structure and was visible as a discrete feature due to its dark charcoal staining and abundant amount of fire-cracked rock. The pit was circular in plan view, had a basin-shaped profile, and measured 90 cm long, 85 cm wide, and 50 cm deep. It was completely excavated in one level and both a flotation and a pollen sample were collected from the fill. This fill consisted of a hard sandy clay with large amounts of charcoal, daub, 50 pieces of fire-cracked rock, 12 pieces of flaked stone, and some animal bone. Based on its stratigraphic context, this feature probably dates to the Cienega phase.

Feature 560, Pit

Feature 560 was a small pit discovered while excavating Unit 453, one of the many 2-m by 2-m control units within Stripping Block 5. It was circular in plan view, had a conical-shaped profile, and measured approximately 44 cm in diameter and 24 cm deep. The pit, which was only partially excavated, had approximately half the fill removed in one level, and a flotation sample was collected. This pit originated in Stratum 503, and was filled with a similar sediment with a significant amount of charcoal and some fire-cracked rock. Feature 560 displayed no evidence of in situ burning and could have functioned as a storage pit. Based on its stratigraphic context, this feature likely dates to approximately 1500 B.C.

Feature 563, Pit

Feature 563 was a small pit discovered while excavating Unit 514, a 2-m by 2-m control unit located in Stripping Block 5. This pit originated in Stratum 502, and was circular in plan view with sloping sidewalls and a rounded base. Feature 563 measured 46 cm in length, 44 cm in width, and 8 cm in depth, and it was completely excavated in one level. Most of the fill, which consisted of charcoal-flecked, reddish-brown sandy silt, was collected as a flotation sample. No artifacts were recovered. This feature exhibited no evidence of burning, and it may have originally functioned as a storage pit. Based on its stratigraphic context, this feature almost certainly dates to the Cienega phase.

Feature 570, Pit

Feature 570 was a large pit discovered while excavating a 2-m by 2-m control unit, Unit 488, in Stripping Block 5. This pit was oblong in plan view, had a basin-shaped profile, and measured 1.43 m long, 83 cm wide, and 48 cm deep. It originated in Stratum 503, cut down into Stratum 504.01, and was filled with moderately hard yellow silt with six pieces of flaked stone and 18 pieces of fire-cracked rock. It was completely excavated in one level, and both a flotation and a pollen sample were collected. The pit displayed no evidence of burning and may have originally functioned as an extramural storage pit. Based on its stratigraphic context, this feature probably dates to about 1500 B.C.

Feature 571, Pit

Feature 571 was a small, oblong-shaped pit discovered while excavating Unit 488, a 2-m by 2-m control unit, in Stripping Block 5. This pit likely originated at a higher elevation (probably within Stratum 503), but was not recognized until some of it had been removed at the top of Stratum 504. It had a basin-shaped profile and measured 87 cm long, 69 cm wide, and 36 cm deep. The pit was completely excavated in one level, and a flotation sample was collected from the fill. This fill consisted of brown, silty clay with three pieces of flaked stone, 11 pieces of fire-cracked rock, and some animal bone. The feature did not appear burned and may have functioned as a storage pit. Based on its stratigraphic context, this feature probably dates to near 1500 B.C.

Feature 572, Roasting Pit

Feature 572 was a large, irregularly shaped roasting pit discovered while excavating Unit 486, a 2-m by 2-m control unit, located within Stripping Block 5. This pit originated in Stratum 503, and was defined as a dark ashy stain with visible daub and fire-cracked rock. The fill consisted of sandy clay with a high density of artifacts, charcoal, ash, and daub. Artifacts recovered from this fill included 51 pieces of fire-cracked rock, 18 pieces of flaked stone, a core, and some animal bone. The pit, which measured 1.10 m long, 0.95 m wide, and 29 cm deep, was completely excavated in one level, and both a flotation and a pollen sample were collected from the fill. The pit itself did not appear burned, although the large amount of charcoal and fire-cracked rock suggested its use as a roasting pit. A sample of mesquite charcoal provided a radiocarbon date of 3280±40 b.p.

(uncalibrated ^{14}C years), or 1650-1510 B.C. (calibrated calendar years at the 1-sigma range of probability).

Feature 575, Pit

Feature 575 was a small pit discovered while excavating a 2-m by 2-m control unit, Unit 491, in Stripping Block 5. The pit, which was 67 cm in length, 65 cm in width, and 12 cm in depth, became visible as a distinct feature due to a circular arrangement of fire-cracked rock situated near the base. Upon excavation, it became apparent that the upper portion of the pit had been removed during mechanical stripping. The remaining portion of the pit was completely excavated in one level, and a flotation sample was collected from the fill. The feature likely originated in Stratum 503, and was filled with a dark brown sandy clay with abundant charcoal flecking and a high artifact density. Artifacts recovered from this fill included at least 90 pieces of fire-cracked rock, 12 of which were larger than 5 cm in diameter, and three pieces of flaked stone. Although the pit itself was not burned, the large amount of charcoal and fire-cracked rock suggested its use as a roasting pit. Based on its stratigraphic context, this feature probably dates to approximately 1500 B.C.

Feature 576, Pit

Feature 576 was a small, circular pit discovered during the excavation of Units 470 and 490, two 2-m by 2-m control units, located in Stripping Block 5. Most of this pit was located within Unit 470, although a small portion extended east into Unit 490. This feature originated in Stratum 504. The pit was completely excavated, but because it was located within two separate control units, it was bisected along those lines and the fill removed separately from each unit. The pit had a basin-shaped profile, and measured 80 cm long, 67 cm wide, and 26 cm deep. The fill consisted of a hard silty clay with some charcoal flecking and eight pieces of fire-cracked rock. No other artifacts were recovered, but multiple flotation samples were collected. This pit did not appear burned, and it may have been used for storage. Based on its stratigraphic context, this feature likely dates to about 2100 B.C.

Feature 578, Pit

Feature 578 was a small pit discovered during excavation of control Unit 551 in Stripping Block 5. This pit was circular in plan view, had a basin-shaped profile, and measured 30 cm in diameter and 11 cm in depth. It originated in Stratum 504.01, and was filled with a hard sandy clay with some silt and a small amount of charcoal. The pit was completely excavated, and nearly all the fill was collected as a flotation sample. Two pieces of fire-cracked rock were the only artifacts recovered. This feature displayed no evidence of burning, and it may have functioned as a storage pit. Based on its stratigraphic context, this feature probably dates to near 2100 B.C.

Feature 579, Pit

Feature 579 was a small, circular pit discovered during excavation of two 2-m by 2-m control units, Units 491 and 492, located in Stripping Block 5. This pit was completely excavated, but because it was located within two separate control units, it was bisected along those lines and the fill removed separately from each unit. It originated in Stratum 504.01, had a basin-shaped profile, and measured 70 cm in diameter and 23 cm in depth. The fill consisted of a hard silty-sand with some charcoal, nine pieces of flaked stone, some animal bone, and seven pieces of fire-cracked rock. A flotation sample was also collected. The pit displayed no evidence of burning, and it may have functioned as a small storage pit. Based on its stratigraphic context, this feature probably dates to roughly 2100 B.C.

Feature 584, Pit

Feature 584 was a small pit discovered during excavation of a 2-m by 2-m control unit, Unit 472, in Stripping Block 5. This pit was circular in plan view, had a basin-shaped profile, and was 70 cm long, 62 cm wide, and 22 cm deep. It originated in Stratum 504.01, and was filled with a mixture of reddish-brown sand and a grayish-brown silty clay. Occasional flecks of charcoal were present throughout the fill, and several pieces of flaked stone were recovered. The pit was completely excavated in one level, and most of the fill was collected for flotation and pollen samples. This feature did not appear burned and may have functioned as a small storage pit. Based on its stratigraphic context, this feature likely dates to about 2100 B.C.

Feature 588, Pit

Feature 588 was a small pit discovered during the excavation of Unit 550, a 2-m by 2-m control unit located in Stripping Block 5. This pit was recognized as a discrete feature due to the concentration of charcoal and oxidized soil (possibly daub) originating in Stratum 503. The pit was completely excavated, and all the fill was collected as a flotation sample. The pit was circular in plan view, had a basin-shaped profile, and was 34 cm long, 33 cm wide, and 12 cm deep. The fill consisted of a hard, silty clay with charcoal flecking, daub, and one piece of flaked stone. This feature displayed no evidence of burning and could have been a trash-filled storage pit. Based on its stratigraphic context, this feature probably dates to approximately 1500 B.C.

Feature 589, Pit

Feature 589 was a circular pit discovered during excavation of Units 507 and 508, two 2-m by 2-m control units, located in Stripping Block 5. This feature originated in Stratum 503. This pit was completely excavated, but because it was located within two separate control units, it was bisected along those lines and the fill removed separately from each unit. The pit had a basin-shaped profile, and measured 84 cm in length, 82 cm in width, and 29 cm in depth. It originated in Stratum 503, and was filled with a reddish-brown silty-sand with some charcoal, eight pieces of flaked stone, and four pieces of fire-cracked rock. From this fill, both a flotation and pollen sample were collected. The pit was not burned and may have served a storage function. Based on its stratigraphic context, this feature probably dates to near 1500 B.C.

Feature 592, Pit

Feature 592 was an irregularly shaped pit located within control Units 551, 552, and 532 in Stripping Block 5. This feature originated in Stratum 504.01. It appeared relatively ovate at the top, although when excavated, it resolved into two smaller depressions. The base of the pit was highly disturbed by rodent turbation. The pit measured 1.85 m in length, 85 cm in width, and 17 cm in depth. The fill was gray silty sand with abundant amounts of charcoal and several small pieces of fire-cracked rock. Margins of the pit did not appear to be oxidized. Artifacts recovered from the fill included pieces of flaked stone, one abraded cobble, and one flaked stone core. Based on its stratigraphic context, this feature likely dates to about 2100 B.C.

Feature 593, Bell-shaped Pit

Feature 593 was a bell-shaped pit discovered while excavating control Unit 513 in Stripping Block 5. This pit originated in Stratum 504.01, and measured approximately 1 m in diameter and 18 cm in depth. It was completely excavated in one level, and the majority of the fill was collected as a flotation sample. This fill consisted of a hard sandy clay with some silt, abundant charcoal, ash, 55 pieces of flaked stone, some animal bone, and 61 pieces of fire-cracked rock. Although the pit itself exhibited no evidence of burning, the abundance of charcoal, ash, and fire-cracked rock suggested it may have been used for roasting. It overlapped Feature 601, another pit, but it is not clear which pit intrudes the other. Based on its stratigraphic context, this feature probably dates to roughly 2100 B.C.

Feature 594, Pit

Feature 594 was a small pit discovered during the excavation of Units 491 and 511, two 2-m by 2-m control units located within Stripping Block 5. This pit likely originated at a higher elevation, and only its bottom portion remained after excavation of natural stratigraphy within the two units. The preserved portion had a circular top, a basin-shaped profile, and was 1.00 m long, 0.95 m wide, and 7 cm deep. The pit was completely excavated, but because it was located within two separate control units, it was bisected along those lines and the fill removed separately from each unit. Feature 594 originated in Stratum 504, and was filled with a hard silty clay mottled with reddish-brown sand. It contained charcoal flecking throughout, four pieces of flaked stone, and one piece of fire-cracked rock. A flotation sample and a pollen sample were collected. The pit did not appear burned and was likely used for storage. Based on its stratigraphic context, this feature likely dates to approximately 2100 B.C.

Feature 595, Pit

Feature 595 was a small, irregularly shaped pit discovered during the excavation of one of the many 2-m by 2-m control units, Unit 513, located within Stripping Block 5. Feature 595 had a basin-shaped profile and measured 1.10 m in length, 62 cm in width, and 17 cm in depth. It was completely excavated in one level, and most of the fill was collected as a flotation sample. It originated in Stratum 504, and was filled with a brown silty clay with charcoal and sand. A relatively large number of artifacts was recovered from this fill, including nine pieces of flaked stone and four pieces of fire-cracked rock. This pit did not appear burned, and it may have functioned as a storage pit. Based on its stratigraphic context, this feature probably dates to about 2100 B.C.

Feature 596, Pit

Feature 596 was a small, circular pit discovered while excavating control Unit 511 in Stripping Block 5. This feature originated in Stratum 504.01. Approximately half the pit, the portion contained within Unit 511, was excavated. The rest was located to the east, within control Unit 531, where the feature was not recognized during excavation of the natural stratigraphy, and was completely removed. This pit was circular in plan view, had a basin-shaped profile, and measured at least 75 cm in diameter and 17 cm in depth. It was filled with hard reddish-brown sand with some clay, charcoal flecking, and daub. Artifact density was low, and one hammerstone and four pieces of fire-cracked rock were recovered. A flotation sample and a pollen sample were collected. The pit appeared to be unburned and could have served a storage function. Based on its stratigraphic context, this feature probably dates to about 2100 B.C.

Feature 597, Pit

Feature 597 was a small pit discovered during excavation of control Unit 550 in Stripping Block 5. This pit was circular in plan view, had a basin-shaped profile, and was 59 cm long, 57 cm wide, and 14 cm deep. It originated in Stratum 504, and was completely excavated in one level. Most of the fill was collected as a flotation sample and a pollen sample, and it consisted of a hard silty clay with charcoal flecking, two pieces of flaked stone, and six pieces of fire-cracked rock. The feature did not display any evidence of in situ burning, and it may have functioned as a storage pit. Based on its stratigraphic context, this feature likely dates to roughly 2100 B.C.

Feature 598, Pit

Feature 598 was a small possible pit discovered during excavation of a 2-m by 2-m control unit, Unit 550. The pit was circular in plan view and basin shaped in profile. It measured 38 cm in length, 20 cm in width, and 6 cm in depth. The fill was grayish-brown silty sand with a few small charcoal flecks. One possible mano fragment was recovered from the fill. One small piece of fire-cracked rock was noted, but not collected. Based on its stratigraphic context, this feature probably dates to near 2100 B.C.

Feature 599, Pit

Feature 599 was a small pit discovered while excavating Unit 550, a 2-m by 2-m control unit, within Stripping Block 5. This pit was recognized within Stratum 504.01 as a dense cluster of fire-cracked rock. Once the pit was completely excavated, it was clear that it had originated at a higher elevation and that only the bottom portion remained. This remaining portion was circular in plan view, had a basin-shaped profile, and was 48 cm long, 46 cm wide, and 5 cm deep. Feature 599 was filled with a moderately hard silty sand with some charcoal flecking and ash. Thirteen pieces of fire-cracked rock were the only artifacts recovered, but both a flotation and a pollen sample were collected. This pit exhibited no evidence of in situ burning, although based on the presence of the ash, charcoal, and fire-cracked rock, it may have been used as a roasting feature. Based on its stratigraphic context, this feature probably dates to approximately 2100 B.C.

Feature 600, Pit

Feature 600 was a small pit discovered during excavation of a 2-m by 2-m control unit, Unit 551, located within Stripping Block 5. Approximately half the pit, the portion contained within Unit 551, was excavated. The rest was located to the west, within control Unit 531, where the feature was not recognized during the excavation of the natural stratigraphy and it was completely removed. This pit was likely circular in plan view, with a basin-shaped profile, and measured at least 55 cm in diameter and 60 cm in depth. It originated in Stratum 504.01, and contained a fill composed of a clayey sand with a small amount of charcoal flecking, some ash, and no artifacts. Because the pit was shallow, most of the fill was collected as a flotation sample. This pit displayed no evidence of burning, and it may have functioned as a storage pit. Based on its stratigraphic context, this feature likely dates to about 2100 B.C.

Feature 601, Pit

Feature 601 was a small pit discovered in control Units 493 and 513, two 2-m by 2-m control units located within Stripping Block 5. Approximately half of this feature was located within Unit 493 and was completely excavated in one level. The rest was located within Unit 513 to the north. Unfortunately, during the excavation of natural stratigraphy within this unit, Feature 601 was not identified and was completely removed. This pit was circular in plan view, had a basin-shaped profile, and was 80 cm long, 75 cm wide, and 18 cm deep. It originated in Stratum 504.01, and was recognized due to the heavy concentration of charcoal located at the center. It was filled with a hard clayey sand with 25 pieces of flaked stone and 41 pieces of fire-cracked rock. This pit displayed no evidence of burning and may have been used for storage. Based on its stratigraphic context, this feature probably dates to about 2100 B.C.

Feature 609, Pit

Feature 609 was a small pit located within Stripping Block 5. This pit was circular in plan view, had a basin-shaped profile, and measured 52 cm in length, 44 cm in width, and 11 cm in depth. Feature 609 originated in Stratum 504.01, and was filled with a hard silty clay with no artifacts or fire-cracked rock. The pit was completely excavated in one level, and a flotation sample was collected. It displayed no evidence of burning and likely functioned as an extramural storage feature. Based on its stratigraphic context, this feature probably dates to roughly 2100 B.C.

Feature 610, Pit

Feature 610 was a small, shallow pit located within Stripping Block 5. This pit was circular in plan view, had a basin-shaped profile, and measured 33 cm in diameter and 8 cm in depth. It originated in Stratum 504.01, and was completely excavated in one level. Because it was shallow, all the fill was collected as either a flotation or a pollen sample. The pit was filled with hard silty clay with some charcoal flecking and no artifacts. It exhibited no evidence of burning and may have functioned as a storage pit. Based on its stratigraphic context, this feature likely dates to approximately 2100 B.C.

Feature 611, Pit

This small circular pit was discovered during mechanical stripping, and the eastern half was then excavated by hand. This feature originated in Stratum 504.01. It was basin shaped in profile and measured 45 cm in length, 40 cm in width, and 8 cm in depth. The fill of the pit was dark brown silty clay with a few small flecks of charcoal. No artifacts were recovered from the excavated fill. Based on its stratigraphic context, this feature probably dates to near 2100 B.C.

Feature 612, Pit

This small circular pit was discovered during mechanical stripping, and was then completely excavated by hand. This feature originated in Stratum 504.01. It had straight sidewalls and a relatively flat base. The pit measured 23 cm in length, 22 cm in width, and 17 cm in depth. The fill was grayish-tan clay with small caliche flecks and a few pockets of orange sand. No artifacts were recovered from the feature, and all the fill was collected as a flotation sample. Based on its stratigraphic context, this feature likely dates to about 2100 B.C.

Feature 613, Pit

This small circular pit was discovered during mechanical stripping, and it was then completely excavated by hand. This feature originated in Stratum 504.01. The pit was basin shaped in profile and measured 41 cm in diameter and 13 cm in depth. Two discrete strata were visible in the fill of the feature. The upper 7 cm of fill was dark brown silty clay with caliche striations. The lower 6 cm of fill consisted of reddish sand with some clay mottling. Flecks of charcoal and burned daub were present throughout both strata of the fill. No artifacts were recovered from the pit. Based on its stratigraphic context, this feature probably dates to approximately 2100 B.C.

Feature 615, Pit

This small circular pit was discovered during mechanical stripping, and was subsequently completely excavated by hand. This feature originated in Stratum 504.01. It was basin shaped in profile and measured 78 cm in length, 73 cm in width, and 8 cm in depth. The fill was reddish sand, with some clay mottling with a few small charcoal flecks and caliche nodules. One small possible piece of fire-cracked rock was noted in the fill, but not collected. No artifacts were recovered from the fill. Based on its stratigraphic context, this feature probably dates to roughly 2100 B.C.

Feature 616, Pit

This small circular pit was discovered during mechanical stripping, and was then excavated completely by hand. This feature originated in Stratum 504.01. It was basin shaped in profile, and measured 77 cm in length, 72 cm in width, and 16 cm in depth. The fill was a mixture of tan silt and dark brown clay. Small charcoal flecks and pieces of caliche were noted in the fill. No artifacts were recovered from the feature. Based on its stratigraphic context, this feature probably dates to near 2100 B.C.

Feature 619, Pit

This small circular pit was discovered during mechanical stripping, and was then completely excavated by hand. This feature originated in Stratum 504.01. It was basin shaped in profile, and measured 80 cm in length, 75 cm in width, and 21 cm in depth. The fill was reddish sand mottled with dark brown clay with abundant charcoal flecking. The margins of the pit were not oxidized. Artifacts recovered from the fill included five pieces of flaked stone and two decayed fragments of animal bone. Fifteen pieces of fire-cracked rock greater than 5 cm in diameter were noted, but not collected. Based on its stratigraphic context, this feature likely dates to about 2100 B.C.

Feature 622, Pit

This small ovate pit was discovered during mechanical stripping, and was then completely excavated by hand. This feature originated in Stratum 504.01. It was basin shaped in profile and measured 87 cm in length, 79 cm in width, and 15 cm in depth. The fill was dark brown silty clay with abundant pieces of charcoal and charcoal flecking. The margins of the pit showed small patches of oxidization. Artifacts recovered from the fill included 15 pieces of flaked stone and a few fragmentary animal bones. Five pieces of fire-cracked rock were noted in the fill, but were not collected. Based on its stratigraphic context, this feature probably dates to near 2100 B.C.

Feature 623, Pit

This small oval pit was discovered during mechanical stripping, and the eastern half was excavated by hand. This feature originated in Stratum 504.01. It was basin shaped in profile, and measured 93 cm in length, 61 cm in width, and 13 cm in depth. The fill was dark brown clay with a few small pieces of charcoal. Three pieces of flaked stone were recovered from the fill. Based on its stratigraphic context, this feature probably dates to roughly 2100 B.C.

Feature 624, Pit

This small circular pit was discovered during mechanical stripping, and was then completely excavated by hand. This feature originated in Stratum 504.01. It was intruded by the fill of a prehistoric canal, Feature 143, BB:13:481. The pit was basin shaped in profile, and measured 70 cm in diameter and 15 cm in depth. Two discrete strata were visible in the fill. The upper 6 cm of fill was yellowish silt with some charcoal flecking. One piece of flaked stone was recovered from the upper fill; two small pieces of fire-cracked rock were noted, but not collected. The lower 9 cm of fill was compact brown clay with some silt mottling. Some charcoal flecking was also present in this lower stratum, but no artifacts were recovered. Based on its stratigraphic context, this feature likely dates to about 2100 B.C.

Feature 625, Pit

This small circular pit was discovered during mechanical stripping, and the southern half was subsequently excavated by hand. It was basin shaped in profile, and measured 80 cm in length, 74 cm in width, and 9 cm in depth. The fill was a grayish-tan mixture of sand and clay with a few small charcoal flecks and pieces of unburned daub. No artifacts were recovered from the fill. Five small pieces of fire-cracked rock were noted, but not collected. Based on its stratigraphic context, this feature probably dates to approximately 2100 B.C.

Feature 626, Pit

This small oval pit was discovered during mechanical stripping, and the western half was then completely excavated by hand. This feature originated in Stratum 504.01. The length of this basin-shaped pit was unknown, although it measured 65 cm in width and 21 cm in depth. The fill was dark brown silty clay with charcoal inclusions and a few small flecks of caliche. One piece of flaked stone was the only artifact recovered from the excavated fill of the pit. Three small pieces of fire-cracked rock were noted, but not collected. Based on its stratigraphic context, this feature probably dates to near 2100 B.C.

Feature 628, Charcoal Concentration

This circular charcoal stain was first discovered during mechanical stripping, and it was thought to be a small pit. Upon excavation, it was found to be a concentration of charcoal within the fill above an extramural surface, Feature 627. Feature 628 originated in Stratum 504.01. The fill was dark brown silty clay that slowly transitioned to the reddish sand of the extramural surface. A flotation sample and a pollen sample were taken from the fill, and an incipient plain ware sherd was collected from the area originally identified as a pit. Based on its stratigraphic context, this feature likely dates to about 2100 B.C.

Feature 630, Pit

This small oval pit was discovered during mechanical stripping, and was then completely excavated by hand. This feature originated in Stratum 503. It was basin shaped in profile, and was 95 cm long, 84 cm wide, and 29 cm deep. The fill was a mixture of dark brown clay and reddish sand with abundant amounts of charcoal and roughly 30 small pieces of fire-cracked rock. Neither the margins nor the base of the pit showed any signs of oxidization. Two small fragments of animal bone were collected from the fill. A sample of charred annual plant tissue provided a radiocarbon date of 3220±40 b.p. (uncalibrated ^{14}C years), or 1520-1440 B.C. (calibrated calendar years, at the 1-sigma range of probability).

Feature 631, Bell-shaped Pit

This bell-shaped pit was discovered during mechanical stripping, and the northern half was subsequently excavated by hand. This feature originated in Stratum 504.01. The top of the pit measured 74 cm in length, and its width was estimated at 64 cm. It measured 21 cm in depth, and had a basal length of 92 cm. Basal width was inferred to be 80 cm. Three strata were present in the fill of the pit. The upper 8 cm of fill was dark brown silty clay. A 2-cm-thick layer of reddish sand was present between the upper and lower fill. The lower 11 cm of fill was mottled clay and sand. Small caliche nodules were present throughout the fill. A few pieces of fire-cracked rock were noted, but not collected. No artifacts were recovered from the excavated portion of the pit. Based on its stratigraphic context, this feature probably dates to near 2100 B.C.

Feature 632, Roasting Pit

This circular roasting pit was discovered during mechanical stripping, and the northern half was subsequently excavated by hand. This feature originated in Stratum 504.01. It measured 1.65 m in length, 1.57 m in width, and 29 cm in depth. The fill was reddish sand mottled with pockets of dark brown clay. Charcoal was abundant throughout the fill, and more than 130 pieces of fire-cracked rock greater than 5 cm in size were noted. No artifacts were recovered from the fill. Based on its stratigraphic context, this feature probably dates to roughly 2100 B.C.

Feature 633, Historic Pit

This large historic-era pit was discovered in the profile of a backhoe trench. The surrounding sediment was stripped to the visible top of the pit fill. The pit measured 2.4 m in length, 1.3 m in width, and 17 cm in depth. A noncontrol unit, Unit 243, was excavated into the dark brown silty clay fill of the pit. The fill was not screened, and no artifacts were collected from Feature 633.

Feature 3360, Pit

This small circular pit was discovered during mechanical stripping, and the western half was excavated by hand. This feature originated in Stratum 504.01. It had vertical side walls and a flat bottom. The pit measured 65 cm in length, 60 cm in width, and 26 cm in depth. The fill of the pit was mottled dark brown clay and reddish sand, with a very thin layer of reddish sand just above the base of the pit. Charcoal flecks were present throughout the fill. Artifacts recovered from the fill included one piece of animal bone and six pieces of flaked stone. Based on its stratigraphic context, this feature likely dates to about 2100 B.C.

Feature 3361, Bell-shaped Pit

This bell-shaped pit was discovered during mechanical stripping, and the eastern half was excavated by hand. This feature originated in the top of Stratum 502. The pit was 85 cm long and 70 cm wide at the top. It had a basal length of 95 cm, a basal width of 80 cm, and a depth of 23 cm. Two discrete strata were visible in the fill of the pit. The upper 11 cm of fill was brown silty clay with charcoal flecking and several pieces of flaked stone. The lower 12 cm of fill was reddish sand with charcoal flecking and several small pieces of oxidized daub. One piece of flaked stone was recovered from the lower fill. Three pieces of fire-cracked rock were noted in the lower fill, but not collected. Based on its stratigraphic context, this feature probably dates to the Early Ceramic period or a Hohokam period.

Feature 3362, Pit

This small circular pit was discovered during mechanical stripping, and the western half was excavated by hand. This feature originated in Stratum 504.01. It was basin shaped in profile and measured 50 cm in diameter and 5 cm in depth. The fill was reddish sand with charcoal flecking and small gravels. One possible piece of ground stone was collected from the fill. Two pieces of fire-cracked rock greater than 5 cm in diameter were found on the base of the pit, but not collected. Based on its stratigraphic context, this feature likely dates to about 2100 B.C.

Feature 3363, Pit

This small circular pit was discovered during mechanical stripping, and the western half was excavated by hand. This feature originated in Stratum 502. It was basin shaped in profile, and measured 85 cm in length, 83 cm in width, and 27 cm in depth. The fill was dark brown clay that gradually became mixed with reddish sand toward the base of the pit. Charcoal flecking and caliche striations were present throughout the fill, but became more frequent with depth. No artifacts were recovered from the fill. Three pieces of fire-cracked rock were noted in the fill, but not collected. Based on its stratigraphic context, this feature probably dates to the Cienega phase (800 B.C.-A.D. 50) of the Early Agricultural period.

Feature 3368, Pit

This small circular pit was discovered during mechanical stripping, and the western half was then excavated by hand. This feature originated in Stratum 503. It intruded Feature 3367, another small pit, on the northwestern edge. Feature 3368 was basin shaped in profile and measured 80 cm in length, 60 cm in width, and 10 cm in depth. Fill was mottled reddish sand and brown clay with charcoal and small pieces of oxidized daub. The margins of the pit did not appear oxidized. Artifacts recovered from the fill included a few pieces of flaked stone and animal bone. Two pieces of fire-cracked rock greater than 5 cm in diameter were observed in the fill. Based on its stratigraphic context, this feature likely dates to approximately 1500 B.C.

Feature 3369, Pit

This small circular pit was discovered during mechanical stripping, and the eastern half was subsequently excavated by hand. This feature originated in Stratum 503. It was basin shaped in profile, and was 60 cm long, 58 cm wide, and 12 cm deep. The fill was mottled reddish sand and brown clay with some light charcoal flecking. One piece of flaked stone was recovered from the excavated fill. A small piece of fire-cracked rock was visible in the profile of the unexcavated half of the pit. Based on its stratigraphic context, this feature probably dates to near 1500 B.C.

Feature 3370, Pit

This small oval pit was discovered during mechanical stripping, and the western half was excavated by hand. This feature originated in Stratum 504. It was basin shaped in profile, and measured 65 cm in length, 42 cm in width, and 10 cm in depth. The fill was mottled reddish sand and brown clay with some light charcoal flecking. A mano and one piece of flaked stone were recovered from the fill. Based on its stratigraphic context, this feature probably dates to roughly 2100 B.C.

Feature 3373, Roasting Pit

This oval roasting pit was discovered during mechanical stripping, and the eastern half was excavated by hand. This feature originated in Stratum 503. It was basin shaped in profile and measured 1 m in length, 60 cm in depth, and 25 cm in depth. The fill was brown clayey sand with abundant charcoal pieces and flecking throughout. The base of the pit was highly oxidized. No artifacts were recovered from the excavated fill of Feature 3373. Based on its stratigraphic context, this feature likely dates to about 1500 B.C.

Feature 3374, Pit

This small circular pit was discovered during mechanical stripping and then completely excavated by hand. This feature originated in Stratum 503. It was basin shaped in profile and measured 42 cm in length, 40 cm in width, and 6 cm in depth. The fill of the pit was heavily compacted oxidized sand. An ochre-stained mano was visible from the top of the fill, and when excavated, was found to be lying on the base of the pit. The mano was the only artifact recovered from the fill. The margins and base of the pit did not appear to be oxidized. Based on its stratigraphic context, this feature probably dates to near 1500 B.C.

Feature 3375, Pit

This small circular pit was discovered during mechanical stripping, and the western half was excavated by hand. This feature originated in Stratum 504. It was basin shaped in profile, and was 63 cm in diameter and 6 cm deep. The fill was brown clayey sand with carbonate striations and pieces of charcoal throughout. All excavated fill was collected as a flotation sample. No artifacts were recovered from the excavated portion of the pit. Based on its stratigraphic context, this feature likely dates to about 2100 B.C.

Feature 3381, Pit

This small circular pit was discovered during mechanical stripping, and was completely excavated by hand. This feature originated in Stratum 504. It intruded on the northern edge of a pit structure, Feature 3371. Feature 3381 was basin shaped in profile, and measured 43 cm in diameter and 6 cm in depth. The fill was brown sandy silt with caliche striations and charcoal flecking throughout. The entirety of the fill was collected as a flotation sample. No artifacts were collected from the fill. Based on its stratigraphic context, this feature likely dates to about 2100 B.C.

OTHER PREHISTORIC FEATURES

Feature 627, Extramural Surface

This extramural surface was discovered during excavation of what was thought to be a small pit, Feature 628. Feature 627 originated in Stratum 504. Upon excavation of this circular stain, it was found to be a concentration of charcoal within the fill above Feature 627, an extramural surface. The fill was dark brown silty clay that slowly transitioned to the reddish sand of the extramural surface. A flotation sample and a pollen sample were taken from the fill, and an incipient plain ware sherd was collected from the area. Based on its stratigraphic context, this feature probably dates to roughly 2100 B.C.

Feature 3414, Extramural Surface

This extramural surface was discovered during mechanical stripping, and was subsequently cleared by hand. This feature was on top of Stratum 504.01. The exposed area of the surface was 50 m long and 35 m wide. All the Stratum 504 features excavated during the 2002 field season (Features 3359 through 3403) originate at this surface. The surface consisted of a compacted deposit of reddish sand at a fairly consistent elevation. One ground stone mano was collected directly from the surface just northwest of a pit structure, Feature 3371.

CHAPTER 4

FEATURE DESCRIPTIONS: PART 4. BRICKYARD LOCUS, THE CLEARWATER SITE, AZ BB:13:6 (ASM)

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Archaeological work conducted during the Rio Nuevo Archaeology project resulted in the discovery of hundreds of features—areas in which human activities took place. Descriptions of excavated features and summarized data on unexcavated features are presented in this chapter. Descriptions of human burials found during the project are provided in Chapter 18 (this volume).

Work during this project was conducted at four different archaeological sites. The San Agustín Mission, Mission Gardens, Brickyard, and Congress Street loci were located at the Clearwater site, AZ BB:13:6 (ASM), on the western side of the Santa Cruz River. AZ BB:13:481 (ASM) were the Prehistoric, Protohistoric, and Historic era canals, ditches, and a spillway, also located on the western side of the Santa Cruz River. The Tucson Presidio has been designated AZ BB:13:13 (ASM), and the site includes both prehistoric- and historic-era features. Finally, a portion of a historic-era residential block on the northern side of Clark Street and east of the Interstate 10 (I-10) frontage road was designated AZ BB:13:735 (ASM).

The feature descriptions in this chapter are grouped by locus, except for canals, which are described in Part 6 and which are grouped by time period. All site numbers in this chapter are Arizona State Museum (ASM) numbers. Radiocarbon dates are reported in both uncalibrated radiocarbon years before present (b.p.), and in calibrated calendar years at the 1-sigma range of probability. Excavated and unexcavated features are listed, by site/locus and time period, in Table 4.1 (see Part 1 of this chapter).

Excavations at the Brickyard locus, the Clearwater site, AZ BB:13:6 (ASM), located Early Agricultural period features dating to the Cienega phase (800 B.C.-A.D. 50). A roasting pit, Feature 3287, probably dates to the Early Ceramic period (A.D. 50-500), and two pit structures, Features 3293 and 9376, date to either the Early Ceramic period or the Hohokam periods (see Table 4.1). A suite of features associated with the Tucson Pressed Brick Company complex, which operated from the 1890s to the 1960s, was found above the prehistoric features (see Figures 1.12 and 1.14, this volume).

PIT STRUCTURES

Feature 3220, Pit Structure

Description

Feature 3220 was discovered during mechanical stripping and was then completely excavated by hand (Figure 4.38). This feature was a round pit structure measuring approximately 2.77 m in diameter. Nine possible postholes and a central pit were discovered inside the structure. No entry was identified, and orientation of the pit structure could not be determined. There was no evidence the structure burned, and no artifacts were found in contact with the floor.

Internal Features

Nine possible postholes were discovered in the floor of the structure. Seven of these postholes were excavated and each measured 10 cm in diameter and 5 cm deep. The two unexcavated postholes also measured 10 cm in diameter. All the postholes were found around the interior edge of the northern half of the structure.

Feature 3220.01 was an elliptical pit with a basin-shaped profile that was discovered in the center of the floor. It measured 95 cm in length, 65 cm in width, and 9 cm in depth. Two pieces of flaked stone and about 20 pieces of fire-cracked rock were discovered in the fill, with four of the fire-cracked

Figure 4.38. Feature 3220, a Cienega phase pithouse, Brickyard locus, the Clearwater site, AZ BB:13:6 (ASM).

rocks measuring over 5 cm in diameter. Five of the pieces of fire-cracked rock recovered were also ground stone fragments. Some small patches of oxidization were found in the fill and on the bottom of the pit, possibly suggesting its use as a small roasting pit or informal hearth.

Internal Strata and Artifact Contents

Approximately 17 cm of fill was excavated between the stripped surface and the floor of the pit structure. The fill was flood silt with small amounts of burned daub and charcoal flecking. Artifacts found within the fill included pieces of flaked stone, a few small sherds, fragments of unworked faunal bone, a terrestrial snail shell, and a possible figurine fragment.

Roughly 190 pieces of fire-cracked rock were found in the fill. Most measured less than 5 cm in diameter, and all but 30 pieces were confined to the southern half the pit structure. After the southern half was excavated, the outline of the base of an intrusive pit, Feature 3244, was discovered in the floor of the structure. It was not noticed during excavation and may have been the source of the concentration of fire-cracked rock in this half of the pit structure.

Construction and Remodeling Evidence

When excavated, the walls of this structure extended about 15 cm above the floor, although they may have been slightly truncated by mechanical stripping and modern activity at the brickyard. Neither the walls nor the floor of this pit structure appeared plastered or prepared in any way. The postholes discovered in the floor probably held wall support posts, but represented the only evidence discovered for a superstructure.

Stratigraphic Relationships

This feature was built into the alluvial clays of the floodplain. Sometime after its abandonment, the feature was filled with flood silts. An intrusive pit, Feature 3244, was later built into the southern half of the filled structure. Feature 3216, a modern subterranean brick processing area, then impacted the southeastern ends of both the pit structure and the intrusive pit.

Abandonment and Postabandonment

The very small amount of burned daub discovered in the fill suggested that this pit structure did not burn. It was unclear, however, if the superstructure was left in place or if it was scavenged after abandonment of the structure. The lack of artifacts on the floor suggested the pit structure was cleaned out prior to abandonment. After abandonment, the pit structure was filled by flood silts.

Feature 3245, Pit Structure

Description

Feature 3245 was discovered during mechanical stripping of the area. It was then completely excavated by hand (Figure 4.39). This was a round pit structure measuring some 3 m in diameter. Excavation of the pit structure revealed the possibility that this house actually had two separate floors or occupation surfaces and may have been remodeled. Thirty-three of the postholes found within the structure originated at the upper floor. A possible hearth and a depression that may have been a pit also originated at this surface. Some small pieces of oxidized daub were found lying on the upper floor, although no artifacts were present. Upon reaching this floor of compacted clay, some silty areas were noticed and investigated. Excavations below the upper floor revealed two additional large postholes originating in a possible second, lower floor. A Cienega style projectile point was found just above this surface, along with several larger chunks of burned daub with reed impressions. Except the oxidized daub, neither surface showed any evidence of burning.

The postholes in the upper floor were arranged along the inside edge of the pit structure. Two breaks in the posthole pattern may indicate entrances to the structure. There was one larger opening to the east and a smaller opening to the west. There were no other indications about the orientation of the pit structure. Because only two postholes were discovered in the lower floor, no determination could be made regarding the orientation of the structure during its earlier use.

No artifacts were present on the upper floor, and only one projectile point was found just above the lower floor. This feature was most likely used as a habitation structure.

Internal Features

Thirty-three postholes (A to EE, Feature 3245.01, and Feature 3245.02) were discovered in the upper floor of the pit structure. Feature 3245.05, a possible hearth, and Feature 3245.06, a possible pit, were also found in the upper floor. Two postholes, Features 3245.03 and 3245.04, were found associated with the lower floor.

The 33 postholes from the upper floor ranged in size from 9 cm to 24 cm in diameter, and from 3 cm to 12 cm in depth. Twenty-seven of these postholes (A to AA) were found near the interior edges of the pit structure. Three postholes (BB, DD, and EE) were on the southern side of the pit structure, just inside the first ring of postholes. Two others (CC and Feature 3245.01) were located just inside the first ring of postholes in the northeastern quadrant of the structure. The last of the 33 postholes, Feature 3245.02, was located in the northwestern quadrant, about halfway between the wall and the center point of the structure. A core was found inside this posthole.

Feature 3245.05 was an oxidized area of the upper floor that could represent a hearth. The oxidized area was roughly circular, and measured about 17 cm in diameter. This feature had no depth and therefore no fill.

Feature 3245.06 was a silty depression in the upper floor of the pit structure, located just east of the hearth area. The depression was almost round, with a diameter of 35 cm, a depth of 6 cm, and silty fill. The depression may be the poorly preserved remains of a pit. This feature contained an ochre-stained mano.

The remaining two postholes were associated with the lower floor.

Feature 3245.03 was located near the western edge of the pit structure and measured 30 cm in length, 35 cm in width, and 15 cm in depth. The fill was silty with charcoal flecking. No artifacts were found in this feature.

Feature 3245.04 was located slightly back from the southern edge of the pit structure and measured 30 cm in diameter and 11 cm in depth. The fill was silty and contained no artifacts.

Internal Strata and Artifact Contents

Roughly 20 cm of fill was excavated between the stripped surface and the upper floor of the pit structure. The top 10 cm of this fill was composed of flood silt and contained no artifacts. About 37 small pieces of fire-cracked rock were present. The remaining 10 cm of fill above the upper floor was a mixture of light silts and dark clays, with some charcoal flecking and small pieces of oxidized daub. The density of fire-cracked rock increased to approximately 110 pieces, and artifacts were discovered, including a few pieces of flaked stone, some unworked bone, and a small sherd. When encountered, the upper floor appeared to be a surface of sterile clay with postholes and a possible hearth. When silty areas in the upper floor were investigated, the possibility of a lower floor was discovered. Another 10 cm of fill existed between the upper floor surface and the lower floor surface. This fill was a mix of alluvium, colluvium, and cultural trash. Charcoal flecking was abundant, and some 15 large (greater than

Figure 4.39. Feature 3245, a Cienega phase pithouse, Brickyard locus, the Clearwater site, AZ BB:13:6 (ASM).

5 cm in diameter) pieces of burned daub with reed impressions were found. Artifact density was higher in this fill than in any previous layer of fill. A Cienega style projectile point was found 3 cm above the lower floor.

Construction and Remodeling Evidence

The postholes arranged around the perimeter of the upper floor of the feature probably represent wall support posts of the superstructure. The other postholes further within the feature may represent roof support posts. Very little construction debris remained on the upper floor as evidence of the superstructure.

That the pit structure was remodeled at least once is supported by the presence of a lower floor and the discovery of burned daub in the fill above that floor. The two postholes found in the lower floor give no real indication about how the earlier superstructure was arranged. The walls of Feature 3245 also gave some indication that there was more than one occupation of this structure. The walls of the pit structure were fairly vertical, to the point where they come in contact with the upper floor. Beginning at, or just beneath, the upper floor, the walls belled slightly outward down to the lower floor. The walls did not appear plastered or prepared in any way.

Neither the upper nor the lower floor appeared prepared or plastered.

Stratigraphic Relationships

This pit structure was built into the floodplain alluvium down to the level of the lower floor. Feature 3245 was probably abandoned and the construction and cultural materials scavenged or curated. The remaining pit was then used as a dump for domestic trash and was also partially filled by alluvial and colluvial deposits. The foundation pit was then used a second time, with the top of the old deposits being used as the new, upper floor.

There were no overlying or intrusive features. Feature 3245 is in line with an arc of other pit structures around a central open area.

Abandonment and Postabandonment

After its reuse, the pit structure was abandoned again. It is not clear if the structure burned during either the first or second abandonment. The structure was partially filled by alluvial and colluvial clay deposits, then filled with silts from a flooding episode. After flooding, alluvial and colluvial deposition continued and covered the filled feature.

Feature 3260, Pit Structure

Description

Feature 3260 was discovered during mechanical stripping and was completely excavated by hand (Figure 4.40). This pit structure was slightly ovoid and measured some 2.93 m in diameter. Features discovered within the pit structure included 14 postholes and a hearth. Another pit, Feature 3315, was discovered just beneath the floor of the pit structure and may have been an intramural pit. The entry was not identifiable, and orientation of the pit structure could not be determined. The structure was burned, and no artifacts were found on the floor. This structure may have been used for habitation.

Internal Features

Fourteen postholes were discovered in the floor. They ranged in size from 1 cm to 28 cm in length, 6 cm to 20 cm in width, and 6 cm to 15 cm in depth. All were around the interior circumference of the pit structure, except Feature 3260.03, which was located in the center of the northwestern quadrant. Features 3260.02 and 3260.03 contained remnants of burned support posts.

Feature 3260.01 was an irregularly shaped hearth, roughly 35 cm in diameter and 5 cm deep. The walls and bottom of the hearth were heavily oxidized from use. The fill of the hearth was dark silty clay, with some charcoal flecking and pieces of oxidized daub, much like the fill of the pit structure. The absence of ash in the hearth suggested it was cleaned out prior to abandonment.

Feature 3315 was a pit roughly 75 cm in diameter, just beneath the floor of the pit structure. It was first thought that another floor might exist beneath the first. The pit was initially listed as a separate feature because it was not visible in the floor of the pit structure. However, the fill of this pit contained large lumps of oxidized daub that may have come from burning of the pit structure. This feature may have been an intramural pit.

Internal Strata and Artifact Contents

About 16 cm of fill was excavated between the stripped surface and the floor. No discrete strata existed in the fill, although charcoal flecking and pieces of burned daub became more abundant lower in the fill. A thin layer of charcoal and ash less than 1 cm thick was discovered just above the floor. The floor was oxidized in some areas.

The fill of the pit structure contained pieces of flaked stone, some unworked animal bone, a seashell

Figure 4.40. Feature 3260, a Cienega phase pithouse, Brickyard locus, the Clearwater site, AZ BB:13:6 (ASM).

bead, a small sherd, and a snail shell. Approximately 75 pieces of fire-cracked rock were present in the fill, with only three larger than 5 cm in diameter. No artifacts were present on the floor.

Construction and Remodeling Evidence

The postholes near the edge of the pit structure probably represented wall support posts for the superstructure. Feature 3260.02 may have represented a roof support post. The large amounts of oxidized daub found in the fill were evidence of a wattle-and-daub superstructure.

When excavated, the walls of the pit structure were approximately 16 cm above the floor. The walls may have been slightly truncated by mechanical stripping. The walls, floor, and hearth did not appear to have been plastered or prepared in any way. No evidence was found to indicate that the pit structure had been remodeled.

Stratigraphic Relationships

Feature 3260 was built in the alluvial floodplain. The pit structure was filled with flood silt that covered and mixed with the remains of the burned superstructure. This feature overlay at least one other feature, Feature 3314, an extramural pit. A second pit, Feature 3315, may actually have been a subfeature of Feature 3260 and not a separate, earlier feature. Pit structure Feature 3260 was not intruded on by any other features. It was, however, included in an arc of pit structures situated around a central open area.

Abandonment and Postabandonment

The absence of artifacts on the floor of the pit structure suggested it was cleaned out before it burned. The large amounts of burned daub and charcoal showed that the superstructure was still present and standing when the burning occurred. The feature filled rapidly with flood silt soon after the structure burned, preventing the deposition of cultural trash in the fill. Continuing floodplain processes then covered the filled structure.

Feature 3262, Pit Structure

Description

This feature was discovered during backhoe stripping of the area. After it was uncovered through mechanical stripping, fill of the feature was excavated by hand. This round pit structure measured roughly 3.2 m in diameter. Two possible postholes were the only features found in the pit structure. No entry was discovered, and orientation of the structure could not be determined. The structure appeared to have burned, and a possible de facto artifact assemblage was revealed on the floor. The feature was constructed into the fill of an earlier pit structure, Feature 3270.

Internal Features

It was difficult to discern features in this pit structure, as the floor was a layer of use-compacted fill from the lower pit structure, Feature 3270. The two internal features that were identified were possible postholes, located near the interior edge of the pit structure. They measured 10 cm in diameter and 10 cm in depth.

Internal Strata and Artifact Contents

About 28 cm of fill was excavated between the stripped surface and the floor of this pit structure. No strata were discernable in the fill, but quantities of charcoal and burned daub increased in the lower fill. Patches of the floor showed oxidization.

Artifact density throughout the fill was low, although it was higher toward the top of the fill. Artifacts discovered in the fill included pieces of flaked stone, unworked animal bone, some sherds, and a broken Cienega style projectile point. The artifact assemblage found on the floor consisted of a steatite bead, an unfinished vesicular basalt bead, a pestle blank, and a core tool.

Construction and Remodeling Evidence

The two possible postholes may have represented wall support posts for the superstructure. The large amounts of oxidized daub indicated the superstructure was of wattle-and-daub construction.

When excavated, the walls of the pit structure were approximately 28 cm above the floor. The walls of the pit structure may have been slightly truncated by mechanical stripping. An area about three-quarters of the circumference of the pit structure showed a slight slope toward the walls of the pit structure. The sloping area ran clockwise from the western side to the southern side of the feature, and began as far as 50 cm from the structure wall at its widest point. This sloping surface was thought to be an overexcavation of the foundation pit during construction of the feature. On the eastern and southeastern sides of the feature, this sloping surface was the top of the fill of the lower pit structure, Feature 3270. The walls and floor did not appear to be plastered or prepared in any way. No evidence for remodeling the pit structure was found.

Stratigraphic Relationships

Feature 3362 was built almost entirely into the fill of Feature 3270, an earlier pit structure. The northern edge of Feature 3362 also intruded on two earlier extramural pits, Feature 3310 and Feature 3311. This structure was not intruded on by any other features. Feature 3262 was included in an arc of other pit structures around a central open area. This feature is less than 30 cm northeast of Feature 9168, another pit structure, and approximately 1 m south of another, Feature 3260.

Abandonment and Postabandonment

The residual utility of the artifacts on the floor suggested the burning of this structure occurred before it was cleaned out, and the burning may not have been intentional. The oxidized construction materials found in the fill of the feature were evidence that the superstructure was still intact at the time of burning. Shortly after the burning, the foundation pit filled with waterborne silt, possibly from a single flooding episode.

Feature 3264, Pit Structure

Description

Feature 3264 was discovered during mechanical stripping, and was subsequently completely excavated by hand (Figure 4.41). This round pit structure measured 3.7 m in diameter. Features discovered within pit structure Feature 3264 include 52 postholes and a hearth. No entry was discovered, and no breaks in the pattern of postholes existed, except where the structure is intruded on by a historic-era outhouse, Feature 3258, on the northern side. Consequently, orientation of the structure could not be determined. Pit structure Feature 3264 was built into the fill of Feature 3294, an earlier pit structure that was lying beneath it. A possible de facto artifact assemblage was discovered on the floor. The pit structure was not burned.

Internal Features

Fifty-two postholes were discovered in the floor. They ranged in size from 6 cm to 17 cm in diameter, and from 3 cm to 15 cm in depth. All but 10 were arranged around the interior of the structure wall. These 10 roughly formed another ring inside the first, closer to the center of the pit structure. Three of the postholes in the inner ring (SS, TT, and Feature 3264.02) overlapped slightly, and may have represented adjustments to, or maintenance of, the superstructure supports. Artifacts were found in the fill of six of the 52 postholes. These artifacts included unworked animal bone, pieces of flaked stone, and a stone tool.

Figure 4.41. Feature 3264, a Cienega phase pithouse, Brickyard locus, the Clearwater site, AZ BB:13:6 (ASM).

The postholes near the pit edge were located during investigations of what appeared to be a silt-filled floor groove in the otherwise dark clay floor. Excavation of the silt revealed that this feature was actually a ring of postholes that had been constructed into a silt deposit in the fill of the lower house, Feature 3294.

Feature 3264.01 was a roughly circular, basin-shaped hearth located just west of the center of the pit structure. It was 34 cm long, 30 cm wide, and 10 cm deep. The sides and bottom of the feature were well oxidized, and it had a slightly oxidized apron. The fill of the feature was light silt mixed with ash, and a white residue was present around the inside rim. The residue was in patches, and it is unclear if it was the remnants of plaster or a concentration of ash.

Internal Strata and Artifact Contents

Approximately 15 cm of fill was encountered between the stripped surface and the floor. No discrete strata were discernable in the fill. The fill was light flood silt with some pockets of dark clay, primarily near the floor. Quantities of charcoal flecking and burned daub were small, but increased slightly with depth, as did general artifact density. Artifacts collected from the fill included large numbers of pieces of flaked stone and unworked animal bone. Fire-cracked rock was also abundant (328 pieces), although most were small (only 51 over 5 cm in diameter). Also discovered in the fill were five sherds, two ceramic figurine fragments, a shell bead, a core, some lumps of ochre, a Cienega style projectile point, and three pieces of ground stone, including a mano.

An assemblage of artifacts was found resting on, or just above, the floor. The assemblage consisted of two cores, a piece of flaked stone, a Cienega style projectile point, a bone cruciform, and three pieces of ground stone, including a ground stone palette. The piece of flaked stone, the palette, the bone cruciform, and one of the cores were stained with ochre.

Construction and Remodeling Evidence

The ring of postholes near the interior of the pit walls probably represented the wall support posts for the superstructure. It is unknown if all the postholes were in use at the same time, and the large number may have represented remodeling or maintenance of the superstructure. The ring closer to the center of the pit structure may have represented roof support posts. The cluster of three overlapping postholes on the western side of this ring was further possible evidence that the pit structure had been remodeled.

When excavated, the pit structure walls were roughly 18 cm above the floor, although they may have been truncated by mechanical stripping. The white residue on the rim of the hearth may be evidence of plaster, although none was found on either the walls or the floor of the pit structure. There was no evidence the walls or the floor were prepared in any way.

Stratigraphic Relationships

Feature 3264 was built into the fill of an earlier pit structure, Feature 3294. The later pit structure filled through both cultural and natural processes, and once filled, was buried by these same processes. During modern use of the area as a brickyard, a pit excavated for use as an outhouse, Feature 3258, intruded on the extreme northern end of both pit structures. This pit structure lies in an arc of pit structures centered around a central open area.

Abandonment and Postabandonment

Lack of oxidization on the walls and floor of Feature 3264 suggested it did not burn. Neither the floor assemblage of artifacts nor the hearth was cleaned out when the structure was abandoned. Scavenging or curation of the cultural materials did not occur, although whether the same was true for the construction materials is unknown. After abandonment of the structure, it was filled for a time with alluvial deposits, colluvium, and cultural trash. After this, the feature filled with waterborne silt from one or more flooding episodes.

Feature 3270, Pit Structure

Description

Feature 3270 was discovered during the excavation of a later pit structure, Feature 3262. After hand-excavation of the later pit structure, the remainder of the fill in Feature 3270 was also excavated by hand (Figure 4.42). Feature 3270 was a slightly ovoid-shaped pit structure measuring approximately 4.3 m in diameter. Internal features discovered within the pit structure included 9 postholes, 2 possible hearths, a large bell pit, and 2 small intramural pits. No entry was discovered, and the orientation of the pit structure could not be determined. The upper stratum of feature fill was removed from roughly half of this structure when a later pit structure, Feature 3262, was constructed. Feature 3270 burned, and a possible de facto artifact assemblage was revealed on the floor.

Figure 4.42. Features 3270 and 9168, Early Agricultural period pithouses, Brickyard locus, the Clearwater site, AZ BB:13:6 (ASM).

Internal Features

Nine postholes were discovered in the floor of the structure. They ranged in size from 8 cm to 12 cm in diameter and from 6 cm to 10 cm in depth. All the postholes were close to the interior edge of the pit walls, and all but one were located in the southeastern quadrant of the structure. This last posthole was situated in the northeastern quadrant.

Feature 3270.01 was a circular, basin-shaped hearth measuring some 45 cm in diameter and 5 cm in depth. The sides and bottom were heavily oxidized. The remnants of some plaster on the western rim of this feature suggested it was originally completely plastered. The fill of the hearth was a mixture of dark clay and gray ash, capped by a clean deposit of dark clay. This clean clay cap may have represented a sealing of the feature at the end of its use-life, prior to abandonment of the structure. This feature was constructed into the western edge of a clay deposit that caps a large bell pit, Feature 3270.02.

Feature 3270.02 was a large bell-shaped pit in the center of the pit structure. It measured approximately 1.10 m in length and 1.05 m in width at its mouth. The feature was about 77 cm deep and had a basal diameter of about 1.15 m. It was capped by a deposit of clay some 18 cm in depth, with areas of heavy oxidation. These oxidized areas were located in relation to the two possible hearth areas of the structure, Feature 3270.01 and Feature 3270.03. The 59 cm of fill under the clay cap was mottled, silty clay with large concentrations of charcoal and highly oxidized daub.

Several pieces of flaked stone and unworked animal bone were recovered from the clay cap, although most of the artifacts collected were from the fill beneath the cap. Artifacts collected from the lower fill of the feature included pieces of flaked stone, some unworked animal bone, a possible ground stone tool, a mano fragment, some lumps of red ochre, and a ceramic figurine fragment. About 90 pieces of fire-cracked rock over 5 cm in diameter were also discovered in the lower fill.

The clay cap over this feature was thought to represent a sealing of the pit at the end of its use-life, prior to abandonment of the structure. The presence of large amounts of charcoal and burned daub in the fill suggested the feature was used as a dump for the remains of a burned superstructure of another pit structure. After the dumping, a clay cap was constructed to seal the pit. The clay cap was later used as the location for the two possible hearth features, Features 3270.01 and 3270.03. Oxidation of the clay cap was thought to have resulted from its use as the location of these two hearths.

Feature 3270.03 was a rectangular area of heavily oxidized plaster on the eastern edge of the clay cap of Feature 3270.02. This area was roughly 40 cm long and 30 cm wide, but had almost no depth. The area was also thought to represent a hearth, possibly used after the sealing of another hearth, Feature 3270.01.

Feature 3270.04 was a roughly circular basin-shaped pit, located southwest of Feature 3270.02. This feature measured 56 cm in length and 50 cm in width, with a depth of 18 cm. The fill was dark silty clay consistent with the general fill of the pit structure. This fill, in combination with pieces of charcoal and oxidized daub found within it, suggested the feature was still in use when the superstructure burned and collapsed. The only artifacts recovered from the feature were a few pieces of flaked stone and unworked animal bone.

Feature 3270.05 was a circular basin-shaped pit that measured 45 cm in diameter and 18 cm in depth. This feature was located just northeast of Feature 3270.02. The fill of Feature 3270.05 was silty clay that resembled the fill of Feature 3270.02 more than the general fill of the pit structure. However, no clay cap was discovered on this feature, making it unclear if this feature was still in use when the pit structure burned. Large amounts of oxidized daub and charcoal flecking were found in the fill, along with a few pieces of flaked stone and some unworked animal bone.

Internal Strata and Artifact Contents

Approximately 30 cm of fill was excavated between the stripped surface and the floor of this pit structure. The upper 24 cm was a layer of dark colluvial clays with a low density of artifacts. Artifacts discovered included pieces of flaked stone, ground stone fragments, unworked animal bone, two possible ceramic figurine fragments, a fragment of a bone tool, and the tip of a Cienega style projectile point. About 246 pieces of fire-cracked rock were also present in the fill, clustered primarily in the southern half of the structure.

The lower 6 cm of fill in the structure consisted of the same clays as the level above, but it contained a high density of large, heavily oxidized daub chunks and charcoal. The density of artifacts remained low. Artifacts included pieces of flaked stone, unworked faunal bone, a terrestrial snail shell, two ground stone fragments, a fragment of a bone tool, and a Cienega style projectile point.

The floor of the pit structure was an unprepared compact clay surface; it showed mostly light oxidization with a few patchy areas of heavier oxidization. The de facto assemblage consisted of a pestle, a lapstone, an anvil, a ground stone disc, a possible manuport, a ceramic fragment, and a flake stone core. Most of the assemblage was clustered in the southeastern quadrant of the structure.

Construction and Remodeling Evidence

The high concentration of charcoal and daub indicated the superstructure was of wattle-and-daub construction. Depth of the fill in this structure further suggested the walls may have originally been roughly 30 cm above the floor but disturbance from construction of the later pit structure, Feature 3262, may have had an impact. Neither the walls nor the floor showed any evidence of being plastered or prepared in any way. The postholes may have held wall support posts.

The subfeatures of this pit structure suggested it may have been remodeled, possibly more than once. Feature 3270.02 was used as a dump for oxidized wattle-and-daub, then capped, before Feature 3270.01, a hearth, was built on it. This hearth was also capped, and another hearth area, Feature 3270.03, was used. These changes may have represented remodeling episodes of the pit structure. No other evidence was found for remodeling of the structure.

Stratigraphic Relationships

This pit structure was built into the alluvial clays of the floodplain. After abandonment, the structure was at least partially filled with alluvium, colluvium, and cultural trash. Features 3262 and 9168, two other pit structures, intruded on Feature 3270. Two extramural pits, Features 3310 and 3311, were built into the fill of Feature 3270 after abandonment but prior to construction of Feature 3262.

Abandonment and Postabandonment

Heavy oxidation of the floor and the large amount of oxidized daub and charcoal in the fill indicated the superstructure was still in place when the structure burned. Residual utility of the artifacts found on the floor suggested that the structure was not burned intentionally. After burning and collapse of the superstructure, a combination of natural floodplain processes and the dumping of cultural trash filled the structure. Two later extramural pits, Features 3310 and 3311, were constructed, partially intruding the fill of the structure. Sometime after these two pits filled, a later pit structure, Feature 3262, was also constructed into the fill of Feature 3270.

Feature 9168, another pit structure, also intruded on Feature 3270 sometime after its abandonment and filling. The chronological relationship between Feature 9168 and the other intrusive features was unknown.

Feature 3273, Pit Structure

Description

Feature 3273 was discovered during mechanical stripping and was then fully excavated by hand (Figure 4.43). It was a round pit structure that measured about 3.35 m in diameter. Features discovered within the pit structure included a hearth, a floor groove, an intramural pit, and four postholes, as well as two possible postholes and one depression that may have originally been a floor pit. Alignment of the postholes into two rows and the location of the hearth suggest the entry was located in the northeastern quadrant. This structure seems to have been used for habitation, possibly for an extended period of time. The structure burned, and artifacts suggesting a de facto assemblage were found on the floor.

Internal Features

The hearth, Feature 3273.01, was located near the center of the pit structure, skewed slightly to the northeast. Feature 3273.02, a floor groove, ran along the entire circumference of the pit structure. Four

Figure 4.43. Feature 3273, a Cienega phase pithouse, Brickyard locus, the Clearwater site, AZ BB:13:6 (ASM).

well-defined postholes, Feature 3273.03-3273.06, and two possible postholes, A and B, were arranged into two rows, running roughly southwest to northeast.

Feature 3273.01 was a round, basin-shaped hearth, 35 cm in diameter, with heavily oxidized edges. A raised, oxidized collar was also present around the rim of the hearth, except in one area disturbed by a rodent burrow. There was no evidence the hearth was plastered. Fill of the hearth consisted almost entirely of gray ash, although some pieces of burned daub and a few small fire-cracked rocks were found in the ash. Also associated with the hearth was an area of ash rake-out on the floor just to the west. The area was an irregularly shaped ash deposit approximately 70 cm long by 60 cm wide.

Feature 3273.02 was a roughly V-shaped floor groove that ran around the entire circumference of the pit structure. Width of the groove varied from about 10 cm to 17 cm. The floor groove was contiguous with the pit edge for three-quarters of the circumference, separating from the edge slightly in the southwestern quadrant. The floor groove was filled by flood silt mixed with burned construction materials. In addition to oxidized daub, pieces of burned upright posts, 3-4 cm in diameter, and burned thatching were found in situ in the floor groove. Artifacts found in the fill of the floor groove included a few pieces of fire-cracked rock, some flaked stone, a seashell, a core, and a piece of ground stone with ochre staining. All the artifacts were confined to the eastern half of the groove.

The four postholes and two possible postholes ranged from 15 cm to 36 cm in diameter and from 22 cm to 37 cm in depth. The postholes were aligned in two rows, running roughly southwest to northeast. The rows bent together slightly toward the northeast, where the postholes neared the hearth.

Internal Strata and Artifact Contents

About 19 cm of fill was excavated between the stripped surface and the floor of the pit structure. No discrete strata were discernable, although quantities of burned daub and ash increased in the lower fill. High amounts of charcoal and a few ash lenses were also present in the fill, and their frequency also increased with depth. A 2-cm- to 3-cm-thin layer of compacted silt was present just above the clay floor, perhaps representing an accumulation during use. Patches of the floor were oxidized, with roughly 20 percent of the floor area showing oxidization. The fill of the pit structure contained high densities of flaked stone and unworked animal bone. Also found in the fill were four pieces of ground stone, a core, two seashells, an ochre lump, and a ceramic figurine fragment. Approximately 70 pieces of fire-cracked rock were found in the fill, most of which were fairly small (less than 5 cm in diameter). The artifact assemblage found on the floor of the pit structure consisted of 2 Cienega style projectile points, 2 metates, 4 cores, 1 hammerstone, a piece of flaked stone, and a separate cluster of flaked stone. A few small pieces of fire-cracked rock were present on the floor. Most of the artifacts that constituted the floor assemblage were concentrated to the east and slightly south of the hearth. The reason for the concentration of artifacts on the eastern side of the pit structure, both in the floor groove and on the floor itself, is unknown.

Construction and Remodeling Evidence

The two rows of postholes probably represent central support posts for the roofing superstructure, as they are arranged halfway to the wall on either side of the centerline of the pit. The large amount of oxidized daub, as well as the burned thatching and support posts found in the floor groove, are evidence of a wattle-and-daub superstructure.

When excavated, the pit structure walls were about 25 cm above the floor. The walls may have been slightly truncated by mechanical stripping. The walls, floor, and hearth did not appear to be plastered or prepared in any way. The 2-3 cm of compacted silt found above the floor may represent an accumulation during use. No evidence of remodeling for the pit structure was found.

Stratigraphic Relationships

This pit structure was built into the alluvial clays of the floodplain. Above the remains of the burned superstructure, the pit structure was filled entirely with flood silt. The structure was not intruded on by any other features, nor did it intrude on any features. Feature 3273 was included in an arc of other pit structures around a central open area.

Abandonment and Postabandonment

The layer of compacted silt present on the floor likely accumulated during the use-life of the structure. The residual utility of the artifacts found on the floor suggested burning of this structure occurred before it could be cleaned out and it might not have been intentional. The substantial amount of construction materials found in the fill is evidence the superstructure was probably still intact at the time of burning. Shortly after the superstructure burned and collapsed, the feature filled rapidly with waterborne silts, possibly in a single flooding episode. The absence of alluvial or colluvial clays and cultural trash in the fill of the pit structure seems to support this scenario. Continuing natural floodplain processes then covered the filled structure.

Feature 3274, Pit Structure

Description

The northeastern quadrant of Feature 3274 was discovered during mechanical stripping around Feature 3201, a brick pad from the historic-era brickyard. Upon discovery, the overlying brick pad was removed to fully expose the pit structure. An overlying and intrusive pit was found in the southeastern quadrant of the structure, but was left unexcavated. The northern half of Feature 3274 was subsequently excavated by hand.

This pit structure was round and measured 3.1 m in diameter. Four postholes were found within the structure, three near the center of the structure and one near the northwestern edge. The entry was not identifiable, and orientation of the structure could not be determined. Very few artifacts that could possibly be linked to the occupation of the pit structure were found, and no evidence of burning was found.

Internal Features

Four postholes were revealed. They measured 12-16 cm in diameter and were 10-12 cm deep. Three of the postholes were clustered near the center of the pit structure, and the fourth was found on the northwestern edge of the feature. More postholes probably existed previously, but were not preserved. No artifacts were found in any of the postholes.

Internal Strata and Artifact Contents

Approximately 28 cm of fill was removed between the stripped surface and the floor. The top 2 cm of fill was flood silt deposited after the feature had been mostly filled through alluvial and colluvial processes and by cultural trash deposition. The flood deposit had no charcoal, although the lower fill contained some small charcoal flecking that increased in concentration with depth. Some oxidized daub was found in the lower fill and was originally thought to be evidence that the superstructure had burned. However, the localization of this daub at the extreme southwestern edge of the excavation suggests the daub came from the pit that intruded into the pit structure. The pit, seen in profile, showed several large chunks of burned daub restricted to the area on which it intruded.

Both the upper and lower fills contained moderate densities of fire-cracked rock and flaked stone and small quantities of unworked bone and sherds. The lower fill also contained two small ceramic figurine fragments and a possible pecking stone. One piece of unworked bone, one piece of flaked stone, and two large fire-cracked rocks were found on the floor of the structure.

Construction and Remodeling Evidence

When discovered, the walls of Feature 3274 were found to be at least 28 cm above the floor, although how much they were truncated by mechanical stripping or construction of Feature 3201, the brick pad, is unknown. Neither the walls nor the floor of the pit structure were plastered, or appeared prepared in any way. Except the four postholes, no evidence of the superstructure was preserved.

Stratigraphic Relationships

The pit structure was built in the floodplain alluvium, and was filled primarily by both natural and cultural deposition. The remainder of the structure was then filled with waterborne silts in a flooding episode. The unexcavated intrusive pit in the southeastern quadrant of Feature 3274 was built after the pit structure had already been mostly filled. The flood episode occurred later, filling both the intrusive pit and the pit structure with a fine alluvial silt. Feature 3274 is well removed from most other pits and pit structures at the Brickyard locus.

Abandonment and Postabandonment

Very few of the artifacts found seem to be associated with occupation of this pit structure. No evidence of in situ burning was present. The paucity of both artifacts and construction materials suggested curation and scavenging occurred during or after abandonment. The structure was filled through both natural and cultural processes. Natural processes continued to deposit sediment and covered the filled pit of the structure.

Feature 3290, Pit Structure

Description

Feature 3290 was found during mechanical stripping. After discovery, the western half of the feature was excavated by hand. This pit structure was round and measured about 3.95 m in diameter. No postholes or other internal features were discovered. No entry was found, and orientation of the pit structure could not be determined. The feature showed no signs of having burned, and no artifacts were found on the floor of the structure.

Internal Features

No internal features were revealed.

Internal Strata and Artifact Contents

Less than 5 cm of fill was excavated between the mechanically stripped surface and the floor of this pit structure. The silt fill did not contain any discrete strata. Artifact density was moderate and included 25 pieces of flaked stone, 1 incipient sherd, and 6 other sherds. Fifty-six pieces of fire-cracked rock were found in the fill, 40 of which were less than 5 cm in diameter.

Construction and Remodeling Evidence

When excavated, the walls of Feature 3290 were less than 5 cm above the floor. It was unknown if the state of the walls was due to lack of preservation or if it resulted from modern activities on the site. The walls of this structure were almost certainly higher when it was constructed. No evidence of the superstructure of this feature remained.

Stratigraphic Relationships

This feature did not intrude on other features, nor was it intruded on by any features. This pit structure was located well to the east of all other pit structures in the project area.

Abandonment and Postabandonment

There was no evidence this structure burned prior to abandonment. Sometime after abandonment, Feature 3290 was filled by silts from a flooding episode. Natural processes continued to deposit sediments that covered the filled pit of the structure.

Feature 3293, Pit Structure

Description

Feature 3293 was discovered during mechanical stripping and was then completely excavated by hand (Figure 4.44). This pit structure was rectangular with rounded corners. It measured about 2.55 m in length and 2.05 m in width. A utility trench for the modern brickyard cuts this structure along its north-south axis. A plastered hearth was discovered in the floor of the pit structure. No entry was located, and the orientation of the pit structure could not be determined. There was evidence the structure burned, and a possible de facto artifact assemblage was found on the floor.

Internal Features

Feature 3293.01 was a roughly circular, plastered hearth that measured 26 cm in length, 25 cm in width,

Figure 4.44. Feature 3293, an Early Ceramic period or Hohokam pithouse, Brickyard locus, the Clearwater site, AZ BB:13:6 (ASM).

and 8 cm in depth. In cross section, the hearth was basin shaped, with sloping walls on the western edge and vertical walls on the east. Plaster was present on the vertical eastern wall of the hearth and was roughly 2 cm thick. Fill of the hearth was almost pure ash and was collected entirely as a flotation sample.

Internal Strata and Artifact Contents

Approximately 19 cm of fill was excavated between the stripped surface and the floor. Large amounts of burned daub were present in the fill. Chunks of charcoal, as well as some intact pieces of burned post, were also discovered in the fill. No discrete strata were identified, although daub and charcoal density increased with depth. Artifacts recovered from the fill included pieces of flaked stone, about 60 sherds, and some unworked animal bone. Two pieces of flaked stone, four individual sherds, and two concentrations of sherds were found on the floor.

Construction and Remodeling Evidence

The high concentration of charcoal and daub indicated the superstructure was of wattle-and-daub construction. The walls of the pit structure extended some 19 cm above the floor, although they may have been slightly truncated by mechanical stripping. Only the hearth was plastered. Neither the walls nor the floor showed any evidence of being plastered or prepared in any way.

Stratigraphic Relationships

Feature 3293 was of a completely different type and shape of structure than the other structures found in this area. Construction details and the presence of ceramics on the floor suggested that this structure represents a later occupation of the area than the other pit structures. Further, this pit structure was well removed from the other structures at the Brickyard locus.

The eastern half of the structure was slightly intruded on by a later roasting pit, Feature 3287. The roaster barely impacted the top 5 cm of the fill of Feature 3293. Both features were later cut by a utility trench, constructed for a gas line to one of the kilns at the modern brickyard.

Abandonment and Postabandonment

The large amount of charcoal and burned daub suggested the superstructure was still intact when the structure burned. Artifacts found on the floor of the structure indicated that the structure was not cleaned out before it burned. However, the artifacts did not possess residual utility and may have been left behind when the structure was abandoned. After the structure burned, the remaining pit was filled by alluvial and colluvial processes. These continuing processes then covered the filled foundation pit.

Date

A sample of charred mesquite seed provided a radiocarbon date of 770±140 b.p. (uncalibrated ^{14}C years), which was rejected as too young. The architectural style and associated pottery type suggest this feature dates to the Early Ceramic period (A.D. 50-500) or to a Hohokam period.

Feature 3294, Pit Structure

Description

Feature 3294 was discovered during excavation of Feature 3264, a later, intrusive pit structure. Feature 3264 was built into the fill of Feature 3294. Excavation of Feature 3294 by hand continued, and it is estimated that about 50 percent of the lower structure was excavated to the floor (Figure 4.45). Only that portion of Feature 3294 under the eastern half of Feature 3264 was excavated. From the portion of the feature that was exposed, it was estimated to have been a round pit structure measuring about 2.5 m in diameter. No entry was discovered, and orientation could not be determined. Features found within the

Figure 4.45. Feature 3294, a Cienega phase pithouse, Brickyard locus, the Clearwater site, AZ BB:13:6 (ASM).

structure included 20 postholes and a possible hearth. No artifacts were discovered on the floor, but there was evidence the structure had burned.

Internal Features

Twenty postholes were revealed in the floor of the pit structure. They ranged in size from 7 cm to 25 cm in diameter and from 4 cm to 16 cm in depth. Seventeen of the postholes were arranged in an arc, just inside what appeared to be the eastern and southeastern walls of the structure. The remaining three postholes were near the approximate center of the pit structure.

Feature 3294.01 was a small, oxidized possible hearth area roughly 20 cm in diameter and 3 cm deep. The fill was gray-white ash with no artifacts in evidence. It was uncertain if this area represented a hearth due to the presence of a well-defined posthole, posthole M, that lay under the entire western half of the hearth.

Posthole M measured approximately 25 cm in length, 20 cm in width, and 16 cm in depth. The top 2-3 cm of fill of the posthole was sand, while the remaining fill was silt with some cultural trash.

Two scenarios seemed possible. The first was that the posthole was no longer in use when the hearth was placed over it. The second scenario was that the oxidized area of the hearth actually represented where a piece of burning superstructure came in contact with the floor, causing the oxidation. No other evidence was found that would suggest which scenario was correct.

Internal Strata and Artifact Contents

About 35 cm of fill was encountered between the floor of the upper intrusive feature and the floor of the lower pit structure. The top 20 cm of fill was a mixture of light silts, dark clays, and cultural trash. The next 10 cm of fill was of the same composition but contained large quantities of burned daub and charcoal flecking. This fill showed concentrations of silt toward the center of the structure and concentrations of clay toward the edges. The last 5 cm of fill were heavily oxidized and contained a much larger concentration of clays than the upper fill.

Artifact density in the fill was high. The upper 20 cm contained more than 200 pieces of flaked stone, not including microflakes, and approximately 50 pieces of unworked animal bone. Also recovered from the fill were 3 small cores, a possible hammerstone, 5 pieces of ground stone reused as fire-cracked rock, 2 snail shells, a seashell fragment, a piece of mica, a Cienega style projectile point, 2 ceramic figurine fragments, 5 small incipient plain ware sherds, and a fragment of a bone awl.

For artifact collection, the lower fill was treated as one stratum, roughly 15 cm deep. Flaked stone (255 pieces) and unworked animal bone (87 pieces) were still present in high densities. Other artifacts recovered from this fill included a fragment of seashell, a Cienega style projectile point, seven sherds, and five ceramic figurine fragments. Approximately 280 pieces of fire-cracked rock were discovered in the upper stratum, and some 120 pieces were found in the lower two strata. Most of the fire-cracked rock was less than 5 cm in diameter.

Construction and Remodeling Evidence

The fact that only a portion of the floor of the pit structure was uncovered made conclusions about details of construction difficult. The walls of Feature 3294 were not easily visible, except one small portion in the extreme south of the feature. Height of the walls was unknown. Eastern and southeastern walls were inferred by the presence of the arc of postholes present in the floor. These probably represented the wall support posts of the superstructure, while the more central postholes represented roof support posts. The existence of a wattle-and-daub superstructure was implied by the large amounts of burned daub present in the fill. The walls, floor, and hearth of the structure did not appear plastered or prepared in any way.

There was no solid evidence for a remodeling of this structure. If Feature 3294.01 was a hearth, it shows that the post that rested in posthole M was removed and support for the roof of the superstructure was adjusted.

Stratigraphic Relationships

This feature was intruded on by a later pit structure located above it. After Feature 3294 had been mostly or completely filled by alluvial, colluvial, and cultural processes, the later pit structure, Feature 3264, was constructed into the fill. After the upper intrusive structure was filled, both features were later intruded on by Feature 3258, an outhouse pit constructed for the modern brickyard.

Abandonment and Postabandonment

The layer of clay on the floor suggested Feature 3294 stood abandoned for a time before the superstructure burned. Heavy oxidation of the clay layer and large amounts of daub present in the fill suggested the superstructure was still in place when the feature burned. After the burning and collapse of the superstructure, a combination of natural floodplain processes and the dumping of cultural trash mostly or completely filled the structure. A later pit structure, Feature 3264, was then constructed into the fill of this feature. During modern use of the area as a brickyard, a pit constructed for use as an outhouse intruded on the northern portion of both the upper and lower pit structures.

Feature 3296, Pit Structure

Description

Feature 3296 was discovered during excavation of Feature 3213, a subterranean rail line built by brickyard personnel. Construction of the rail line destroyed the extreme southwestern portion of the structure, and the pit structure was visible in profile in the wall of the rail bed. The area was mechanically stripped to reveal the rest of the structure. The pit structure was then excavated by hand (Figure 4.46).

This structure was roughly circular and measured about 3.4 m in diameter. Eleven postholes, a possible hearth area, and a roasting pit were discovered in the floor. No entry was identified and orientation of the pit structure could not be determined. The structure appeared to have burned, and a possible de facto artifact assemblage was found on the floor.

Internal Features

Eleven postholes were found on the floor of the pit structure. They ranged in size from 8 cm to 21 cm in diameter and 4 cm to 18 cm in depth. Nine of the postholes were arranged around the interior of the structure wall. Three of the postholes were located about halfway between the wall and the center of the structure. These three postholes, A, I, and K, were also slightly larger than the other nine postholes.

Feature 3296.01 was an oxidized patch of the floor that may have served as an informal hearth area. The oxidization measured roughly 30 cm in diameter and had no depth. It was located just southeast of the center of the structure.

Feature 3296.02 was an intramural roasting pit that measured 37 cm in length, 36 cm in width, and 10 cm in depth. It became visible on the western side of the structure, just at the level of the floor, which suggested it was an intramural feature. The fill was comprised primarily of fire-cracked rock, although some ash and oxidized soil was present.

Internal Strata and Artifact Contents

Roughly 14 cm of fill was present between the stripped surface and the floor. The fill consisted of flood silts with some burned daub and charcoal flecking. No discrete strata were discernable in the fill. Artifacts recovered from the fill included some flaked stone, a few sherds, some unworked animal bone, two ground stone fragments, a biface, and a projectile point fragment. Some 200 pieces of fire-cracked rock were discovered, only 18 of which measured more than 5 cm in diameter.

The floor of the structure showed some areas of oxidization. The artifact assemblage found on the floor consisted of a flaked stone scraper, a piece of ground stone, a flake, and a hammerstone.

Construction and Remodeling Evidence

When excavated, the walls of this structure measured 14 cm above the floor. Neither the walls nor the floor appeared to have been plastered or prepared in any way.

Figure 4.46. Feature 3296, a Cienega phase pithouse, Brickyard locus, the Clearwater site, AZ BB:13:6 (ASM).

Stratigraphic Relationships

This structure was built into the alluvial clays of the floodplain. Sometime after its abandonment, the structure filled with silts from a flooding episode. Two prehistoric pits, Features 3313 and 3336, were then constructed through the fill of the structure. Later, both a historic pit, Feature 3341, and a subterranean rail line, Feature 3213, intruded on this structure. The rail line destroyed a small portion in the southwesternmost part of the pit structure.

Abandonment and Postabandonment

The floor of this structure showed slight oxidization, and only small amounts of charcoal and burned daub were found in the fill. This suggested the superstructure was only partially intact and/or only partially burned. The few artifacts found on the floor of the structure did not conclusively indicate whether the structure was cleaned out prior to abandonment. After abandonment, the foundation pit of the structure was filled and then covered by continuing alluvial and colluvial processes.

Feature 3300, Pit Structure

Description

Feature 3300 was found during backhoe stripping. After discovery, the eastern half of the pit structure was excavated by hand. This pit structure was roughly circular and measured about 3.75 m in diameter. A small pit, two possible hearth areas, and a floor groove were revealed in the floor of the excavated portion of this structure. No entry was discovered, and no orientation for the structure could be determined. The structure did not burn, and no artifacts were discovered on the floor.

Internal Features

No postholes were revealed in this structure.

Feature 3300.01 was a groove in the floor of the structure. The groove varied in width along its length, measuring between 1 cm and 10 cm. It ran through most of the eastern half of the structure, was interrupted by a historic-era pit at its easternmost point, and ended 1.5 m before reaching the unexcavated western half of the structure. When excavated, it was unclear if the groove ended at this point or if it was intruded on by a historic pit originating from the south. Fill of the groove was the same as the fill of the structure. It contained charcoal flecking and small pieces of burned daub. Artifacts recovered from the groove consisted of a few pieces of flaked stone.

Feature 3300.02 was a small circular pit measuring 45 cm in diameter. It was discovered in the northern part of the structure very near the floor groove and structure wall. The small pit contained high amounts of charcoal and burned daub. A few pieces of flaked stone, a mano fragment, and a fragment of a ground stone tray were recovered from the fill.

Feature 3300.03 was an oxidized patch of floor discovered near the center of the structure, lying partially in the unexcavated western half. The visible portion of the oxidization measured roughly 27 cm in length and 15 cm in width. This oxidized area of floor may have been an informal hearth. Feature 3300.03 had no depth, and no artifacts were recovered.

Feature 3300.04 was a second oxidized patch discovered on the floor of the pit structure. It was located just southeast of Feature 3300.03. The oxidization was roughly circular, 20 cm in diameter. This area may represent an informal hearth. It had no depth, and no artifacts were recovered.

Internal Strata and Artifact Contents

Approximately 11 cm of fill was excavated between the stripped surface and the floor of this pit structure. The fill of the structure consisted of flood silts with small amounts of charcoal, burned daub, and ash. No discrete strata were discernable in the fill. Artifacts recovered from the fill included 42 pieces of flaked stone, 1 sherd, a Cienega style projectile point, and 3 pieces of unworked animal bone. Roughly 60 pieces of fire-cracked rock, 13 of which measured more than 5 cm in diameter, were also discovered in the fill.

Construction and Remodeling Evidence

When excavated, the walls of this pit structure measured some 11 cm above the floor. The walls may have been slightly truncated by mechanical stripping. No evidence was discovered that the walls or the floor were plastered or prepared in any way.

Stratigraphic Relationships

Feature 3300 was constructed into the alluvial clays of the floodplain. After abandonment, the foundation pit filled with flood silts and was covered by continuing alluvial and colluvial processes. A historic pit and an outhouse pit were later constructed and intruded on the prehistoric pit structure.

Abandonment and Postabandonment

The lack of oxidization of the floor of this pit structure suggested that it did not burn. The lack of artifacts on the floor further suggested that the structure was cleaned out prior to abandonment. After abandonment, the structure was filled with silts from a flooding episode, and the filled foundation pit was covered by alluvial and colluvial deposition.

Feature 3306, Pit Structure

Description

Feature 3306 was discovered during mechanical stripping. The northern half of the feature was then excavated by hand. This feature was a round pit structure measuring 3.85 m in diameter. No internal features were discovered in the excavated half of the pit structure. No entry was found, and the orientation of the structure could not be determined. The floor showed a small patch of oxidization under a piece of burned daub, but this was the only evidence the structure may have burned. Only fire-cracked rocks were found in contact with the floor.

Internal Features

No internal features were revealed in the structure.

Internal Strata and Artifact Contents

Roughly 7 cm of fill was removed between the stripped surface and the floor of the structure. No discrete strata existed in the fill, which was a mixture of flood silts and cultural trash. Some very small pieces of burned daub and charcoal flecking were present, although it is unclear if these originated from this structure. Artifacts discovered within the fill were both historic and prehistoric in age. The historic-era artifacts consisted of glass and metal, while the prehistoric-era artifacts were pieces of flaked stone, a flaked stone core, and three sherds. Eight pieces of fire-cracked rock were found in contact with the floor.

The floor of this structure showed only one small area of oxidization. This occurred beneath a small chunk of burned daub that was resting on the floor. The lack of other oxidized materials made it unclear if this structure had burned. Some mottling suggestive of unburned, decaying daub was found in the fill, implying that if the structure did burn, the burning was only partial.

Construction and Remodeling Evidence

When excavated, the walls of this structure were found to be approximately 7 cm above the floor. They may have been slightly truncated by mechanical stripping. Neither the walls nor the floor appeared to have been plastered or prepared in any way. Lack of internal features and superstructure materials made further construction details difficult to ascertain.

Stratigraphic Relationships

The pit structure was built in the floodplain alluvium, and after abandonment, it was filled by waterborne silts in a flooding episode. The excavated northern half was intruded on by a historic pit, Feature 3309. A prehistoric pit, Feature 3307, intruded on the unexcavated southern half of Feature 3306. This pit, a possible thermal feature, was left unexcavated.

Feature 3306 did not intrude on any other features. It was located in close proximity to Feature 3308, another pit structure, and Feature 3298, a possible pit structure.

Abandonment and Postabandonment

Lack of artifacts suggested the pit structure had been cleaned out prior to abandonment. Very little other evidence existed from which to draw conclusions about the nature of the abandonment. The small patch of oxidization on the floor along with the chunk of oxidized daub indicated the structure may have burned. Lack of other evidence of burning or oxidization suggested that burning, if it occurred, may have only been partial.

Sometime after the structure was abandoned, it was filled by silts from a flooding episode. Continuing natural processes then covered the filled structure.

Feature 3308, Pit Structure

Description

Feature 3308 was discovered during mechanical stripping, and its southern half was excavated by hand. The northern half of the feature was left unexcavated. This feature was a round pit structure that measured some 3.65 m in diameter. A very shallow pit was found within the structure. No entry was discovered, and the orientation of the pit structure could not be determined. The structure was not burned, and a single artifact was found in contact with the floor.

Internal Features

Feature 3308.01 was a circular pit discovered just south of the center of this pit structure. It measured about 35 cm in diameter and 6 cm in depth. No artifacts were found within the pit.

Internal Strata and Artifact Contents

Approximately 10 cm of fill was removed between the stripped surface and the floor. No discrete strata were discernable within the fill, although clay concentration increased with depth. The fill contained some charcoal flecking and small pieces of burned daub. Artifact density was moderate, but decreased with depth. Artifacts discovered within the fill included flaked stone, unworked faunal bone, and sherds. Eighteen pieces of fire-cracked rock measuring more than 5 cm in diameter were found in the fill. One piece of unworked faunal bone and six pieces of fire-cracked rock were found in contact with the floor.

Construction and Remodeling Evidence

The walls of this structure were found to be roughly 10 cm above the floor. They may have been slightly truncated by mechanical stripping. Neither the walls nor the floor appeared plastered or prepared in any way. No evidence of the superstructure was preserved.

Stratigraphic Relationships

This pit structure was built in the floodplain alluvium and was filled with flood silts and some cultural trash. During modern use of the area as a brickyard, an intrusive pit, Feature 3342, was excavated into the northern half of this structure. This pit structure was located just northwest of another pit structure, Feature 3306.

Abandonment and Postabandonment

No evidence existed to suggest the nature of the abandonment of pit structure Feature 3308. No in situ burning was evident. Lack of construction materials suggested that the superstructure was scavenged or was not preserved. After the structure was abandoned, it was partially filled by alluvial and colluvial clays and cultural trash. A later flooding episode filled the remainder of the foundation pit with silt. Natural floodplain processes subsequently buried the filled feature.

Feature 3312, Pit Structure

Description

Feature 3312 was discovered during mechanical stripping; the eastern half was then excavated by hand. This pit structure was round and measured about 3.6 m in diameter. No postholes were found, although an oxidized patch of the floor was investigated as a possible hearth area. No entry was discovered and the orientation of the pit structure could not be determined. The structure did not burn. A possible de facto artifact assemblage was found in the excavated half of Feature 3312.

Internal Features

No postholes were discovered in the structure. A small oxidized patch of floor in the center of the structure was identified as a possible hearth area. The oxidization measured 30 cm long and 20 cm wide, but had no depth. No artifacts were found in association with this possible hearth.

Internal Strata and Artifact Contents

Roughly 11 cm of fill was removed between the stripped surface and the floor of the pit structure. No discrete strata were discernable in the fill, but clay content increased with depth. Very small amounts of charcoal flecking and burned daub were present. Artifact density was low and consisted of pieces of flaked stone, some unworked animal bone, and one sherd. About 120 pieces of fire-cracked rock, most less than 5 cm in diameter, were discovered in the fill. Two pieces of ground stone, two pieces of flaked stone, and one piece of unworked faunal bone were found in contact with the floor.

Construction and Remodeling Evidence

When excavated, the walls of this feature were found to be approximately 11 cm above the floor. The walls may have been slightly truncated by mechanical stripping or by modern activity associated with the brickyard. Neither the walls nor the floor appeared plastered or prepared in any way. No evidence of a superstructure for the feature was discovered.

Stratigraphic Relationships

This pit structure was built in the floodplain alluvium and was filled by waterborne silts from a flooding episode. It is intruded on by two pit features, Features 3316 and 3319. Feature 3316 was a slab-lined pit that intrudes on the northeastern corner of Feature 3312. Feature 3319 intrudes slightly upon the extreme western edge of Feature 3312. Both Feature 3319 and the western half of the pit structure were left unexcavated.

The structure was located in the extreme northwestern corner of the project area, well removed from most of the other features at the site. However, the areas north and west of the feature were not mechanically stripped and were only tested with trenches.

Abandonment and Postabandonment

The floor assemblage discovered in the structure suggested it was not cleaned out prior to abandonment. This pit structure did not burn; sometime after abandonment, the structure filled with silts from a flooding episode. Continuing natural processes then covered the filled foundation pit.

Feature 3323, Pit Structure

Description

Feature 3323 was discovered during backhoe stripping under a brick pad, Feature 3201, from the modern brickyard. After it was found, the northern half of the pit structure was excavated by hand (Figure 4.47).

The pit structure was roughly circular and measured about 3.8 m in diameter. Only the northern half of the structure was excavated. Nine postholes, three possible postholes, and a hearth were revealed in the floor of the excavated portion of the feature. The floor and walls of the structure appeared to have been plastered. The structure had burned, and a small de facto artifact assemblage was discovered on the floor.

Internal Features

Nine postholes and three possible postholes were found. They ranged from 7 cm to 30 cm in length, 7 cm to 16 cm in width, and 2 cm to 24 cm in depth. Fire-cracked rock was recovered from posthole A. None of the other postholes contained any artifacts.

Three of the postholes, A, K, and L, were arranged along the central east-west axis of the house and may have represented roof support posts. The other postholes were all arranged around the interior circumference of the structure wall and may have represented wall support posts.

Feature 3323.01 was a roughly circular, highly oxidized hearth, measuring 45 cm in diameter and 10 cm in depth. Only three-quarters of the hearth was excavated, because the feature extended into the unexcavated portion of the structure. The fill consisted of silts similar to the fill of the structure and contained fire-cracked rock, small chunks of charcoal, and burned daub. The base of the hearth contained a thin layer of ash. One piece of ground stone was recovered from the fill.

Internal Strata and Artifact Contents

About 30 cm of fill was excavated between the stripped surface and the floor. Two discrete strata were visible in the fill. The upper 14 cm of fill consisted of flood-deposited silts with some small chunks of burned daub and charcoal. Artifacts recovered from the upper fill included roughly 65 pieces of flaked stone, 28 sherds, some fragmentary unworked animal bone, a shell pendant fragment, and one ceramic figurine fragment.

The lower 16 cm of fill also consisted of flood silts, but was mixed with large amounts of burned daub and charcoal. The daub and charcoal appeared to be the remains of a burned superstructure. Artifacts recovered from this fill included approximately 107 pieces of flaked stone, 12 sherds, some fragmentary unworked animal bone, 2 ground stone fragments, 2 ceramic figurine fragments, and the tip of a projectile point.

The floor assemblage consisted of a metate, two pieces of flaked stone, and two pieces of fire-cracked rock. The metate was discovered partially capping the hearth of the structure, Feature 3323.01.

Construction and Remodeling Evidence

When excavated, the walls of the pit structure were 25 cm above the floor. They may have been slightly truncated by backhoe stripping, or by construction of the overlying brick pad, Feature 3201.

The large quantities of charcoal and burned daub suggested a superstructure of wattle-and-daub construction. Areas of plaster found on the walls and the floor of the structure suggested both were plastered. No evidence for any remodeling of the structure was discovered.

Stratigraphic Relationships

This pit structure was constructed into the floodplain alluvium. It is intruded on by Feature 3324, a small pit. During modern use of the area as a brickyard, a large brick pad, Feature 3201, was constructed over the

Figure 4.47. Feature 3323, a Cienega phase pithouse, Brickyard locus, the Clearwater site, AZ BB:13:6 (ASM).

pit structure. The structure was located in an arc of other pit structures around a central open area.

Abandonment and Postabandonment

The oxidized floor and walls suggested that Feature 3323 burned. The large amounts of burned daub and charcoal discovered in the fill indicated the superstructure may have been intact when the burning occurred. The few artifacts on the floor suggested the structure may have been at least partially cleaned out prior to abandonment. However, the limited excavation of the structure, as well as the presence of the metate capping the hearth, made this unclear.

After the structure was abandoned, alluvial and colluvial processes filled, then covered, the foundation pit.

Date

A sample of charred maize provided a radiocarbon date of 2530±50 b.p. (uncalibrated ^{14}C years), or 790-550 B.C. (calibrated calendar years at the 1-sigma range of probability).

Feature 3325, Pit Structure

Description

Feature 3325 was found during backhoe stripping. After it was discovered, the southern half of the pit structure was excavated by hand. This pit structure was roughly circular and measured about 3.4 m in diameter. Seventeen postholes and one large intramural pit were revealed in the floor of the excavated portion. No entry was discovered, and no orientation for the structure could be determined. Feature 3325 was constructed in the fill of an earlier pit structure, Feature 3412. Oxidization of the floor and walls showed that the structure burned, but no artifacts were found on the floor.

Internal Features

Fifteen of the 17 postholes were arranged around the interior circumference of the structure wall (postholes A to O). They ranged in size from 12 cm to 26 cm in length, 10 cm to 29 cm in width, and 6 cm to 29 cm in depth. No artifacts were found in any of the postholes. The remaining two postholes, P and Q, were more centrally located in the southern half of the pit structure, close to the eastern edge of the intramural pit, Feature 3325.01. They ranged in size from 14 cm to 25 cm in length and 20 cm to 29 cm in width, but neither was excavated.

Feature 3325.01 was a large, elliptical pit, measuring 1.52 m in length, 1.03 m in width, and 59 cm in depth. The silt fill of the pit contained large amounts of fire-cracked rock and small amounts of burned daub. Artifacts recovered from the pit included pieces of flaked stone, unworked animal bone, two ceramic figurine fragments, a piece of ground stone, and a clay bead.

Internal Strata and Artifact Contents

About 14 cm of fill was excavated between the stripped surface and the floor. No discrete strata were visible in the fill. Fire-cracked rock and charcoal flecking were present throughout the fill and increased slightly with depth. Small lenses of ash were visible just above the floor of the pit structure. Very little burned daub was found in the fill of the structure. Artifacts recovered from the fill included pieces of flaked stone, a few sherds, some pieces of unworked animal bone, and one ceramic figurine fragment. No artifacts were recovered from the floor.

Construction and Remodeling Evidence

The locations of the postholes suggested the posts around the interior circumference of the structure represented wall support posts, while the two central postholes represented roof support posts. Oxidization of the floor and walls showed that the structure burned, but very little evidence remained of the probable wattle-and-daub superstructure. The walls and floor did not appear plastered or prepared in any way. No evidence of remodeling was discovered. The walls of this pit structure may have been slightly truncated by backhoe stripping.

Stratigraphic Relationships

Feature 3325 was constructed into the filled foundation pit of an earlier pit structure, Feature 3412. It is not intruded on by any other feature. This structure was found in close proximity to an arc of other pit structures arranged around an open central area.

Abandonment and Postabandonment

This structure appears to have been cleaned out before it was abandoned. Although oxidization of the floor and wall of the structure showed that it burned, the small amounts of burned daub suggested the superstructure either was not intact or was not preserved. Sometime after the structure was abandoned, it was filled with silt from a flooding episode. The filled foundation pit was then covered by alluvial and colluvial processes.

Date

A sample of charred maize from Feature 3325.01 provided a radiocarbon date of 2500±50 b.p. (uncalibrated ^{14}C years), or 780-520 B.C. (calibrated calendar years, at the 1-sigma range of probability).

Feature 3327, Pit Structure

Description

Feature 3327 was found during backhoe stripping. After its discovery, the pit structure was completely excavated by hand (Figure 4.48). The pit structure was roughly circular and measured approximately 3.4 m in diameter. Six postholes, a floor groove, a hearth, and two intramural pits were revealed in the floor of the pit structure. An underlying feature, Feature 3357, originally thought to be another earlier pit structure, was found to be an inhumation. No entry was discovered, and the orientation of the structure could not be determined. The structure was burned, and a large de facto artifact assemblage was found on the floor.

Internal Features

Six postholes were discovered in the floor of the pit structure. They were all roughly circular and ranged in size from 12-14 cm in length, 12-15 cm in width, and 9-13 cm in depth. The postholes were found arranged in a circle halfway between the center of the pit structure and the wall. They may have represented roof support posts for the superstructure.

Feature 3327.01 was a roughly circular, highly oxidized hearth with a basin-shaped profile. It was 21 cm in diameter and 6 cm deep. Located just northwest of the center of the pit structure, the hearth was filled with ash. The fill contained no artifacts.

Feature 3327.02 was a floor groove that extended the entire interior circumference of the structure wall. It averaged roughly 20 cm in width and 58 cm in depth, and its outer edge was contiguous with the structure wall for its entire length. Artifacts recovered from the silt fill of the groove included some fire-cracked rock, pieces of flaked stone, unworked animal bone, and a shell. Large chunks of oxidized daub were also found in the floor groove.

Feature 3327.03 was an oval intramural pit, 47 cm long, 36 cm wide, and 11 cm deep. Located just northwest of the hearth, Feature 3327.01, the silt fill of the pit contained no artifacts. This pit intruded on the fill of Feature 3357, the underlying inhumation.

Feature 3327.04 was an oval intramural pit that measured 56 cm in length, 42 cm in width, and 8 cm in depth. It was discovered just northwest of another intramural pit, Feature 3327.03. The fill of Feature 3327.04 was also silt, and it also contained no artifacts.

Internal Strata and Artifact Contents

Some 18 cm of fill was excavated between the stripped surface and the floor. The upper 12 cm of fill consisted of alluvial clays and contained small chunks of daub and charcoal flecking. This fill also contained large amounts of fire-cracked rock. Artifacts recovered from the upper fill included pieces of flaked stone, some unworked animal bone, a piece of ground stone, a mano fragment, a flaked stone core, some incipient plain ware sherds, and four intrusive Hohokam sherds.

The lower 6 cm of fill consisted of silt with abundant amounts of oxidized daub and charcoal. Many of the pieces of daub were large, and a few contained impressions of reeds and grasses. Artifacts recovered from the lower fill included pieces of flaked stone, a few utilized flakes, two incipient plain ware sherds, a biface fragment, a shell, three intrusive Hohokam sherds, and a ground stone fragment.

A large artifact assemblage was found on the floor, with most of the artifacts confined to the southern half of the structure. The floor assemblage consisted of 1 large metate, 1 mano, 1 lapstone, 5 hammerstones, 1 utilized piece of flaked stone, and 2 core tools.

Figure 4.48. Feature 3227, a Cienega phase pithouse, Brickyard locus, the Clearwater site, AZ BB:13:6 (ASM).

Construction and Remodeling Evidence

When excavated, the walls of the structure extended 18 cm above the floor. The walls of the pit structure may have been slightly truncated by backhoe stripping. The floor groove, central postholes, and oxidized daub indicated the presence of a superstructure, probably constructed of wattle and daub. Small areas of plaster found on the walls and floor suggested that both were plastered. No evidence existed for any renovation or remodeling of the structure.

Stratigraphic Relationships

This pit structure was constructed into the alluvial floodplain. When first excavated, the feature was thought to have been constructed into the fill of an earlier pit structure. The possible existence of a lower house was suggested by redeposited fill found in the bottom and side wall of an intramural pit, Feature 3327.03. Upon further investigation, this fill was found to actually be the fill of an inhumation, Feature 3357. The inhumation had been placed in a subfloor pit within the pit structure. When excavated, the boundaries of the burial pit were indistinct. One or both of the two intramural pits, Features 3327.03 and 3327.04, may actually represent the top of this burial pit. No other features intruded on this pit structure, nor did it intrude on any other features.

This pit structure is located in an arc of other pit structures arranged around an open central area.

Abandonment and Postabandonment

The oxidization of the floor and walls, as well as the large amounts of burned daub found in the fill, indicated the wattle-and-daub superstructure was probably still in place when the structure burned. The large artifact assemblage found on the floor was evidence that the structure was not cleaned out before the burning occurred. After the pit structure was abandoned, a flooding episode deposited silt in the structure. Alluvial and colluvial processes then filled the remainder of the foundation pit. Finally, these continuing processes covered the filled foundation pit.

Feature 3332, Pit Structure

Description

This feature was discovered during backhoe stripping under a large brick pad (Feature 3201) constructed for the brickyard. After it was exposed, the northern half of the structure was excavated completely by hand. This pit structure was roughly circular and measured roughly 3.27 m in diameter. Only the northern half of the structure was excavated. During excavation, Feature 3343, an intrusive pit, and Feature 3413, an underlying pit structure, were discovered. A floor groove was revealed in the floor of the excavated portion of the feature. No entry was discovered, and no orientation for the structure could be determined. Oxidization of the floor and walls suggested the structure burned, but no artifacts were recovered from the floor.

Internal Features

No postholes were revealed in the floor of the structure.

Feature 3332.01 was a floor groove that extended for most of the circumference of the northern half of the structure. The groove was contiguous with the wall in the northwestern quadrant of the structure. In the northeastern quadrant, the floor groove was interrupted for about 80 cm before it resumed and continued into the unexcavated southern half of the structure. In the northeastern quadrant, the groove was constructed into the fill of the lower structure, Feature 3413. During excavation, it was unclear if the interruption of the groove was intentional, or if it was simply not preserved in this area.

Internal Strata and Artifact Contents

Approximately 13 cm of fill was excavated between the stripped surface and the floor of the structure. The walls were slightly truncated by mechanical stripping, or by construction of the brick pad, Feature 3201. There were no discrete strata visible in the fill. The fill consisted of flood silt with large chunks of oxidized daub and a small amount of charcoal flecking. Fire-cracked rock was present throughout the fill. Artifacts recovered from the fill included abundant amounts of flaked stone, a few sherds, and a few pieces of unworked animal bone. No artifacts were recovered from the floor of the structure.

Construction and Remodeling Evidence

Large chunks of oxidized daub with reed impressions were discovered in the fill of the structure. This suggested the probable presence of a wattle-and-daub superstructure. Wall support posts were probably anchored in the floor groove. No evidence was discovered that the walls were plastered or prepared in any way.

Stratigraphic Relationships

Feature 3332 was partially constructed into the fill of an earlier pit structure, Feature 3413. The eastern one-third of the upper pit structure was constructed into the western third of the lower. Sometime after the upper structure was abandoned, it filled with silt from a flooding episode. An intrusive pit was later constructed through the fill of both the upper and lower structures. Feature 3332 was in close proximity to an arc of other pit structures arranged around a central open area.

Abandonment and Postabandonment

The presence of oxidized daub, as well as evidence of oxidization on the floor and walls, suggested this structure burned. The lack of artifacts on the floor indicated that the structure was likely cleaned out before it burned. After it was abandoned, the structure filled with silts from a flooding episode. An intrusive pit, Feature 3343, was constructed through the filled foundation pit. Both features were then covered by alluvial and colluvial deposits.

Feature 9168, Pit Structure

Description

Feature 9168 was first discovered in the profile of backhoe Trench 33. It was then uncovered during mechanical stripping and fully excavated by hand (Figure 4.49; see also Figure 4.42). This round pit structure measured approximately 3.8 m in diameter. Six postholes, a hearth, and a floor groove were exposed inside the pit structure. No entry was discernable, and the pattern of postholes was interrupted by the backhoe trench; therefore, orientation of the structure could not be determined. There was no evidence the pit structure burned. A small assemblage of artifacts was found spread across the floor.

Internal Features

Six postholes were discovered in the floor of the feature. Their measurements ranged from 12 cm to 18 cm in diameter and from 12 cm to 29 cm in depth. Five were discovered north of the backhoe trench that ran through the pit structure. These were arranged in an arc lying halfway between the pit edge and the center of the structure. Unworked animal bone was discovered in the fill of one of the postholes, Feature 9168.03. Only one additional posthole was discovered south of the trench.

Feature 9168.01 was a roughly circular, basin-shaped hearth. It was located just east of the center of the structure. Feature 9168.01 was 52 cm long, 44 cm wide, and 8 cm deep. Some oxidization was present in the bottom of the hearth, although there was evidence the feature had been disturbed by rodent turbation. The fill was light clayey silt with small lenses of fine gray ash. A small ovoid lens of ash, measuring 12 cm by 10 cm, was discovered on the floor of the structure just northwest of the hearth. This ash may have represented rake-out from the hearth.

Feature 9168.02 was a floor groove around the interior circumference of the pit structure. The width of the feature varied between roughly 10 cm and 24 cm, and its depth was about 24 cm below the level of the floor. It ran the entire circumference of the structure, except where it had been disrupted by the backhoe trench. North of the backhoe trench, the groove was mostly contiguous with the walls of the pit structure, separating in only two places. South of the trench, the groove was not contiguous with the structure wall anywhere along its length, sometimes separated by as much as 36 cm. The fill of this feature was a mixture of light silts and dark clays. Pieces of flaked stone and unworked animal bone were recovered from the feature. Also present were roughly 40 pieces of fire-cracked rock.

Internal Strata and Artifact Content

Approximately 21 cm of fill was excavated between the stripped surface and the floor of the pit structure. The upper 12 cm of fill was a light clayey silt with some charcoal flecking and pieces of daub. A few of the pieces of daub were slightly oxidized, but most were unburned. The lower 9 cm of fill was a mixture of light silts and dark clays. Charcoal flecking

Figure 4.49. Feature 9168, a Cienega phase pithouse, Brickyard locus, the Clearwater site, AZ BB:13:6 (ASM).

increased with depth, as did the concentration of daub, most of which was unburned. The floor of the pit structure was not burned.

Pieces of flaked stone and animal bone were recovered from both strata of the fill. The upper fill also contained two sherds, a core, a seashell, and a snail shell. The lower fill also contained a seashell. The density of fire-cracked rock was higher in the upper fill (*n* = 233) than in the lower (*n* = 101). A few pieces of flaked stone, some unworked animal bone, and two hammerstones were discovered spread across the floor. Twelve pieces of fire-cracked rock were also found in contact with the floor.

Construction and Remodeling Evidence

The floor groove probably represented the remnants of the wall support for the superstructure. The more central location of the postholes in the floor indicated they were possibly roof support posts. High amounts of daub present in the fill show that the superstructure was one of wattle-and-daub construction. The structure displayed no evidence of having been burned, and elements of the superstructure may have been scavenged after abandonment, or simply were not preserved.

When excavated, the walls extended 21 cm above the floor, although the walls may have been truncated by mechanical stripping. None of the surfaces or features in the structure appeared to have been plastered or prepared in any way. No evidence of remodeling for the pit structure was found.

Stratigraphic Relationships

This pit structure was built into the alluvial clays of the floodplain. After abandonment, the foundation pit was used to dump cultural trash and was partially filled by alluvial and colluvial processes. Feature 9168 intrudes into an earlier pit structure, Feature 3270. The northeastern quadrant of Feature 9168 was constructed into the fill of the southwestern quadrant of Feature 3270. It is not intruded on by any feature.

This pit structure lies in an arc of pit structures arranged around a central open area.

Abandonment and Postabandonment

Artifacts on the floor and ash left in the hearth suggested the feature was not cleaned out during abandonment. The structure did not burn, and it was unclear if the superstructure was scavenged after abandonment or if it was not preserved. This feature was primarily filled with alluvial deposits, colluvium, and cultural trash. A later flood episode filled the remainder with silt. The filled structure was eventually covered by continuing floodplain processes.

Feature 9357, Pit Structure (A "Bighouse")

Description

Feature 9357 was first discovered in backhoe Trench 112 during earlier testing of the site, and it was recorded as Feature 357. During subsequent excavation, the feature was completely exposed using mechanical stripping and rerecorded as Feature 9357. After it was exposed, the structure was completely excavated by hand (Figure 4.50).

This pit structure was circular and measured roughly 5.25 m in diameter. The feature was unusual in that it was significantly larger than any other pit structure discovered at the site. A plastered hearth, three large postholes, and three smaller possible postholes were discovered in the floor. A possible entryway was exposed in the southwestern quadrant of the structure that suggested it was oriented in that direction. Two inhumations and a gas pipe utility trench intruded on the eastern portion of the structure. The structure had burned, and a possible de facto artifact assemblage was recovered from the floor.

Internal Features

All the internal features discovered in the floor were in the southwestern quadrant of the pit structure. Feature 9357.01 was a plastered hearth with a raised, plastered collar. It measured 50 cm in length, 44 cm in width, and 9 cm in depth. Both the margins of the hearth and the collar itself showed signs of intense oxidization. The fill of the hearth was ashy silt overlying a layer of pure white ash. Artifacts recovered from the fill consisted of six pieces of flaked stone and 12 pieces of fragmentary unworked animal bone. Four pieces of fire-cracked rock were also found, but were not collected. The hearth was located southwest of the center of the structure.

Feature 9357.02 was a large posthole that measured 40 cm long, 38 cm wide, and 63 cm deep. It was located almost directly in the center of the structure. The size and location of the posthole suggested that it represented the central support post of the structure. A fragment of in situ burned post was collected from the posthole.

A possible entryway was exposed in the southwestern quadrant of this pit structure. It was represented by a slightly raised area of extremely compacted silty clay that measured about 1.3 m in length and 90 cm in width. It extended from the wall to

Figure 4.50. Feature 9357, a Cienega phase "bighouse," Brickyard locus, the Clearwater site, AZ BB:13:6 (ASM).

roughly one-third the distance to the central post. The area may have represented a small earthen ramp or step used when entering or exiting the structure. Further evidence that this may have served as an entrance was provided by the presence of two postholes, Features 9357.03 and 9357.04, on either side of the area.

Feature 9357.03 was a posthole that measured 25 cm in length, 24 cm in width, and 28 cm in depth. It was located at the northeastern corner of the possible entryway.

Feature 9357.04 was a posthole that measured 32 cm long, 26 cm wide, and 57 cm deep. It was located at the northwestern edge of the possible entryway.

The location of these two postholes, Feature 9357.03 and Feature 9357.04, suggested they served as roof support posts, perhaps on either side of an egress to the structure. Except the central support post, Feature 9357.02, postholes were not found in any other quadrant of the structure. These postholes, along with the location of the hearth and the discovery of the redeposited clay, suggested the possibility that this area served as an entrance to the pit structure.

Posthole A was a roughly circular posthole that measured 15 cm in length, 13 cm in width, and 9 cm in depth. It was located 5 cm northwest of the hearth and contained the same ashy silt fill as the hearth. The location of posthole A suggested it may have served a function related to the hearth.

Posthole B was a slightly oval posthole that measured 29 cm in length, 23 cm in width, and 9 cm in depth. It was located halfway between Feature 9357.03 and Feature 9357.04, just under the edge of the clayey deposit thought to represent the entryway. Its function was unclear, although it may represent something associated with construction or possible remodeling of the entryway.

Posthole C was a slightly oval posthole, 17 cm long, 12 cm wide, and 6 cm deep. It was located just northwest of Feature 9357.04. Its function was unclear, although it may represent something associated with construction or possible remodeling of the entryway.

Internal Strata and Artifact Contents

Approximately 58 cm of fill was excavated between the stripped surface and the floor. Two discrete strata were identified in the fill of the structure. The upper 40 cm of fill was composed of mottled clay and silt with large quantities of fire-cracked rock. Over 1,500 pieces of fire-cracked rock were discovered in the upper fill, over 400 of which were greater than 5 cm in diameter. The density of artifacts in this stratum was also high. Artifacts in the fill consisted of about 260 pieces of flaked stone, 30 sherds, more than 700 pieces of unworked animal bone, 9 flaked stone cores, 48 ground stone fragments, 2 pecking stones, a hammerstone, a mano, a Cienega style projectile point, a possible spindle whorl, and a human tooth. A few small pieces of burned daub and some light charcoal flecking were also present in the upper fill.

The lower 18 cm of fill consisted of silt mixed with large quantities of roof/wall fall. The density of oxidized daub and charcoal flecking increased as the density of fire-cracked rock dropped off sharply. Less than 300 pieces of fire-cracked rock were present in the lower fill, of which only 57 measured more than 5 cm in diameter. Some of the larger pieces of oxidized daub contained reed and grass impressions, and a few were collected. Larger pieces of charcoal and some small lenses of ash were also noted in the lower fill.

Artifacts recovered from the fill consisted of 198 pieces of flaked stone, 14 sherds, approximately 150 pieces of unworked animal bone, 3 ground stone fragments, 3 pieces of incipient plain ware sherds, a shell, a Cienega style projectile point, and 1 flaked stone core.

Twenty pieces of human bone were recovered from the lower fill, concentrated in the extreme eastern side of the structure. These human bone fragments, as well as the human tooth from the upper fill, were thought to have come from the two inhumations that intruded on the eastern edge of the structure.

A floor assemblage was also discovered, confined primarily to the southwestern quadrant of the structure, near the possible entryway. The assemblage included 6 flaked stone scatters, a piece of ground stone, 1 fragmentary piece of unworked animal bone, 2 flaked stone cores, and 4 hammerstones. Pieces of several burned posts were also exposed on the floor, and samples were collected.

Construction and Remodeling Evidence

When excavated, the walls of the structure were about 55 cm above the floor. The walls of the structure may have been slightly truncated by mechanical stripping, but their condition seemed to suggest they were primarily intact. In addition to be being larger in diameter, this structure was also significantly deeper than any of the other structures discovered at the site.

The construction details of the pit structure were very well preserved. Plaster was visible on much of the floor and over half the length of the wall. Plaster preservation on the wall was damaged primarily by intrusive features, such as the two inhumations and the backhoe trench. Wall plaster preservation allowed details of the construction to be observed. The foundation pit for the structure appeared to have been excavated, then the walls backfilled slightly before the plaster was applied. The pit was excavated into the alluvial clays of the floodplain, with the walls belling slightly toward the base. Between 3-5 cm of silty clay fill was placed against the foundation pit edge, preserving the bell shape of the wall. A 1-m- to 2-m-layer of plaster was applied to the fill, again having preserved the bell shape of the original construction. The plaster appeared to be composed of a single layer, and multiple episodes of plastering were not obvious. A few small areas of the wall plaster contained impressions that may have been formed by wall support posts placed against it. The wall plaster and the fill behind it showed signs of oxidization.

The plaster on the floor of the structure was found in a similar state of preservation as the walls. It also seemed to be from a single episode of plastering that was placed directly on the floor of the constructed foundation pit without any fill between. The hearth of the structure was similarly plastered, with a raised, plastered collar around its circumference. Much of the intact plaster on the floor displayed oxidization. Postholes showed up plainly in the plastered floor. The lack of other postholes in the floor beyond those discovered suggested that any other wall support posts were anchored in the bell of the pit walls or in the ground outside the foundation pit.

The compact clay deposit found in the southwestern quadrant of the structure indicated this area may have functioned as an entryway. Postholes discovered on either side of this deposit seemed to suggest roof support posts that reinforced the area around an opening in the superstructure.

It was unclear if the structure had undergone any episodes of remodeling. The redeposited fill behind the wall plaster may have indicated an episode of remodeling, or it may have been an original detail of construction. The single layer of wall and floor plaster suggested it was applied in one episode of construction. Whether the plaster represented an original feature or a remodeling of the structure was unknown. The only other evidence for a possible remodeling were postholes B and C. These two postholes may have served as roof supports around a possible entryway previous to the placement of posthole Features 9357.03 and 9357.04.

Stratigraphic Relationships

This pit structure was constructed into the alluvial floodplain. It did not intrude on any other feature. The Feature 9357 structure was intruded on by two inhumations, Features 3267 and 3268. These inhumations intruded on the extreme eastern edge of the structure sometime after the foundation pit was filled. It was thought that the elements of human bone recovered from the structure came from these inhumations. In more modern times, construction of a gas line for the scove kiln at the brickyard also cut through a portion of the eastern half of the structure. The gas line trench intruded less than 15 cm into the top fill of the structure.

This pit structure was located near a small cluster of other structures to the east, and the possible entryway looks toward another larger cluster of structures to the southwest.

Abandonment and Postabandonment

Oxidization found on the wall and floor plaster, as well as the large amounts of oxidized daub, indicated that the structure burned. The type of artifacts discovered on the floor suggested it had been at least partially cleaned out before it burned. Sometime after the structure burned, a flooding episode deposited silt in the foundation pit of the structure, filling it partially. The remainder of the structure was filled by alluvial and colluvial processes. These continuing processes later covered the filled foundation pit. After the structure had filled, two intrusive inhumations were constructed through the fill. During more modern times, construction of the gas line for the brickyard also intruded on the filled structure.

Date

A sample of charred maize provided a radiocarbon date of 2620±40 b.p. (uncalibrated ^{14}C years), or 820-790 B.C. (calibrated calendar years at the 1-sigma range of probability). Another sample of maize that yielded a radiocarbon date of 2010±40 b.p. was rejected because it is a statistical outlier from all other radiocarbon dates on prehistoric features from the Brickyard locus.

Feature 9372, Pit Structure

Description

Feature 9372 was originally discovered in the profile of backhoe Trench 114. The entirety of the feature was then exposed through mechanical stripping and excavated by hand (Figure 4.51). This feature was a round structure measuring some 4.09 m in diameter. Forty-six postholes and one intramural pit were found inside the structure. No entry was identifiable, and orientation of the pit structure could not be determined because the backhoe trench interrupted the posthole pattern. The structure burned, and a small, possibly de facto artifact assemblage was found on the floor. This feature was probably the remains of a habitation.

Internal Features

Forty-six postholes were revealed in the floor. They ranged in size from 10 cm to 34 cm in diameter and 5 cm to 53 cm in depth. Forty-three of the postholes were arrayed around the interior circumference of the pit structure. The remaining three postholes were evenly spaced along a line running just south of the center of the pit structure. A flake was collected from one of the postholes, Feature 9372.02, and part of a burned post was removed from another posthole, Feature 9372.03.

Feature 9372.01 was an irregularly shaped pit with some slight oxidation on the bottom. The pit measured 42 cm in length, 36 cm in width, and 15 cm deep. It was located slightly west of the center of the pit structure. It is unlikely that this was a hearth, as the oxidization was only slight, and no ash was found in the fill.

Internal Strata and Artifact Contents

Approximately 19 cm of fill was excavated between the stripped surface and the floor of the pit structure. The fill was flood silt mixed with large amounts of heavily oxidized daub. Both daub and charcoal were present at the top of the fill and increased in concentration toward the floor. A patchy charcoal lens about 1-2 cm thick was present above the floor. The floor of the pit structure showed areas of oxidation.

The fill contained flaked stone, unworked animal bone, two pieces of ground stone, a pecking stone, and a Cienega style projectile point. Approximately 231 pieces of fire-cracked rock were found throughout the fill, with only 24 pieces over 5 cm in diameter. No fire-cracked rock was found on the floor. Four pieces of flaked stone, one flaked stone tool, and a biface were found on the pit structure floor. The entire floor assemblage, except one flake, was clustered in the extreme southern end of the pit structure.

Figure 4.51. Feature 9372, a Cienega phase pithouse, Brickyard locus, the Clearwater site, AZ BB:13:6 (ASM).

Construction and Remodeling Evidence

The high concentrations of charcoal and daub indicated the superstructure was of wattle-and-daub construction. The walls of the pit structure extended at least 19 cm above the floor, although they may have been slightly truncated by mechanical stripping. Neither the walls nor the floor showed evidence of being plastered or prepared in any way. The postholes may have held wall support posts, although it is unknown if they were all in use at the same time. Other than the large number of postholes, there was no evidence the pit structure was remodeled.

Stratigraphic Relationships

This pit structure was constructed into the alluvial clays of the floodplain. After the superstructure burned and collapsed onto the floor, the feature filled with flood silt. Feature 9372 intrudes on an earlier extramural pit, Feature 3269, located just to the north. Feature 373, an additional extramural pit, was discovered in the trench profile just east of the pit structure. Both pits were left unexcavated. Feature 9372 was in an arc of pithouses arranged around a central open area.

Abandonment and Postabandonment

The small number of artifacts on the floor suggested the pit structure may have been cleaned out before it burned. However, high concentrations of charcoal and daub showed that the superstructure was still in place when the burning occurred. Shortly after the structure burned, the feature filled rapidly with waterborne silt.

Feature 9376, Pit Structure

Description

This feature was first discovered in profile in backhoe Trench 114 during earlier testing of the site and was recorded as Feature 376. During subsequent excavation, what remained of the structure was uncovered by backhoe stripping under drying racks from the brickyard, Feature 3205, and was renumbered as Feature 9376. Construction of the drying racks severely impacted the pit structure so that only a small portion remained intact immediately south of Trench 114. Any part of the feature north of the trench had been destroyed. The structure was further impacted when a utility trench for the gas line of the brickyard scove kiln was excavated through it.

The remaining portion of this pit structure measured about 1.75 m in length and 1.50 m in width. The outline of the walls suggested that, when constructed, the pit structure was probably rectangular with rounded corners. Two postholes were exposed within the floor of the structure, one of which was impacted by the gas line trench. No entry was discovered, and the orientation of the structure could not be determined. The structure appeared to have burned. Only one artifact was found in contact with the floor.

Internal Features

Two postholes were revealed in the floor of the structure. Feature 9376.01 was a circular posthole, 20 cm in diameter and 28 cm deep. Feature 9376.02 was a circular posthole, 15 cm in diameter and 16 cm deep.

Internal Strata and Artifact Contents

Approximately 13 cm of fill was excavated between the stripped surface and the floor of the structure. No discrete strata were discernable in the fill. The fill consisted of silt mixed with large concentrations of oxidized daub, and it contained very few artifacts. Artifacts consisted of a few pieces of flaked stone and two sherds. Only one artifact, a possible flaked stone tool, was found on the floor, along with a scatter of fire-cracked rock.

Construction and Remodeling Evidence

The large amounts of oxidized daub suggested the existence of a wattle-and-daub superstructure. The two postholes probably represent support posts for this superstructure. Little can be said about the walls due to the severe impact of brickyard construction. The remaining wall portions and the floor did not appear to be plastered or prepared in any way.

The outlines of the walls of this structure suggested it may have been rectangular in shape. Only one structure at the site, Feature 3293, was rectangular in shape, and it appeared to date from a later period than the circular pit structures. Due to the severe disturbance to the pit structure, it was impossible to definitively determine its original shape.

Stratigraphic Relationships

This structure was built into the alluvial floodplain. It did not intrude on any other features. The structure was intruded on by the drying racks from the brickyard, Feature 3205, a gas pipe utility trench, and backhoe Trench 114.

Abandonment and Postabandonment

The abundant amounts of oxidized daub and patchy oxidization on the floor suggested it had burned. The lack of artifacts on the floor seemed to indicate that the structure was cleaned out prior to abandonment. Sometime after it was abandoned, the structure filled with flood silts. Continuing alluvial and colluvial processes then buried the filled foundation pit. Later construction at the brickyard severely impacted what remained of the buried structure.

PREHISTORIC PITS

Feature 3221, Pit

This small, basin-shaped pit was discovered during mechanical stripping. It measured 1.20 m in length, 1.12 m in width, and 9 cm in depth. Fill of the pit was tan silt with small pieces of charcoal, burned daub, and some fire-cracked rock. The margins of the pit were not oxidized. Artifacts recovered from the fill included six pieces of flaked stone, a fragment of ground stone, and a few pieces of animal bone.

Feature 3222, Pit

This small circular pit was discovered during mechanical stripping and was subsequently completely excavated by hand. It measured 70 cm in length, 68 cm in width and 19 cm in depth. Upper fill of the pit was tan silt, while the lower fill was brown silty clay. Small charcoal flecks, pieces of fire-cracked rock, and burned daub were present throughout both strata. Six pieces of flaked stone were recovered from the fill.

Feature 3223, Pit

This small circular pit, discovered during mechanical stripping, had straight walls and a flat bottom. It was 84 cm long, 82 cm wide, and 21 cm deep. The fill was brown silty clay with a few flecks of charcoal and some small gravels. Artifacts recovered from the fill included five small sherds and four pieces of flaked stone. Small patches of oxidization and charcoal were visible in the margins of the pit.

Feature 3225, Pit

This small ovate pit was originally identified as part of the remains of Feature 355, a historic-era structure during backhoe trenching in 1995 (Thiel 1995). When the historic structure was excavated, it was found to be intrusive to this small prehistoric pit. The intrusive structure destroyed the upper part of the eastern margins of the pit.

Feature 3225 measured 1.03 m in length, 45 cm in width, and 45 cm in depth. The profile of the pit was basin shaped. Fill was a highly compacted brown silty clay with small pieces of charcoal and burned daub. The western margin of the pit was highly oxidized. Artifacts recovered from the fill included pieces of flaked stone and a few ground stone fragments. Several small fire-cracked rocks were also noted in the fill, but were not collected.

Feature 3229, Pit

This small circular pit was discovered during mechanical stripping. Another small pit, Feature 3358, intruded on its western side. Only the southern half of the pit was excavated, but the projected dimensions of the pit were 88 cm long, 83 cm wide, and 12 cm deep. Fill of the pit was tan silt that did not contain any artifacts. A fragment of a metate was recovered from the base of the southern half of the pit.

Feature 3237, Pit

This small circular pit was discovered during mechanical stripping. The backhoe impacted the upper portion of the pit, which measured at least 12 cm higher than the level at which it was discovered. A large metate fragment, three mano fragments, and a hammerstone were recovered from the impacted upper portion of the pit. The remaining in situ portion of the pit measured 44 cm in length, 40 cm in width, and 10 cm in depth.

Fill of this remaining portion of the pit was grayish-brown silty clay with some charcoal flecking and small pieces of fire-cracked rock. Margins of the pit did not appear to be oxidized. Artifacts recovered from the in situ fill included an additional fragment of a metate and one piece of flaked stone. This second metate fragment was found resting on the bottom of the pit.

Feature 3238, Pit

This small circular pit was discovered during mechanical stripping, and the eastern half was excavated by hand. The pit was basin shaped in profile, and it measured 1.31 m in length, 1.12 m in width, and 37 cm in depth. Fill was grayish-tan silty clay that increased in clay content toward the base of the pit. Large quantities of charcoal, burned daub, and fire-cracked rock were present in the fill. Artifacts recovered from the fill included six pieces of animal bone, a fragment of ground stone, and about 30 pieces of flaked stone. A few snail shells were also recovered.

Feature 3240, Pit

This small pit was discovered during mechanical stripping, and the northern half was then excavated by hand. It was circular in shape, and was 92 cm long, 90 cm wide, and 22 cm deep. The fill consisted of uniform grayish-brown silt with large quantities of burned daub and fire-cracked rock also present. A few pieces of flaked stone and animal bone were the only artifacts recovered from the fill of the pit.

Feature 3241, Pit

This small circular pit was discovered during mechanical stripping, and the southern half was then excavated by hand. The pit was basin shaped in profile, and measured 65 cm in diameter and 16 cm in depth. The fill of the pit was grayish-brown silty clay with small pieces of charcoal and unburned daub. The only artifact recovered from the fill was a single piece of flaked stone.

Feature 3242, Bell-shaped Pit

This bell pit was discovered during mechanical stripping, and the southern half of the pit was then excavated by hand. The pit measured 90 cm in length and 88 cm in width at its top. The 46-cm-deep pit had a basal length of 95 cm and an inferred basal width of 93 cm. The fill was grayish-brown silty clay, with small pieces of charcoal, burned daub, and fire-cracked rock throughout. Small patches of oxidization were visible on the margins of the pit. Artifacts recovered from the fill of the feature included pieces of flaked stone, some animal bone, and a few pieces of shell.

Feature 3243, Pit

This small pit was discovered during mechanical stripping, and the southern half was then excavated by hand. The pit was irregularly shaped, and measured 67 cm in length, 53 cm in width, and 12 cm in depth. The fill was highly compacted tan silty clay with no artifacts.

Feature 3244, Pit

This small circular pit was discovered during the excavation of a pit structure, Feature 3220, into which it intruded. The pit measured 90 cm in length and 80 cm in width. Only the portion of Feature 3244 that intruded on Feature 3220 was excavated, so the depth remained unknown. Fill of the pit was dark brown clay with some charcoal and numerous fragments of fire-cracked rock. Any artifacts present were collected with the fill of the pit structure and listed as mixed.

Feature 3248, Pit

This small circular pit was discovered during mechanical stripping, and the southern half was then excavated by hand. The pit measured 76 cm in length, 72 cm in width, and 13 cm in depth. The fill was grayish-brown silty clay with no artifacts.

Feature 3249, Pit

The northern half of this small circular pit was excavated by hand. The pit was 86 cm long, 78 cm wide, and 12 cm deep. Fill of the pit was gray-brown silty clay with 90 pieces of fire-cracked rock over 5 cm in diameter. The margins of the pit were oxidized. No artifacts were recovered from the fill of the feature.

Feature 3252, Pit

This small oval pit was discovered during mechanical stripping, and the southern half was then excavated by hand. The pit was basin shaped in profile, and measured 88 cm in length, 74 cm in width, and 17 cm in depth. The fill was uniform grayish-brown silty clay with no artifacts.

Feature 3253, Pit

This small circular pit was discovered during mechanical stripping, and the southern half of the feature was then excavated by hand. The pit measured 78 cm in length, 56 cm in width, and 20 cm in depth. The fill was tan silt with five pieces of fire-cracked rock over 5 cm in diameter. Ten pieces of flaked stone were also collected from the fill.

Feature 3261, Pit

This small circular pit was discovered during mechanical stripping, and the western half was then completely excavated by hand. It was basin shaped in profile and measured 88 cm in length, 83 cm in width, and 25 cm in depth. The fill was tan silt with a few small pieces of fire-cracked rock and burned daub. A single piece of flaked stone was the only artifact recovered from the fill.

Feature 3263, Pit

This small oval pit was discovered during mechanical stripping, and the northern half was then excavated by hand. It was basin shaped in profile and measured 1.1 m in length, 62 cm in width, and 23 cm in depth. The fill was brown silty clay with a few small pieces of fire-cracked rock. The margins of the pit did not appear oxidized. Artifacts recovered from the fill included sherds and pieces of flaked stone.

Feature 3266, Pit

This small circular pit was discovered during mechanical stripping, and the northern half was then excavated by hand. It had straight side walls and a flat base. The pit measured 82 cm in length, 74 cm in width, and 13 cm in depth. The fill was tan silt with some dark brown clay mottling. Charcoal flecking was present in the upper portion of the fill. Artifacts recovered from the fill included pieces of flaked stone and some animal bone. Eleven pieces of fire-cracked rock were also noted in the fill, but were not collected.

Feature 3272, Bell-shaped Pit

This bell pit was discovered during mechanical stripping, and was then completely excavated by hand. The pit was 86 cm long, 74 cm wide at the top, and 64 cm deep. The basal length was 89 cm, and the basal width was 85 cm. The fill was dark brown silty clay with over 160 pieces of fire-cracked rock greater than 5 cm in diameter. The margins of the pit were heavily oxidized. Artifacts recovered from the fill included pieces of flaked stone, a few fragments of ground stone, some animal bone, and a small piece of burned maize cob.

Feature 3284, Pit

This small circular pit was discovered during mechanical stripping, and the northern half was then excavated by hand. It was basin shaped in profile, and measured 96 cm in diameter and 13 cm in depth. The fill was brown silty clay with a few small pieces of fire-cracked rock. The margins of the pit did not appear to be oxidized. Artifacts recovered from the fill included a few pieces of flaked stone and a flaked stone core.

Feature 3285, Pit

This small circular pit was discovered during mechanical stripping, and the northern half was then excavated by hand. It was basin shaped in profile, and measured 60 cm in diameter and 13 cm in depth. The fill was brown silty clay with darker pockets of compacted clay scattered throughout. Artifacts recovered from the fill included pieces of flaked stone and animal bone.

Feature 3287, Roasting Pit

This irregularly shaped roasting pit was discovered during mechanical stripping. Much of the top of the feature was stripped away before it was noted. The roasting pit was intrusive to the fill of Feature 3293, a rectangular pit structure. The in situ portion of Feature 3287 measured 90 cm in length, 62 cm in width, and 5 cm in depth. The fill was dark brown silty clay with numerous pieces of fire-cracked rock. Approximately 58 pieces were recovered from the small in situ portion of the feature. Soil around the margins of the roasting pit showed some light oxidization. Artifacts recovered from the fill included 23 sherds, four pieces of flaked stone, and a single piece of animal bone.

Feature 3288, Pit

This small ovate pit was exposed during mechanical stripping, and the southern half of the feature was then excavated by hand. It was basin shaped in profile, and it was 1.44 m long, 10 cm wide, and 14 cm deep. The fill was dark brown silty clay with 15 pieces of fire-cracked rock greater than 5 cm in diameter. Artifacts recovered from the fill included a few sherds and pieces of flaked stone.

Feature 3289, Pit

This small circular pit was discovered during mechanical stripping, and the northern half was then excavated by hand. It was basin shaped in profile, and measured 1.06 m in length, 99 cm in width, and 3 cm in depth. The fill was dark brown silty clay with approximately 30 pieces of fire-cracked rock measuring less than 5 cm in diameter. Artifacts recovered from the fill included sherds and pieces of flaked stone.

Feature 3295, Pit

This small oval pit was discovered during excavation of Feature 3260, a pit structure near the eastern edge of the pit. The western half of Feature 3295 was excavated by hand. It was basin shaped in profile, and measured 90 cm in length, 82 cm in width, and 17 cm in depth. The fill was dark brown clay, with abundant small pieces of charcoal throughout. A few pieces of fire-cracked rock less than 5 cm in diameter were noted, but not collected. Neither the walls nor the base of the pit showed any signs of oxidization. Artifacts recovered from the fill included pieces of flaked stone and animal bone.

Feature 3313, Roasting Pit

This small circular roasting pit was discovered during excavation of a pit structure, Feature 3296, into which it intruded. The pit was impacted by two historic features: a brick-lined pit, Feature 3209, and a rail line, Feature 3213. Only the bottom portion of the northern half of the pit remained in situ. The fill of this portion was removed by hand. The fill was dark brown silty clay with abundant amounts of charcoal and fire-cracked rock. Over 70 pieces of fire-cracked rock were recorded, most measuring less than 5 cm in diameter. No artifacts were recovered from the fill of the feature.

Feature 3316, Slab-lined Pit

This circular slab-lined pit was discovered during mechanical stripping, and was then completely excavated by hand (Figure 4.52). It intruded into the fill of Feature 3312, an earlier pit structure. The pit was basin shaped and measured 50 cm in length, 49 cm in width, and 37 cm in depth. Slabs of limestone lined the margins of the pit, with an additional slab placed flat to serve as a base for the feature. A few slabs removed by the backhoe may have functioned as a cap over the pit. The slabs averaged 20 cm long, 20 cm wide, and 4 cm thick. The fill of the pit was tan clayey silt with a few pieces of unburned daub and small charcoal flecks. Two pieces of flaked stone were recovered from the fill.

Feature 3318, Pit

This small circular pit was discovered during mechanical stripping, and the northern half was then completely excavated by hand. The pit was basin shaped in profile, and measured 63 cm in diameter and 9 cm in depth. The fill of the pit was tan clayey silt with some light charcoal flecking. A few pieces of flaked stone were recovered from the fill.

Feature 3320, Pit

This oval pit was discovered during mechanical stripping, and the southwestern half was then excavated by hand. It intruded through an extramural surface, Feature 3317, also discovered during mechanical stripping. The pit had straight side walls, and measured 88 cm in length, 65 cm in width, and 44 cm in depth. The fill was dark brown clay with small pieces of charcoal and burned daub. Nineteen pieces of flaked stone and one piece of animal bone were recovered from the fill. Six pieces of fire-cracked rock greater than 5 cm in diameter were also noted, but were not collected.

Figure 4.52. Feature 3316, a slab-lined pit, Brickyard locus, the Clearwater site, AZ BB:13:6 (ASM).

Feature 3326, Pit

This small circular pit was discovered during mechanical stripping, and the northern half was then excavated by hand. The pit was basin shaped in profile, and measured 66 cm in length, 65 cm in width, and 23 cm in depth. The fill of the pit was tan clayey silt. Pottery sherds and pieces of flaked stone were recovered from the fill.

Feature 3328, Pit

This small circular pit was discovered during mechanical stripping, and the western half was then excavated by hand. It intruded through an extramural surface, Feature 3317, also discovered during mechanical stripping. Pit Feature 3328 had straight side walls, and it measured 70 cm in length, 65 cm in width, and 39 cm in depth. The fill of the pit was tan clayey silt that contained abundant charcoal flecks and small pieces of burned daub. Artifacts that were recovered from the pit included 28 pieces of flaked stone and five pieces of animal bone. Thirty-two pieces of fire-cracked rock were also noted in the fill, although these were not collected.

Feature 3329, Pit

This small circular pit was discovered during mechanical stripping, and the northern half was then excavated by hand. The pit was basin shaped in profile, and was 78 cm long, 70 cm wide, and 15 cm deep. The fill of the pit was grayish-tan clayey silt with a few small pieces of charcoal and burned daub. Pieces of flaked stone and animal bone were recovered from the fill.

Feature 3331, Pit

This small circular pit was discovered during mechanical stripping, and the northern half was then excavated by hand. The pit was basin shaped in profile, and measured 60 cm in length, 54 cm in width, and 6 cm in depth. The fill was tan clayey silt with a few small pieces of charcoal and some oxidized daub. No artifacts were recovered from the fill of the pit.

Feature 3334, Pit

This oval pit was discovered during mechanical stripping, and the western half was subsequently excavated by hand. Pit Feature 3334 was basin shaped in profile, and measured 1.98 m in length, 48 cm in width, and 28 cm in depth. The fill was tan clayey silt with dark brown lumps of clay throughout. Two sherds and six pieces of flaked stone were recovered from the fill. Seven pieces of fire-cracked rock greater than 5 cm in diameter were also noted, but were not collected.

Feature 3336, Pit

This small circular pit was discovered during excavation of Feature 3213, a historic rail line. The pit was basin shaped in profile, and was approximately 60 cm in diameter and 44 cm in depth. It was constructed into the fill of a prehistoric pit structure, Feature 3296. The rail line truncated the southern half of both Feature 3336 and Feature 3213, into which it was intrusive.

The remaining fill of the pit was subsequently removed by hand-excavation. The fill was dark brown silty clay with abundant amounts of charcoal. The base of the pit appeared to be slightly oxidized. Artifacts recovered from the fill included ground stone, pieces of flaked stone, and some animal bone. Three pieces of fire-cracked rock greater than 5 cm in diameter were also noted, although these were not collected.

Feature 3358, Pit

This small circular pit was discovered during excavation of another small pit, Feature 3229, into which it intrudes. Only the southern portion of pit Feature 3358 was excavated. The pit was basin shaped in profile, and measured 42 cm in diameter and 18 cm in depth. The fill was brown silty clay with small pieces of charcoal included throughout. Most of the artifacts recovered from Feature 3358 were collected as being mixed with fill from Feature 3229, the underlying pit. One mano was collected as unmixed from the base of the pit.

OTHER PREHISTORIC FEATURES

Feature 3317, Extramural Surface

This extramural surface was found during mechanical stripping, and the northern half was subsequently cleared by hand. The cleared area measured 2.15 m in length and 1.55 m in width. The surface was characterized by a slight depression that rose gently from east to west. Fill above the surface consisted of dark brown clay, with abundant amounts of charcoal and a high concentration of oxidized daub throughout. The average depth of fill over the surface was approximately 10 cm. Artifacts recovered from the fill included 28 pieces of flaked stone, one ground stone mano, a piece of oxidized daub containing reed impressions, a few snail shells, and pieces of both worked and unworked animal bone. One small pecking stone was collected from the surface of Feature 3317.

Two small pits, Features 3320 and 3328, intruded through Feature 3317, while two additional small pits, Features 3321 and 3323, also originated at this surface. The two small pits originating at this surface were not excavated.

HISTORIC-ERA FEATURES

The historic-era features of the Brickyard locus were created during the use of the area by the Tucson Pressed Brick Company, in operation from the 1890s to the 1960s. A portion of the brickyard was previously investigated during the A-Mountain Storm Drain project, and the Rio Nuevo fieldwork uncovered most of the rest of this industrial complex (Diehl and Diehl 1996).

Feature 3200, Scove Kiln Foundation

This adobe foundation was discovered during backhoe stripping around Feature 3201, a large brick surface (Figure 4.53). After it was exposed, the foundation was uncovered by hand. The foundation consisted of two courses of adobe bricks placed side by side. Portions of the southeastern corner of the wall were uncovered during earlier excavations (Diehl 1996), and were recorded as Feature 1004 at that time. Using Sanborn Fire Insurance maps, the adobe bricks were determined to be the foundation for a scove kiln. This information was consistent with oxidization found on the inner course of bricks. Considered as a whole, the kiln foundation measured roughly 33 m long and 11 m wide. The foundation wall was about 85 cm wide along its length.

During the more recent excavation, the remaining portions of the kiln foundation were uncovered, as was a small part of the originally excavated foundation. The wall appeared to have been cut by two large brick surfaces, Features 3201 and 1001, on its eastern and western sides. Feature 3203, a concrete surface, extends through and around cuts in both the eastern and western ends of the foundation. The openings formed by the cuts measured approximately 2.7 m in length. The original purpose of the concrete surface was unknown.

The two courses of the adobe wall were placed side by side and, as previously recorded (Diehl 1996), were aligned differently with respect to the face of the wall. The inner course of bricks was arranged with the long axes perpendicular to the wall face, while the outer course had the long axes parallel to the wall face. The blocks of both courses were similar in size and averaged 50 cm long and 2 cm wide. The inner course of blocks was reddened from oxidization, while the outer course appeared gray and unoxidized.

This kiln was present on the 1919 Sanborn Fire Insurance map. However, the kiln was already gone on the 1922 map, and the Transformer House stands in place of the kiln's southeastern corner.

Figure 4.53. Feature 3200, a scove kiln foundation, Brickyard locus, the Clearwater site, AZ BB:13:6 (ASM).

Feature 3201, Brick Surface

This brick surface was discovered during backhoe stripping at the site, and was subsequently completely excavated by hand (Figure 4.54). The surface consisted of closely fit, dry-laid bricks lying on their

Figure 4.54. Feature 3201, a brick surface, Brickyard locus, the Clearwater site, AZ BB:13:6 (ASM).

long ends. The brick surface measured 27.90 m in length and 4.75 m in width. It was lined on the northern, western, and eastern sides by wooden planks. The southern side of the feature was heavily disturbed by an overlying concrete surface, Feature 3203, and the foundations of a pug mill, Feature 3202. Ripper marks were visible near the disturbed area of the brick pad and many of the bricks were deformed. This brick surface is practically identical to another brick surface discovered during previous testing (Diehl 1996) and recorded as Feature 1001. The two brick surfaces, Features 1001 and 3201, may have been part of the same surface at some time.

The surface was difficult to date because it does not appear on any Sanborn Fire Insurance maps or in any of the aerial photographs of the site. Because the brick pad cuts the walls of a scove kiln shown in use in 1919, it must postdate the kiln. The concrete surface, Feature 3203, that cuts the brick pad underlies the Transformer House shown in the Sanborn map of 1922. Therefore, the brick pad must have been constructed, used, and at least partially destroyed between 1919 and 1922.

Feature 3202, Pug Mill Foundation

Feature 3202 represented the remains of the foundation for one of the brickyard's pug mills (Figure 4.55). The foundation consisted of walls of poured concrete constructed into a pit excavated below the ground surface. The concrete foundation walls contained heavy rebar, some of which protruded out of the top of the foundation. The foundation wall on the eastern side was straight along its length, and measured 3.25 m in length, 90 cm in width, and 1.97 m in depth. The western foundation wall was slightly longer and had two extensions coming off it toward the west. The portion of the western foundation wall running parallel to the eastern wall was 10.6 m long, 90 cm wide, and 2.02 m deep. The branches ran off the northern and southern ends of this wall at roughly 45-degree angles. The branches were 4.6 m long and 2.0 m wide. These branch walls descended into Feature 3203, the poured concrete surface, and could not be excavated to their full depth. Both of these branch walls had large pieces of heavy-duty rebar protruding from their top surfaces.

Construction details of Feature 3202 indicated the walls served as a foundation for a piece of heavy machinery used at the brickyard. The size and configuration of the foundation suggested it may have supported a pug mill for processing the clay used for making bricks. Historic pictures taken of pug mills in use at the brickyard show the machine was the same general shape as the foundation. In the construction of this foundation, a pit would have been excavated, the foundation poured, and the pit backfilled. These processes fit with the general information gathered during excavation of the feature.

No dates are known for the construction or use of this feature. It does not appear on any of the Sanborn Fire Insurance maps between 1919 and 1960, nor in any of the aerial photographs of the site. The only limiting factor on dates of its use is the fact that it cuts a concrete surface, Feature 3203, also present in that area. The concrete surface was lain sometime between 1919 and 1922, meaning that the pug mill could not have been in place before 1919.

Figure 4.55. Feature 3202, the foundation of a pug mill, Brickyard locus, the Clearwater site, AZ BB:13:6 (ASM).

Feature 3203, Concrete Surface

This weak concrete surface was discovered during mechanical stripping around Feature 3201, a large brick surface. The concrete filled the area between the two brick surfaces, Features 3201 and 1001, and cut the foundation wall for Feature 3200, one of the brickyard's scove kilns. The concrete surface itself was cut by the foundation for Feature 3202, a pug mill.

The surface was composed of poor-quality concrete that was heavily damaged by a ripper or another piece of heavy machinery. The concrete surface appeared to postdate both the kiln foundation and the brick surfaces that surrounded it. Three postholes cut into the concrete—

Features 3203.01, 3203.02, and 3203.03—were almost certainly from the electrical poles that stood to the west of the Transformer House. As the Transformer House was on Sanborn maps in 1922, the concrete surface dated from sometime between 1919 and 1922.

The original use of this surface was unknown. It may have been poured to provide a relatively flat work surface for brick production, but this could not be proven.

Feature 3204, Scove Kiln

This feature was a scove kiln, used for firing bricks during the early years of the brickyard (Figures 4.56a-b). Portions of the kiln were originally recorded during three phases of previous testing. These portions were recorded as Features 189, 383, 384, 385, and 386 (Diehl 1996; Thiel 1995). The area was mechanically stripped during the current excavation to uncover the entire northern half and components of the southern half of the scove kiln. Once identified, the stripped portions of the feature were completely excavated by hand.

Eighteen brick floors and 18 fuel chambers (flues) were excavated in the northern half of the kiln. The northernmost sections of 20 brick floors and 20 flues were uncovered in the southern portion. Two flues and three brick floors in this southern portion were fully excavated during testing in 1996 (Diehl 1996). The flues of the kiln appeared to open north on the northern side, and open to the south on the southern side. The total excavated area of the kiln was some 30.25 m in length and 11.25 m in width. The 1919 Sanborn Fire Insurance map showed that the kiln originally measured 100 ft long and 35 ft wide (Diehl 1996). Fill of the excavated areas contained large amounts of charcoal and ash, a few coal clinkers, and abundant amounts of degraded brick and brick chunks. The fill was similar in both the flues and the brick floors, although the concentration of ash in the flues was considerably higher.

The kiln itself was constructed of courses of dry-laid pressed bricks. All the bricks measured approximately 21 cm in length, 10 cm in width, and 7 cm in thickness. The style of the bricks varied both between and within individual flues and brick floors. Although all were pressed bricks, some bricks had a plain frog on one face, others had a frog with a TPBCo maker's mark within it, and a few others had no frog at all. The flues and brick floors of the kiln were all constructed in the same manner. The flues measured between 2.88 m and 2.90 m in length, and from 28 cm to 31 cm in width. The floors had matching lengths, but measured between 68 cm and 1.4 m in width.

A coal pit, Feature 3206, was found abutting the northern half of the kiln. As the flues of the portion of the kiln opened on this side, it was assumed that this coal pit represented the fuel source for the scove kiln.

The kiln was marked as "dilapidated" on the 1922 Sanborn Fire Insurance map, suggesting its last use occurred sometime between 1919 and 1922.

Figure 4.56a-b. Feature 3204, scove kiln, Brickyard locus, the Clearwater site, AZ BB:13:6 (ASM).

Feature 3205, Brick Drying Rack

These remnants of brick drying racks were discovered during backhoe stripping of an area within the brickyard (Figure 4.57). Eighteen linear arrangements of wooden planks were excavated in an area north of the scove kiln, Feature 3204, and the Transformer House. The wooden planks were flanked by pairs of bricks, one on either side of the plank. These bricks occurred at fairly regular intervals the entire length of the plank. Based on photographs of the site, the plank and brick arrangements were thought to represent footers for brick drying racks.

The rack footers covered an area 56 m wide, and the average length of the footers was about 20 m. All the footers were arranged in essentially a roughly north-south alignment. The central and easternmost footers were the best preserved, and many still contained large portions of intact wooden planking. The wooden planks measured 15 cm in width and 4 cm in thickness, but varied greatly in length. Each footer was composed of several pieces of planking along its length. The bricks on either side of the plank were pressed, and extruded bricks varied from gray to bright red in color. The bricks measured 23 cm in length, 12 cm in width, and 8 cm thickness. A few of the footers had “caps” on either end, composed of two to three bricks turned perpendicular to the direction of the footer.

Figure 4.57. Feature 3205, the brick drying rack, Brickyard locus, the Clearwater site, AZ BB:13:6 (ASM).

A few of the footers contained no actual planking but impressions of the wood had been preserved in the clay. Some others had neither wood nor impressions, but the flanking bricks remained in place. The westernmost footers were the most poorly preserved, and in some cases, had been completely obliterated. No artifacts were collected during excavation of the footers.

These brick drying racks did not appear on the 1919 Sanborn Fire Insurance maps, suggesting they were no longer standing at this time.

Feature 3206, Possible Fuel Pit

This pit was discovered during backhoe stripping of an area immediately north of Feature 3204, the scove kiln. It measured 25 m in length and 6 m in width. A 5.7-m by 2.5-m portion of the pit was excavated with the backhoe to a level just above the base. The remaining fill in that portion was then removed by hand. The pit ran the entire length of one side of the scove kiln, ending on the eastern side where both pit and kiln were truncated by a modern garbage dump.

The depth of the excavated portion of the pit was 30 cm, although the pit may have been slightly truncated during backhoe stripping. The fill consisted mostly of compact silt with some gravels. A thin layer of coal and coal dust was discovered just above the pit bottom, but the pit appeared to have been mostly cleaned out before it was abandoned. No artifacts were recovered from the excavated portion of the pit.

The location of the pit, as well as the presence of the coal, suggested this pit was used to hold fuel for the adjacent scove kiln, Feature 3204. The flues on the northern side of the kiln open directly onto this pit. The pit was probably abandoned after the last use of the kiln between 1919 and 1922.

Feature 3207, Well

This historic-era well was found during mechanical stripping of the site (Figure 4.58). After it was discovered, the well was excavated with the backhoe down to a depth of roughly 3.5 m without reaching the bottom. The dimensions and construction details of the well were recorded before it was filled in for safety reasons.

The well opening measured 3.75 m in length and 3.05 m in width. Brick walls lined the well from the ground surface to a depth of about 42 cm. These walls had been constructed of pressed bricks from the brickyard, almost all of which were "wasters." These bricks had been melted to others, were irregular in size, or had broken during their production.

The well contained several layers of fill. A large tractor tire was discovered at the top of the well, just below the ground surface. The top 1.0 m of fill consisted of historic-era trash that included soda bottles, rusty metal, and a piece of costume jewelry. The lower 2.5 m of fill was composed mostly of bricks, rusty metal, and a few machine parts. The dates for the construction and abandonment of the well were unknown, and it did not appear on either the Sanborn Fire Insurance maps or aerial photographs of the site.

Figure 4.58. Feature 3207, the brickyard well, Brickyard locus, the Clearwater site, AZ BB:13:6 (ASM).

Figure 4.59. Feature 3208, brick equipment mounts, Brickyard locus, the Clearwater site, AZ BB:13:6 (ASM).

Feature 3208, Equipment Mounts

This cluster of brick pads was uncovered during mechanical stripping and was cleared of remaining overburden by hand (Figure 4.59). Due to similarities in their construction, the eight separate pads were considered as subfeatures—Feature 3208.01- 3208.08—of a single feature. No further excavation was conducted except small test holes to determine the depth of some of the pads. All were constructed of wire-cut bricks measuring 22 cm in length, 10 cm in width, and 7 cm in thickness.

Feature 3208.01 was a rectangular brick pad, 9 cm long and 65 cm wide. Feature 3208.02 was an L-shaped brick pad, 1.1 m long and 1.0 m wide. Feature 3208.03 was a rectangular brick pad that measured 90 cm in length, 65 cm in width, and 37 cm in depth. Feature 3208.04 was a rectangular brick pad, 90 cm long and 65 cm wide. A small piece of rebar was found protruding from the center of the pad. Although Features 3208.01-3208.04 were similar in size, shape, and construction, it was unknown if they were related to one another in use. Each probably had pieces of machinery mounted on them at one time.

Feature 3208.05 was a roughly rectangular brick pad with a small L-shaped arm protruding off its northeastern corner. The pad measured 1.6 m in length and 85 cm in width. A small 12-cm by 12-cm post was found just east of the small L-shaped portion of the pad. This pad was located immediately north of a brick press, Feature 3210. Its location in relation to a piece of machinery found at the bottom of the brick press suggested this pad may have been a footing for a piece of machinery related to the brick press. The small wooden post was probably for utilities related to this piece of machinery.

Feature 3208.06 was a roughly rectangular brick pad, 3.05 m long, 1.75 m wide, and 1.64 m deep. The function of this brick pad was unknown. Feature 3208.07 was also a roughly rectangular brick pad, 2.5 m long and 1.5 m wide. Its function was unknown.

Feature 3208.08 was a roughly rectangular brick pad that measured 1.55 m in length and 90 cm in width. The function of this brick pad was unknown.

No artifacts were collected from Feature 3208.

Feature 3209, a Brick-lined Pit

This brick-lined pit was discovered during mechanical stripping of the site (Figure 4.60). It was rectangular in shape, and measured 1.45 m in length, 95 cm in width, and 37 cm in depth. The bottom of the pit was a flat surface of concrete. The top courses of the brick walls were slightly impacted by a utility trench constructed after the pit had been filled.

The fill of the pit was a uniform deposit of moderately compacted silt. Artifacts recovered from the fill consisted of a few animal bones, some glass, metal, and a few glass marbles.

This pit was located just south of a short rail line, Feature 3213, used during brick production. Feature 3214, another brick-lined pit similar to Feature 3209, was discovered north of this rail line. It is unknown if both brick-lined pits performed a similar function, or if either was related to use of the rail line. If Feature 3209 was constructed or used at the same time as Feature 3214, it probably postdated the abandonment and filling of the rail bed.

Feature 3210, Pug Mill Foundation

This feature was initially discovered during mechanical stripping, and was then completely excavated by hand (Figures 4.61-4.64). The machinery of a pug mill was placed below ground in a pit that measured 3.90 m in length and 2.95 m in width. The pit was separated into two distinct areas, both of which appeared to have housed separate parts of the machinery. These areas were excavated as subfeatures of the overall pit.

Feature 3210.01 was the deeper of the two areas at 2.80 m long, 1.55 m wide, and 2.38 m deep. This area was lined by wooden planks that formed the walls of the lower pit. The fill of the subfeature contained abundant amounts of historic trash that included metal, bricks, and raw material for brickmaking. Also recovered from this fill were several

Figure 4.60. Feature 3209, a brick-lined pit, Brickyard locus, the Clearwater site, AZ BB:13:6 (ASM).

Figure 4.61. Feature 3210, a pug mill foundation, Brickyard locus, the Clearwater site, AZ BB:13:6 (ASM).

Figure 4.62. Feature 3210, foundation of the early pug mill, Brickyard locus, the Clearwater site, AZ BB:13:6 (ASM).

Figure 4.63. Features 3210 and 3213, the early pug mill and subsurface railroad track, Brickyard locus, the Clearwater site, AZ BB:13:6 (ASM).

metal "scoops" that appeared to have been attached to a conveyor belt. A large metal flywheel was discovered on the floor in this area. The artifacts seemed to suggest that raw material for brickmaking was fed into this area and carried by the "scoops." One end of the belt was probably looped around the flywheel found at the bottom of the pit. A brick pad, Feature 3208.05, immediately north, at the edge of the pit, may also have held a piece of machinery associated with this conveyer belt. The orientation of the flywheel seemed to suggest the belt may have moved in that direction. Feature 3213, the terminus of a short rail track, lay immediately above and south of this subfeature, and may have acted as the mechanism for removing unfired bricks from this area.

Feature 3210.02 was the second area of the pug mill pit. It lay east and above the first area and measured 2.80 m in length, 2.20 m in width, and 1.79 m in depth. This area was also lined by wooden planks that formed walls for the pit. Most of the fill in this area was sand and silt with little historic trash, as compared with the lower subfeature. The upper area was not enclosed on its western side where it opened into Feature 3210.01. It contained a substantial rectangular brick pad, 2.50 m long, 1.35 m wide, and 60 cm deep. The brick pad was constructed of eight courses of wirecut bricks that were 21 cm long, 10 cm wide, and 7 cm thick. Four heavy pieces of rebar protruded from the top of the brick pad. The rebar suggested the pad was a mount, probably for a piece of machinery related to the pug mill. The machinery had been removed prior to the filling of the brick press pit. No evidence was discovered for how this machinery was related to other parts of the pug mill.

This pug mill was the original brickyard mill used in the 1890s.

Figure 4.64. Features 3210, 3213, and 3216, the early pug mill, the subsurface railroad track, and a work area, respectively, Brickyard locus, the Clearwater site, AZ BB:13:6 (ASM).

Feature 3211, Machinery Mounts

This cluster of foundation footers was revealed during mechanical stripping and was then cleared by hand. The proximity of the footers to one another suggested they may have served as footers for the same structure or piece of machinery. Construction of the footers was of two different types: two were concrete and one was brick.

Feature 3211.01 was a large rectangular concrete foundation that measured 2.7 m in length and 55 cm in width. The concrete was weak to the point of crumbling, and it contained many medium-sized stone cobbles in the concrete matrix. The footer had a large crack approximately midway along its length that separated it into two pieces.

Feature 3211.02 was a roughly rectangular brick pad, 1.35 m long and 65 cm wide. The bricks of this footer were heavily crushed and deformed. Five pieces of heavy gauge rebar, also bent and deformed, protruded from various points within the footer, which suggested that whatever had originally been attached to the footer was removed with some force.

Figure 4.65. Feature 3212, a house foundation, Brickyard locus, the Clearwater site, AZ BB:13:6 (ASM).

Feature 3211.03 was an almost square footer constructed of concrete, with a few ceramic tiles imbedded in the concrete matrix. It measured 90 cm in length and 80 cm in width. The concrete of this footer was also weak and crumbling and contained a few medium-sized stone cobbles. The southern portion of the footer was crushed and destroyed.

One piece of diagnostic glass was collected from between Feature 3211.01 and Feature 3211.02.

The proximity of the subfeatures to one another and the damage to all the subfeatures suggested they once served the same function as a foundation for the same structure or piece of machinery. The size of the rebar in Feature 3211.02 indicated what it once supported was probably substantial. No other evidence for the probable function of this foundation was discovered.

Feature 3212, House Foundation

This house foundation was discovered during mechanical stripping (Figure 4.65). The foundation consisted of six roughly square blocks of concrete arranged in two parallel lines of three blocks each (Features 3212.01, 3212.02, 3213.03, 3212.05, 3212.06, and 3212.07). A small square formed from five bricks was thought to be the foundation for some stairs, Feature 3212.04. Also in close proximity was a large, mostly buried conglomeration of medium-sized cobbles, Feature 3212.08. The function of these cobbles was unknown.

Historic aerial photographs of the brickyard showed a house at this location, and the size and arrangement of the concrete pads were consistent with the foundation of a structure. Interviews conducted with the former residents of the house also confirmed that the concrete pads were the foundations of the house structure.

The six concrete pads were all identical in construction. They were composed of concrete with many small-to-medium cobbles. They were arranged into two parallels of three pads each. The two lines ran north-south about 2.5 m apart. The lengths and widths of the individual foundation pads were as follows.

(1) Feature 3212.01: 71 cm long, 70 cm wide
(2) Feature 3212.02: 85 cm long, 68 cm wide
(3) Feature 3212.03: 78 cm long, 75 cm wide
(4) Feature 3212.05: 80 cm long, 64 cm wide
(5) Feature 3212.06: 90 cm long, 60 cm wide
(6) Feature 3212.07: 97 cm long, 68 cm wide

Feature 3212.04 was a small pad consisting of five bricks. The pad measured 38 cm in length and 37 cm in width. Because it was very small, it likely did not represent another foundation for the house. Rather, it probably served as the foundation for a small set of steps for the house.

Feature 3212.08 was a large area of medium-sized cobbles in a clay matrix. The cobbles were very densely packed and appeared to have been dumped there purposefully, in a single episode. The area of cobbles measured 4.32 m in length and 2.10 m in width. Because the area consisted of almost pure rock, it was impossible to probe for a depth of the cobble concentration. The function of these cobbles was unknown.

The house that stood in this spot was visible in a 1950 aerial photograph of the site. The original construction date of the house was unknown.

Feature 3213, Subsurface Railroad Track

This subsurface rail track was discovered during mechanical stripping (Figure 4.66; see also Figure 4.63). Fill of the rail bed was partially removed with the backhoe, but the base of the rail bed was then cleared by hand. The rail line was 21 m long and 2 m wide, and was at a depth of 65 cm below the stripped surface. The rail line began on the eastern side adjacent to the remains of Feature 3210, a brick press, and ended on the western side in a belowground work area, Feature 3216.

When excavated, only impressions of the rails and rail ties remained. From those impressions, it was determined that the ties were 1.2 m long, 15 cm wide, and 10 cm deep. Only one intact tie was recovered from the rail bed. Only the impressions of the rails themselves remained, both across the ties and in the clay base of the rail bed itself. The rails were about 5 cm wide and spaced approximately 80 cm apart. The rail bed had been intentionally filled after it went out of use, and much of the wood and metal from which it was constructed appeared to have been scavenged for reuse. Only small portions of the shoring used to brace the sides of the rail bed were preserved and in situ. No definitive evidence was found for the existence of a roof over the rail line.

Figure 4.66. A close-up of the subsurface railroad track, Feature 3213, Brickyard locus, the Clearwater site, AZ BB:13:6 (ASM).

The spatial relationship between the rail bed; the brick press, Feature 3210; and the work area, Feature 3216, suggested the rail line served to move unfired bricks from the brick press on the east to a kiln located just beyond the work area on the west. Feature 3215, a plank-shored pit, probably also had a function related to the rail line, but this function remained unclear. Part of the work area around the rail line, Feature 3216.01, had a prepared clay floor on both sides of the track that suggested the carts were unloaded in that area.

The rail track was used for brickmaking for an unknown period of time between the founding of the brickyard and 1917, when brickmaking activity shifted to an area further south.

Feature 3214, Brick-lined Pit

This rectangular brick-lined pit was discovered during mechanical stripping of the site and was then completely excavated by hand. It measured 2.15 m in length and 1.32 m in width, and had an interior depth of 36 cm. The exterior side of the pit was completely exposed during excavation of Feature 3216, allowing for more of the construction details to be recorded. The walls of the pit consisted of three in situ courses of brick, although the appearance of the top course suggested that at least one more course once existed. Below the brick was a 12-cm-thick bed of concrete that formed a foundation for the bricks. The exterior depth of the pit, from the top of the bricks to the bottom of the concrete, was 46 cm.

Some 30 cm of fill was excavated between the stripped surface of the feature and the bottom of the pit. The fill was a mix of construction debris, silt, and historic-era trash. Artifacts recovered from the fill included some metal, a mineral sample, a partially reconstructable glass bottle, and a complete glass jar.

The inner walls and the bottom of this feature were lined with a white mortar or plaster. This suggested the pit may have been designed for holding water or some other liquid. No other evidence for the possible function of this pit was discovered.

This pit overlay and intruded on the northeastern portion of the belowground work area, Feature 3216. It was constructed sometime after the work area had been abandoned and filled. This pit was very similar in size and construction to another brick-lined pit, Feature 3209, discovered at the site. It is unknown if the two pits served the same purpose, or if they were in use at the same time.

Feature 3215, Plank-lined Pit

This plank-lined pit was discovered during mechanical stripping of the site. After it was revealed, the pit was excavated completely by hand. The overall length of the feature was 4.00 m, and the width was 1.45 m. During excavation, it was found to be composed of two separate portions that appeared similar, but that were actually constructed differently. This feature was discovered at the western end of a small rail line, Feature 3213, and within a larger pit, Feature 3216, that may have served as a work area for brick production.

The eastern portion of the pit was smaller and roughly square, measuring 1.0 m in length and 90 cm in width. For its construction, a pit was excavated; vertical posts and horizontal planking were used to construct walls. A mortar-like mixture was added to fill the space between the excavated pit and the plank shoring. Most of the plank shoring was found intact, although the boards were missing in some places, leaving only impressions in the plaster.

Approximately 74 cm of fill was excavated between the stripped surface and the floor in this portion of the feature. The fill consisted of mottled sand and silt with pieces of rotted wood and rusty metal. A piece of sheet metal and a metal rod with one threaded end were recovered from the base of the pit.

The western portion of the feature was also plank lined, although it was more rectangular in shape. It measured 2.0 m long and 1.4 m wide. This portion of the feature was constructed by digging trenches for the posts and the planking. Most of the soil enclosed by the planking was not disturbed, and the interior of this portion of the feature had no depth. A measurement taken from the exterior of the plank shoring gave a depth of 65 cm. No artifacts were recovered from this portion of the feature.

Except for the location of this feature at the end of the rail line, Feature 3213, no evidence about its possible function was discovered. The eastern portion of the pit may have originally contained a piece of machinery related to the rail line during the time it functioned, although no evidence of this was recovered. The western portion of the pit may have served as a platform or as a surface for another piece of machinery. The pit was definitely related to early brick production sometime between the founding of the brickyard and 1917.

Feature 3216, Work Area

This was an irregularly shaped belowground work area related to brick production (see Figure 4.64). The area was separated into two subfeatures, Feature 3216.01 and Feature 3216.02, due to the different construction details associated with each. The entire area was 8.7 m long, 5.2 m wide, and had an average depth of 86 cm. It was located at the western terminus of a short belowground rail line, Feature 3213. The eastern end of this rail line terminated in an area that was thought to hold a brick press, suggesting that carts containing bricks were offloaded in this area.

Feature 3216.01 was a large, roughly octagonal shore-lined pit. Some of the wooden shoring was found intact, although most had been scavenged before abandonment and filling of the area. Fill in this area was grayish-brown sandy silt of moderate compaction. The fill contained abundant amounts of historic-era trash, including bricks, concrete chunks, stone cobbles, and rusty metal. The floor of this area was a highly compacted clay surface that extended both north and south of the rail tracks, Feature 3213. Most of the intact wooden shoring was found in this area.

After the pit had been excavated, the planks were placed against the wall and backed with wooden posts. The clay that formed the floor was then deposited to hold the posts in place. The clay floor formed a raised surface that extended roughly 15 cm above the base of the rail bed. The existence of this floor surface suggested that this area was used in connection with operation of the rail line, perhaps for unloading the unfired bricks from the rail carts. No artifacts were found on the floor of this area.

The approximately circular area of Feature 3216.02 was connected to the western end of this work area. Although connected with Feature 3216.01, the construction details of Feature 3216.02 were substantially different. No floor surface was found at the bottom, and the surface from Feature 3216.01 appeared to have stopped just at the edge of Feature 3216.02. Additionally, Feature 3216.02 contained another separate plank-shored area, possibly used for holding machinery, Feature 3215. The plank shoring from the western wall of Feature 3215 extended north and south, effectively bisecting the circular pit. The only difference in the fill from Feature 3216.02 from that of Feature 3216.01 was a noticeably higher concentration of rusty metal.

Both areas of Feature 3216 appeared to have been cleared of anything useful prior to their abandonment and filling. This area served an unknown function related to the movement of bricks from the rail line in the east to a kiln in the west. It did not appear on the Sanborn Fire Insurance maps, suggesting that it functioned between the founding of the brickyard and 1917.

Feature 3216.01 is intruded on in the north by a brick-lined pit, Feature 3214.

Feature 3217, Pit

This square pit was discovered during mechanical excavation of Feature 3216, a large work area. It measured 82 cm in length, 75 cm in width, and 16 cm in depth. The fill of the pit was mottled sand and silt with no artifacts. Sand in the fill was red in color and suggested the presence of deteriorated bricks. The pit was slightly intruded on by the work area, Feature 3216, dating it to between the founding of the brickyard and 1917. No artifacts were recovered from the fill, and the function of the pit could not be determined.

Feature 3256, Office Foundation

This mixed rock and brick foundation was discovered during mechanical stripping (Figure 4.67). The remains of the foundation were cleared by hand after its discovery. It measured 6.0 m in length and 4.2 m in width. The foundation probably represented what remained of the brickyard office. The office was likely constructed sometime in the 1930s, and remained standing until at least 1952, where it can be seen in an aerial photograph of the site.

The foundation was constructed of several different types of brick, as well as masonry stones held together by mortar. Two courses of the foundation remained, and a measurement from the top of the remaining foundation to the base was 15 cm. A possible entryway was located in the eastern side of the foundation. The opening in the foundation measured about 1.35 m in length.

The area enclosed by the foundation was left unexcavated, because the stripped surface was thought to already be below the historic floor level of the building. The lack of construction debris associated with the foundation suggested the office had been dismantled before the foundation was buried. The only artifacts collected from the foundation were several pieces of decorative ceramic cornice that may have once been part of the structure.

The brickyard office is the subject of several photographs taken of the area between the 1940s and the 1960s.

Figure 4.67. Feature 3256, the foundation of the brickyard office, Brickyard locus, the Clearwater site, AZ BB:13:6 (ASM).

Feature 3259, Privy Pit

This privy pit was discovered during mechanical stripping. The pit was then excavated completely by hand. It was roughly square in shape, and measured 1.32 m in length, 1.30 m in width, and 71 cm in depth. Fill of the pit was mostly loosely compacted organic material that contained almost no artifacts. One piece of diagnostic glass was collected from the fill. The dates of use for this feature were unknown.

Feature 3302, Pit

This rectangular pit was discovered during mechanical stripping, when the wooden planks that formed its sides were exposed. The pit was 1.65 m long, 65 cm wide, and 8 cm deep. The sides were constructed of poorly preserved wooden planks that measured approximately 5 cm in width. The northern one-third of the feature had been almost completely destroyed during demolition of the brickyard; only the southern one-third of the pit was excavated. No artifacts were present in the fill. A few pieces of fire-cracked rock were noted, but they are thought to have originated from a prehistoric roasting pit, Feature 3303, into which this pit intruded. The function of Feature 3302 was unknown.

Feature 3309, Pit

This rectangular pit was discovered during mechanical stripping, and was subsequently excavated completely by hand. It measured 1.42 m in width, 60 cm in width, and 28 cm in depth. Fill of the pit was very loose sandy silt that contained many historic-era artifacts. Artifacts recovered from the fill included large amounts of rusty metal, some ceramic, rubber, leather, brick fragments, and two children's toys. One piece of ceramic, probably a child's art project, had a date of October 09, 1930(8?), written in pencil on the back. A few prehistoric artifacts were also collected from the fill and were thought to have come from Feature 3306, a pit structure into whose fill Feature 3309 was constructed. These artifacts included a few sherds, some flaked stone, and several pieces of fire-cracked rock.

This pit was discovered just north of a probable house foundation, Feature 3212. The presence of domestic trash and children's toys in the pit reinforced the hypothesis that the foundation was indeed a house, and it further suggested the pit was related to the functioning of the house. The pit size was small for a privy, but may have served as a planting or a trash pit.

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CHAPTER 4

FEATURE DESCRIPTIONS: PART 5. TUCSON PRESIDIO, AZ BB:13:13 (ASM)

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Archaeological work conducted during the Rio Nuevo Archaeology project resulted in the discovery of hundreds of features—areas in which human activities took place. Descriptions of excavated features and summarized data on unexcavated features are presented in this chapter. Descriptions of human burials found during the project are provided in Chapter 18 (this volume).

Work during this project was conducted at four different archaeological sites. The San Agustín Mission, Mission Gardens, Brickyard, and Congress Street loci were located at the Clearwater site, AZ BB:13:6 (ASM), on the western side of the Santa Cruz River. AZ BB:13:481 (ASM) were the Prehistoric, Protohistoric, and Historic era canals, ditches, and a spillway, also located on the western side of the Santa Cruz River. The Tucson Presidio has been designated AZ BB:13:13 (ASM), and the site includes both prehistoric- and historic-era features. Finally, a portion of a historic-era residential block on the northern side of Clark Street and east of the Interstate 10 (I-10) frontage road was designated AZ BB:13:735 (ASM).

The feature descriptions in this chapter are grouped by locus, except for canals, which are described in Part 6 and which are grouped by time period. All site numbers in this chapter are Arizona State Museum (ASM) numbers. Radiocarbon dates are reported in both uncalibrated radiocarbon years before present (b.p.), and in calibrated calendar years at the 1-sigma range of probability. Excavated and unexcavated features are listed, by site/locus and time period, in Table 4.1 (see Part 1 of this chapter).

Excavations within the Tucson Presidio were conducted at three locations (Figure 4.68). One phase included two units on the eastern side of the 1929 Pima County Courthouse and a long trench between the historic Edward Nye Fish House and the neighboring Hiram Stevens House. More extensive excavations took place at the northeastern corner of the presidio beneath a parking lot as part of another phase.

TEST EXCAVATIONS ALONG THE EASTERN SIDE OF THE PIMA COUNTY COURTHOUSE

Previous excavations in the courtyard area of the Pima County Courthouse in 1992 uncovered deeply stratified deposits dating to the presidio occupation (Thiel et al. 1995). Pima County plans to remove a pair of curving sidewalks along the eastern side of the courthouse for installation of new landscaping and irrigation pipes. This led to a small archaeological testing program. Two 2-m by 1-m excavation units were dug in May 2001. The unit on the southern side of the sidewalk was excavated in seven levels, reaching caliche at about 1.4 m below current ground surface. Fill and construction/demolition debris from the 1929 courthouse was found from the surface to 75 cm below the surface. Beneath this was the historic lawn surface from the 1881-1929 period, approximately 24 cm thick. Beneath the lawn was a 23-cm-deep fill layer from when the 1881 courthouse was constructed. The last level consisted of a 15-cm-deep pre-1881 layer of dark brown clayey sand with a horseshoe, Native American sherds, and two pieces of hardpaste earthenware ceramics. Caliche was found at the base of this layer, dipping downward to the north and east.

The second unit was excavated north of the existing sidewalk. Seven levels were also excavated in this unit. Level 1 was landscaping material put in place in 1992. Levels 2 and 3 contained fill material associated with construction of the 1929 courthouse. Within Level 3, a live electrical line was discovered, preventing excavation of half the unit. The next level, Level 4, contained more construction and demolition debris, while Level 5 was a layer of caliche that may have been dumped in the area during courthouse construction. Beneath this, in Level 6, several rocks cemented together with mortar were found. This represents a wall foundation for the 1883 Tucson City

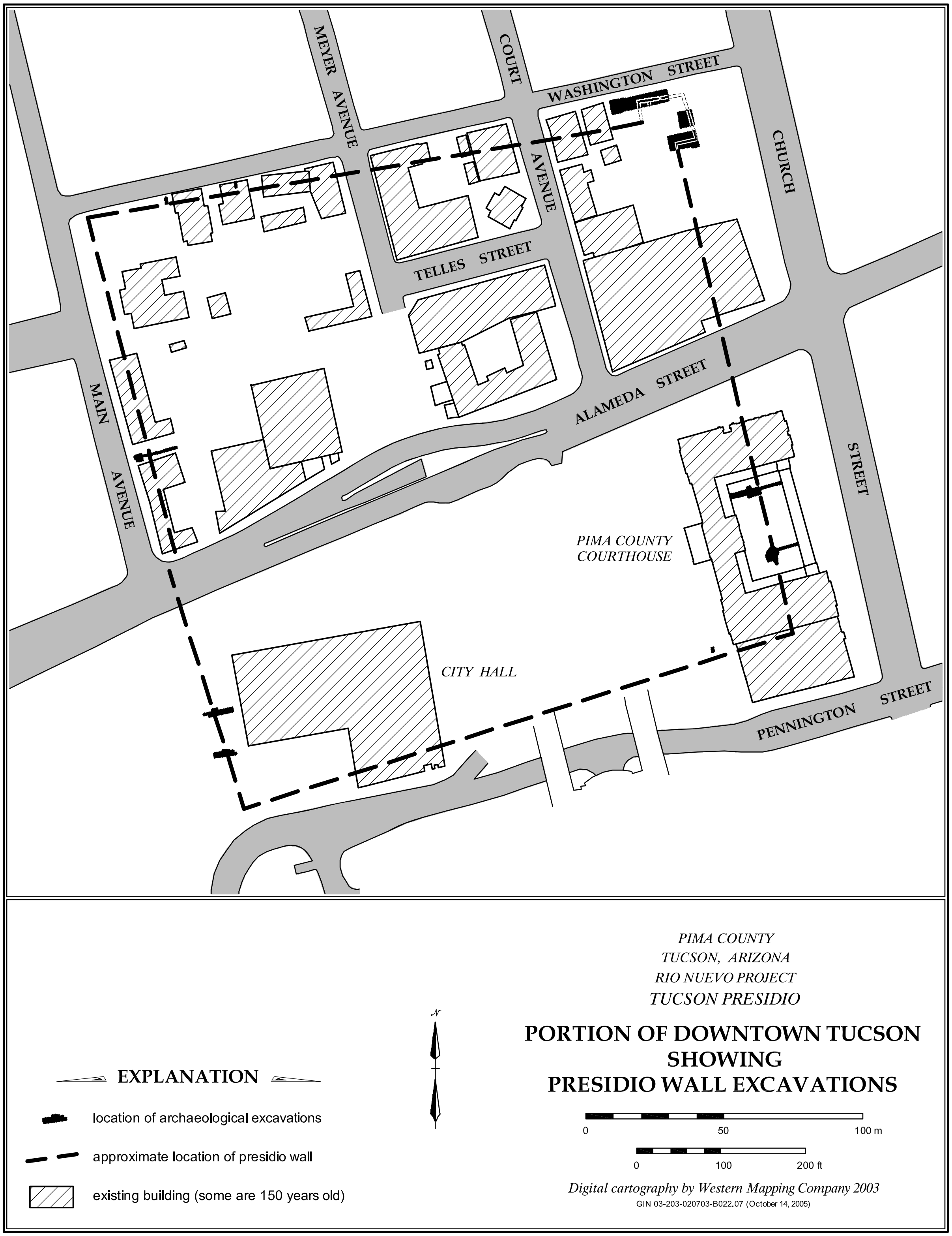

Figure 4.68. Location of excavation areas within the Tucson Presidio, AZ BB:13:13 (ASM).

Firehouse. The 1992 excavation uncovered the northern courtyard wall from this firehouse (Bayman et al. 1995:127); the firehouse was torn down in 1929. Although sterile caliche was not encountered, excavation was terminated at the base of Level 7, at roughly 1.2 m below the modern ground surface.

The limited test excavations in the area east of the Pima County Courthouse indicate that undisturbed archaeological resources are present, deeply buried beneath fill layers associated with the 1929 construction of the building. The improvements were subsequently made along the front of the courthouse, since plans did not include any deep subsurface disturbances. It is likely that a variety of Prehistoric era, presidio-occupation, and American Territorial period archaeological features are present between the courthouse and Church Avenue, and probably extend beneath Church Avenue. Future ground disturbance in these areas should be preceded by test excavations and/or monitoring.

TEST EXCAVATIONS AT THE FISH-STEVENS-DUFFIELD HOUSE

Plans for construction of a room bridging a gap in the National Register-listed Fish-Stevens-Duffield House led to archaeological excavations at the historic-era house in February 2002. The Tucson Museum of Art plans called for placement of a long drainage pipe through the center of the area, removing water from an inner courtyard out to Main Street. Six excavation units of varying size, totaling 14 m in length, followed the alignment of the pipe. All the trenches were 80 cm wide. When the project was completed, the western end of the dig was expanded to provide additional details about several adobe structures discovered in that area (Figures 4.69-4.70).

The excavations revealed a complex set of soil layers, compact surfaces, and adobe walls, in addition to a number of other features. This situation is similar to what was uncovered during excavations within the Pima County Courthouse courtyard (Thiel et al. 1995) and in recent work conducted in the lawn on the western side of the Tucson City Hall. Preservation of features was excellent, and very little disturbance was found. Much of the area below the house and its adjacent courtyard are in a similar condition.

Thirty-three archaeological features were identified during the project (see Table 4.1 in Part 1). Most of the features predate construction of the adobe room in this location in the late 1860s and date to the occupation of the Tucson Presidio (1775-1856). More detailed descriptions of the features are presented below.

Methods

Ten excavation units were dug, for a total of 18 m^2. Work began with removal of the modern brick patio, set in place in 1980. Below the patio was a bed of sand that was removed without screening. A zone of post-1909 soil was under the sand, which was removed mostly without screening. All soil from below this disturbed zone was screened through ¼-inch mesh. All artifacts were collected, sorted by material type, and returned to the laboratory for processing. Flotation samples were taken from a variety of contexts. Plan view and cross-section drawings were made after each feature was uncovered, and profiles were drawn from a variety of sidewalls. Features and profiles were extensively photographed. Elevations were taken from three datum stakes, one of which was arbitrarily set at elevation 10.00, with the other two stakes measured in using a level to provide comparable elevations. These stakes, the unit corner nails, and profile nails were shot in using a computerized surveying device by Western Mapping Company (formerly Geo-Map, Inc.) personnel, who subsequently prepared plan view and profile maps.

After the project was completed, the entire trench was lined with a geotextile to help preserve the features in place. Small pea gravel was then poured into the fill to help stabilize the adobe walls, as well as to allow adequate drainage through the area. Construction of the two rooms connecting the Fish and Stevens Houses was completed in the summer of 2002.

Archaeological Features

Work at the Fish-Stevens-Duffield House was atypical for a historical archaeology project in Tucson in that well-preserved, deeply stratified deposits were present throughout the entire area. Most historic-era sites in the downtown area have shallow deposits, or are disturbed by construction and demolition activities or utility trenches. Exceptions to this rule have included the courtyard of the Pima County Courthouse, the area on the western lawn of City Hall, and the northeastern corner of the presidio. The following feature descriptions for those features found during the Museum of Art project begins with the oldest features and progresses to the most recent.

Early Presidio Features

The earliest features documented in the trench were found resting on, or cutting into, the underlying natural sediment, which was a consolidated tan silty sand with a high gravel content. This sediment was documented in Units 201, 203, and 206. The sediment appears to be culturally sterile, and prehistoric features do not appear to be preserved in this area.

The earliest structure, Feature 331, was found in the west side of the trench (Figures 4.71-4.72). The portion exposed consisted of an L-shaped adobe brick wall identified in excavation Units 200, 217, and 229.

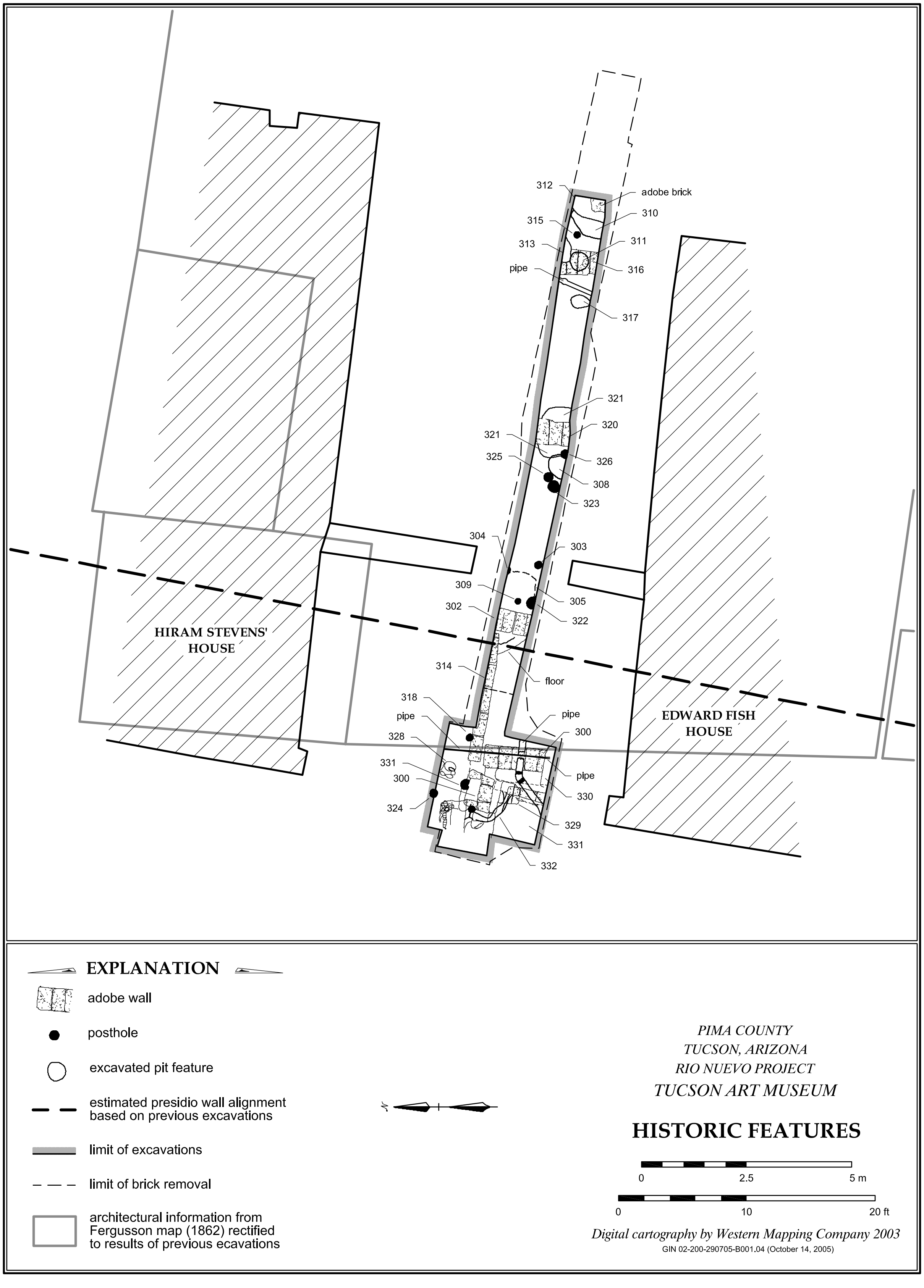

Figure 4.69. Archaeological features found at the Tucson Museum of Art project area, Tucson Presidio, AZ BB:13:13 (ASM).

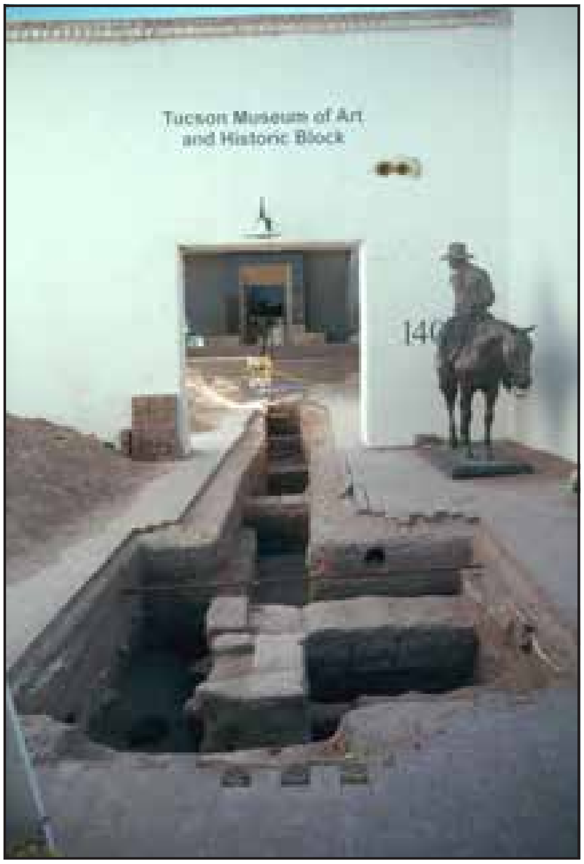

Figure 4.70. Overview of the excavations at the Tucson Museum of Art complex, Tucson Presidio, AZ BB:13:13 (ASM).

Figure 4.71. Archaeological features at the western end of the Tucson Museum of Art project area trench, Tucson Presidio, AZ BB:13:13 (ASM).

Figure 4.72. Features 331 and 332, an adobe wall and a molded adobe corner fireplace from an early presidio home, Tucson Presidio, AZ BB:13:13 (ASM).

The northern and eastern walls of the building were partially present within the excavation area, extending into the western and southern sidewalls. The adobe walls had cobble foundations upon which up to two courses of brick survived. The brown adobe bricks were poorly preserved, and were between 23 cm and 42 cm in length and 22 cm in width. The wall was preserved to a height of roughly 42 cm above the hard-packed dirt floor present inside the room, at elevation 11.43.

Feature 332 was the fireplace found in the northeastern corner of the Feature 331 room in excavation Unit 332 (see Figure 4.72). The fireplace consisted of a quarter-circle of adobe, 8-13 cm high. The adobe was quite irregular, and appears to have been molded in place by hand. The interior of the fireplace contained a dark gray-to-brown soft sandy silt with a large amount of ash and charcoal. A flotation sample was collected from the interior, but the rest of the fill was left in place.

The interior of the room was filled with a loosely compacted brown sandy silt, with a moderate amount of gravel and pieces of broken adobe. Artifacts were abundant in this fill and included Native American sherds, animal bone, and Mexican majolica sherds. There was no evidence of burning and no in situ artifacts on the floor. The structure appears to have been torn down so that another structure, Feature 300, could be built on top of it.

Two postholes found immediately north of the structure appeared to date to the same time frame. Feature 328 was an oval-shaped hole, 26 cm long by 22 cm wide, found in excavation Unit 328. The hole had vertical sides, was 39 cm deep, and was filled with a brown silty sand with a few small sherds, flaked stone, and pieces of animal bone. The top of the posthole was at elevation 11.35. Feature 318 was found in excavation Unit 200; it was 22 cm long by 14 cm wide. It had straight sides and a flat base. The top of the posthole was at elevation 11.13, and its base was at elevation 11.63. It was filled with a loosely compact brown silty sand.

Several meters east of the structure was a shallow borrow pit, Feature 327, that was documented in excavation Units 201, 203, and 205. The pit was

5.1 m long (east-west) and was exposed within the 80-cm-wide trench. The top of the pit was at elevation 11.18, and it was 31 cm deep at its deepest point. The pit was filled with a moderately compact gray brown silty sand. Native American sherds, flaked stone, ground stone, animal bone, and majolica sherds were found in the excavated fill. This pit was probably excavated to obtain material to make adobe bricks and was then filled with trash and soil, some of which may have washed in from upslope.

A pair of postholes was found between the early structure and the borrow pit. Feature 325 was a circular posthole located in Unit 203. The posthole had vertical sides and was 19 cm deep, originating at elevation 11.38. It was filled with a loose, brown silty coarse sand. No artifacts were found within the posthole. Feature 326 was located in the southeastern corner of Unit 203. This post was 16 cm long and at least 10 cm wide, extending into the wall of the unit. It had vertical sides and was filled with a brown silty coarse sand with no artifacts. The two posts may have been for a ramada built in this area, but due to the limited exposure, their exact function remains unknown.

Further east, a small arroyo, Feature 317, was discovered. The arroyo ran southeast to northwest through excavation Unit 206, and was 34 cm wide. It was approximately 54 cm deep, and contained a yellowish-brown sand with a high gravel content. Among the artifacts found in the arroyo were animal bones, Native American sherds, flaked stone, metal, and majolica sherds.

The earliest presidio-occupation features suggested a small, poorly built home was built against the western wall of the presidio at this location. The actual presidio wall is probably beneath the sidewalk or on the eastern side of Main Street, a few meters west of the excavation area. The postholes found in the area east of the structure may have been from a ramada or a corral. A shallow borrow pit indicated some dirt was mined for adobe inside the presidio. A small arroyo is indicative of the natural environment of the area. Drainage may have been an issue for residents of the western side of the presidio, because there must have been considerable runoff from the higher elevations to the east after monsoon rains.

Late Presidio Features

The length of time Feature 331 stood is unknown. The upper portions of the building were eventually torn down, probably with some recycling of materials, and another building was constructed in its place. In the units at the western end of the trench, a portion of the northern and eastern walls of Feature 300, a substantial adobe brick structure, was uncovered on top of a layer of soil covering the remains of the earlier building. It was found in excavation Units 200 and 217. The northern wall was two adobe bricks wide, placed with their long ends facing outward (east-west), and was 49 cm wide. The eastern wall was a single brick wide, with the short ends on the interior and exterior face of the wall; it was roughly 46 cm wide. The bricks were pink adobe, with a thin grayish-tan mud mortar cementing them together. The mortar was some 3 cm thick between each course. The wall survived to a height of four courses, with the base of the wall at elevation 11.16 and its top at elevation 10.63.

Unlike the earlier structure, this building was built without a stone foundation; the adobe bricks were simply placed on the existing ground surface. There was no indication of a floor surface inside the structure, although the building probably originally had a dirt floor. The use of the structure stopped when the western side of the building was dismantled, perhaps with destruction of the western presidio wall and the widening of Main Street in the 1850s.

A post, Feature 324, was found north of the structure in excavation Unit 221. The post was about 23 cm in diameter, with its top at elevation 10.87 and its base at elevation 12.05. The upper half of the post was a hollow area, and the lower half was a brown sandy silt. Native American sherds, an animal bone, and a round lead disk were found in its fill. Another posthole, Feature 309, was found in excavation Unit 201, and based on its elevation, probably dates to the same time frame. The post was 13 cm in diameter, and had straight walls. The top of the hole was at elevation 10.86 and its base at elevation 11.28. It was filled with a brown, highly organic sandy silt that was loosely compacted and had charcoal in its upper portion.

A hard surface, Feature 319, was present in much of the trench, extending from the eastern side of Feature 300 8 m to the east, just beyond Feature 320, the western wall of another structure. It was uncovered in excavation Units 201, 202, 203, and 205. The surface was a compact reddish-brown coarse sand that ranged in elevation from 10.62 at the western end, sloping downward to 11.00 on the eastern side of the trench. Laminated coarse silty sand layers lay on the surface, indicating it was covered by sheetwash from upslope.

A pit, Feature 321, was cut through this hard surface into the underlying borrow pit, Feature 327. It was found in excavation Unit 205. This basin-shaped pit was 1.25 m long east-west, and was at least 72 cm long north-south. It had sloping sides, and was 28 cm deep. The pit was filled with a moderately compact gray-brown silty sand. Native American sherds, flaked stone, ground stone, animal bone, and majolica sherds were found in the fill. Only a portion of the feature could be excavated, because it lay below Feature 320, a wall.

Features 320 and 316, two adobe walls, were constructed during the presidio occupation. Feature 316 was found in excavation Unit 206, and Feature 320 was found in Unit 205. The structure was located several meters east of Feature 300, and had been built on top of the hard surface, Feature 319. Both walls were made from dark brown adobe bricks that measured about 61 cm in length, 31 cm in width, and 8 cm in thickness. Three courses of bricks were preserved, with a lighter gray mortar bonding the bricks together. The structure was 3.35 m wide (measuring from exterior to exterior of the bricks). The structure does not appear to have been completed, and the area outside and inside the walls was filled with water-deposited silty sands that apparently traveled downslope from the southeast. The structure was built above an earlier pit, Feature 321.

East of the Feature 316 wall was a small posthole, Feature 315, found in excavation Unit 206. It was roughly 14 cm in diameter, with the top at elevation 10.90 and the base at elevation 10.97. The hole contained a brown silty sand with a high amount of charcoal. No artifacts were found within the posthole.

The late presidio-occupation features suggested the early presidio structure may have been replaced with a more substantial, durable building at this location. Trampling by humans and/or animals formed a compact surface, upon which a second adobe structure was constructed. It is unclear, however, if this second building was completed. Slopewash from the east eventually filled portions of the area.

Late Presidio-Early American Territorial Period Features

The arrival of the Americans in 1856 marked the end of the Tucson Presidio fort. A rapid increase in population and the reduced threat of Apaches led to the demolition of many presidio structures, including the western wall. Feature 300, the structure with thick adobe walls, had the northern wall truncated, probably as Main Street widened. The eastern wall was reused, with an east-west wall, Feature 314, appended to the northern corner (Figure 4.73). Feature 314 was a single-brick-wide adobe wall, sitting on Feature 319, a hard surface. It was found in excavation Units 201 and 202. The wall was 4.29 m long and 27 cm wide. It turns north at the eastern end, beyond the trenched area. The top of the three-course-tall wall ranged from elevation 10.71-11.77, and its base ranged from elevation 11.06-11.13. The area inside the corner formed by Features 314 and 300 was filled with broken adobe bricks, several clumps of lime, Native American sherds, animal bone, and majolica. One oxidized area, measuring roughly 22 cm by 20 cm, was present beneath the fill.

East of Feature 314 was a hard surface, Feature 307, that was located in excavation Units 201, 202, 203, 205, and 206. Feature 307 was a gray-brown silty sand with a high ash content. It was very compact and sloped to the west, ranging in elevation from 10.61 to 10.76 over the roughly 12.5 m the surface was traced. Resting on top of the surface were layers of greenish-gray silty sand, which had an unpleasant organic odor, covered by a layer of brown silty sand.

Three features cut through this surface, either originating at the surface level or in the fill layer immediately above it. Feature 303 was a 16-cm-diameter posthole found in excavation Unit 201. The top of the posthole was noticed at 10.74; it was 20 cm deep, filled with gray ash and a brown, highly organic sand. The entire contents of the posthole were submitted as a flotation sample. Feature 304, another posthole, was nearby. This feature was 10 cm in diameter, with its top found at elevation 10.73 and its base at elevation 11.00. It was filled with gray ash and brown highly organic silty sand. The fill of this post was also floated. The two posts may have been part of a ramada, although the limited exposure prevented a more accurate interpretation. Feature 311 also cut this surface, and it was located in excavation Unit 206. This pit was some 47 cm in diameter, and was 18 cm deep, originating at elevation 10.65. It was filled with a homogenous brown

Figure 4.73. Feature 314, a late presidio-occupation to early American Territorial period adobe wall, Tucson Presidio, AZ BB:13:13 (ASM).

silty sand that was loosely compact. Native American sherds were found in its fill.

The 1862 Fergusson map of Tucson depicts a wall in the area of the excavation. The wall runs south to north, turns a corner, runs west-east for a short length, and then heads north again. Features 300 and 314 probably represent the remains of this structure.

The Fish House

In the mid-to-late 1860s, Edward Nye Fish constructed a house adjacent to Hiram Stevens' and Milton Duffield's dwellings. The Fish House was built in the Sonoran Row House style and was several rooms long by one or two rooms wide. The northern pair of rooms were torn down around 1909 (Fortier 1980; Lyons 1981). Some accounts suggest a fire precipitated the demolition, although no archaeological evidence was found supporting this.

The 1860s Fish House was built on top of an existing hard ground surface, designated Feature 306. This surface was found in three excavation units, Units 201, 202, and 203. Along the eastern side in Unit 203, it was at elevation 10.55, rising to elevation 10.62 in Unit 201, before sloping upward at its western end in Unit 201 to elevation 10.45. The surface was a gray, burned layer lying below an organic-rich brown clayey silt fill layer. Some of this layer probably contained decomposed straw, perhaps suggesting that prior to construction of the Fish House, the area was used as a stables.

Portions of two adobe brick wall foundations were found on the surface of Feature 306, immediately beneath the disturbed fill layer below the brick pavement. Feature 329 is the western wall of the room and was found in excavation Units 200 and 229. This foundation was very fragmentary and consisted of only three adobe bricks that had been partially damaged by a modern sewer line. Edward Fortier identified another segment of this wall at the exterior of the southwestern corner of the Stevens-Duffield House (Fortier 1980). The pink bricks were 48 cm wide, with their top at elevation 10.52 and their base at elevation 10.58.

Feature 302 was the eastern foundation found in excavation Unit 202 (Figure 4.74). Two complete and two partial bricks, pink in color, were exposed in the trench. The complete bricks were 51 cm long, 26-27 cm wide, and 7-8 cm thick. The top of the foundation was at elevation 10.58, and the base was at elevation 10.64. The structure represented by the two adobe walls was 4.7 m wide.

Inside the foundation, Feature 330, a brick-and-concrete pad, was found in excavation Unit 229. The pad was at least 1.16 m long east-west, with only 12 cm protruding into the excavated area. The concrete was 7 cm thick, with one complete brick and impressions from other bricks. The top of the pad was at elevation 10.53, and the base was at elevation 10.60. The most likely explanation for the feature is that it was the base of a brick fireplace, although other options, such as a floor support pier, are also possible. The use of concrete and brick suggested this was constructed sometime after the 1860s, probably after the 1880s, when both concrete and bricks became widely available in Tucson.

Figure 4.74. Features 301 and 302, the eastern foundation of the late 1860s Fish House and an adjacent hard ground surface; several postholes are also visible; Tucson Presidio, AZ BB:13:13 (ASM).

A second hard surface, Feature 301, was found inside the structure, extending outside to the west for a total length of roughly 12.5 m. It was uncovered in excavation Units 201, 202, 203, 205, and 206. The surface was at elevation 10.45 on the western side, sloping downward through the rest of the trench at between elevations 10.58 and 10.61. This fairly flat surface was comprised of a blocky brown silty clay with a high organic content, some of which appeared to be straw. The amount of organic material declined on the eastern side of the trench.

A pit, Feature 308, cut through the hard surface Feature 306 and may date to the American Territorial period. It was found in excavation Unit 203. The pit was 62 cm long and at least 38 cm wide, extending beyond the trenched area. The top of the pit was at elevation 10.70, and it was only 3 cm deep. The pit was filled with a brown silty sand with a high gravel content. Native American sherds, flaked stone, and animal bone were recovered from the fill. The function of the pit is unclear.

Oral histories have suggested a portion of the Fish House was constructed from the eastern presidio wall. The current excavations have shown this is not the case. Instead, the presidio wall is further west, beneath the modern sidewalk or the eastern edge of Main Street. Some of the materials used to make the adobe bricks for the house may derive from presidio-occupation structures, but within the trench area, all the presidio walls are found beneath Feature 306, a hard surface that developed in the area after these features were demolished.

Post-1900 Features

A number of features discovered during the project date to the American Territorial or American Statehood periods, reflecting continued use of the area. Feature 305 was a pit discovered in excavation Unit 201 directly below the disturbed layer. Only a portion of the feature was within the trenched area; this segment was 40 cm long and 30 cm wide. The top of the pit was at elevation 10.56, and it was 31 cm deep. It contained a homogenous gray brown silty sand that was loosely compacted. Native American sherds, ground stone, and animal bones were found in the fill. The pit may predate the demolition of the Fish House room, although this remains uncertain because the top of the pit was disturbed.

Feature 310, an ash-filled pit, was stratigraphically below the organic layer in excavation Unit 206 and was cut into by Feature 312. The pit extended into the southern and eastern profiles of Unit 206, with an area measuring 76 cm by 40 cm excavated. Feature 310 was 18 cm deep. Artifacts found in the pit included Native American sherds, animal bone, glass, metal, and an adobe brick. A flotation sample was also collected.

Feature 312 was a pit revealed in excavation Unit 206. It was 76 cm long north-to-south, and 50 cm wide. The top of the pit was found at elevation 10.60, and it was 28 cm deep, filled with a crumbly greenish-brown silt with a high organic content. A piece of red adobe brick lay at the top of the feature. The pit was thought to be the location of a planting hole in the Fish House backyard.

A portion of a dog burial, Feature 313, was found in excavation Unit 206. The top of a pit was found at elevation 10.74, extending down to elevation 11.09. The pit was 53 cm long, with 23 cm extending into the trench. It was filled with light reddish-brown silty sand with many pieces of gravel. Articulated dog skeletal elements were found at the base of the pit, indicating that sometime during the American Territorial period, a family pet was buried in the backyard of the Fish House.

Feature 322 was a posthole found in excavation Unit 201. The post was 26 cm in diameter, with the top at elevation 10.63 and the base at elevation 11.13. It was filled with a loose brown silty sand with a high gravel content. The post was modern and likely dated to within the last 50 years.

Posthole Feature 323 was found in excavation Unit 203. The posthole was approximately 24 cm in diameter, with the top at elevation 10.63 and the base at 11.23. It was filled with a brown silty sand with a large amount of gravel. The post was modern, put in place in the last 50 years, and was pulled out of the ground rather than left in place.

The features dating to the post-1900 period indicated that after demolition of the connecting rooms, the backyard area was used for typical backyard activities. The postholes may have held up a porch, or may have been used to support plants. Small planting pits were found nearby, and some of the posts may have also held up trellises or arbors. Pet burials are frequently found in backyards, and the discovery of a small dog was not unexpected.

EXCAVATIONS AT THE NORTHEASTERN CORNER OF THE TUCSON PRESIDIO

In December 2002 and January 2003, Desert Archaeology conducted test excavations in a paved parking lot at the southwestern corner of Church Avenue and Washington Street. In December 1954, the University of Arizona conducted excavations in the area, just prior to construction of the lot, uncovering a thick adobe wall that turned a corner, as well as an underlying Hohokam pithouse. Questions remained regarding if the wide adobe wall was the exterior wall of the presidio or the tower that was reported to have existed at this location. In this section, detailed feature descriptions are preceded by a short history of the block and an interpretation of the uncovered features.

The History of the Block

Block 181 was laid out in 1872 into nine lots. Lots 1 and 2 were located at the northeastern corner of the block, with Lot 3 immediately to the south. Lot 1 was roughly 34 m long, north-south, and 19 m wide, east-west. Lot 2 was located to the west, and was approximately 29 m on the northern side, 33 m long along the western side, 27 m wide on the southern side, and 35 m along the eastern side. The actual measurements vary slightly because the lots were irregular.

The initial sale of the property occurred a few years after the Village of Tucson survey (Table 4.4). Anastasio Telles purchased Lot 1 on 1 March 1875. He was born circa 1833, in Sonora, Mexico. He was married prior to 1858, to Manuela Vilderray[1] [spelled Vildoragga in 1858 and Bilderalla in 1864]. In 1860, the couple lived in Tucson with their daughter Luisa. Anastacio worked as a laborer (1860 Census, New Mexico, Doña Ana County, Tucson p. 5). In 1864, Anastacio was a farmer in Tucson, with $200 in personal possessions. He lived there with his wife and daughter.

A number of other Telles lived nearby and are probable relatives: Cristiana (27), Maria (15), Prundencio (20), Hilario (22), Polonio (25), and Susanna (25) (1864 Census, A.T., Pima County, Tucson lines 408-411, counted also on lines 1292-1294, where he is a farmer owning $300 in real estate and $200 in personal property). In 1866, Anastacio and Manuela lived with daughter Louisa in Tucson (1866 Census, A.T., Pima County, Tucson lines 642-644). The family lived in Tucson until at least 1875, but is missing from the 1870 census and could not be located on the 1880 census. Antonio Baldonado purchased Lot 2 on 4 February 1875.

The adjacent lot, Lot 2, was purchased by Herbert Dodge in 1885. Dodge was born in December 1861, in Illinois. He was married circa 1888, to Julia [Royce?]. Julia was born in January 1872, in Michigan. She had five children, one of whom died in childhood. The other four children were: William C. (born in October 1889), Charles H. (born December 1888), Winnifred (born January 1892), and Hazel M. (born January

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[1] Names are spelled as recorded and may vary.

Table 4.4. Early property owners of Lots 1 and 2, Block 181, Tucson Presidio, AZ BB:13:13 (ASM).

Lot	Grantor	Grantee	Date	Pima County Deed Record Entry (Book:Page)
1	Village of Tucson	Anastacio Telles	1 March 1875	2:764
2	Village of Tucson	Antonio Baldonado	4 February 1875	4:627
1	M. Telles	William C. Barden	19 May 1875	2:762
2	Antonio Baldonado	John S. Warner	—	4:629
2	John S. Warner	James H. Toole	9 May 1881	10:350
2	James H. Toole	John N. Brown	22 December 1881	11:23
1	William C. Barden	S. W. Carpenter	29 July 1881	10:609
1	S. W. Carpenter	John N. Brown	—	10:610
1, 2	John N. Brown	Mrs. June Ramboz	5 June 1882	11:377
1, 2	Mrs. June Ramboz	J. McC. Elliott	6 June 1882	11:383
1, 2	James McC. Elliott	Charles K. Drake	31 July 1892	5:514
1, 2	James McC. Elliott	H. B. Dodge	10 January 1885	13:32
1, 2	H. B. Dodge	C. F. Schumacher	12 October 1888	14:720
1, 2	C. F. Schumacher	H. B. Dodge	11 April 1889	15:316
1, 2	J. McC. Elliott	H. B. Dodge	11 September 1888	16:107
1, 2	H. B. Dodge	Julia Dodge	30 January 1890	21:382
1, 2	Julia A. Dodge	A. W. Ashbrook	25 April 1891	23:24
1, 2	Alice W. Ashbrook	H. B. Dodge	25 April 1891	26:16
1, 2	H. B. Dodge	Jas. H. Borland	1 June 1896	25:780
1, 2	Jas. H. Borland	H. B. Dodge	2 June 1896	25:796
1, 2	M. G. Ashbrook	H. B. Dodge	5 June 1896	27:92
1, 2	H. B. Dodge	Julia A. Dodge	22 October 1899	27:783
1, 2	Herbert B. Dodge	Oscar T. Richey	16 April 1902	33:609
1, 2	Herbert B. Dodge	E. P. Van Kuren	21 February 1903	35:80
1, 2	E. P. Van Kuren	Charles F. Hoff	29 June 1905	37:384

1895). On 18 June 1900, the couple, their four children, Julia's grandmother Julia Simpson, and a lodger named Lorenzo Haley lived at 187 North Church Avenue. Herbert was working as a grocer clerk and William, Charles, and Winnifred were attending school (Herbert Dodge household, 1900 U.S. census, Pima County, Arizona, Tucson, ED 49, sheet 18A).

The 1908 city directory indicated William Dodge was working as a driver for the Union Meat Market, while Charles was a machine helper at the Southern Pacific Railroad shops.

On 15 April 1910, Julia headed a household at 187 North Church Avenue. She was now divorced from Herbert, an unusual situation for her time and place. She worked as a bookkeeper for a furniture store, with her eldest three children working at a grocery store. Living with the family as boarders were four women—A. Barker, Anne Barker, Maude McCormick, and Mamie McFadden (Julia Dodge household, 1910 U.S. census, Pima County, Arizona, Tucson, ED 102, sheet 17A). The 1910-1911 city directory lists Julia Dodge was a bookkeeper at W. Golding, Winifred was a bookkeeper at the Pacific Grocery, that William worked at the Union Meat Market, and Charles was working at the Southern Pacific Railroad as a machine helper.

The family moved out of the house prior to collection of data for the 1918 city directory, when four individuals lived in the home. The boardinghouse they operated on the adjacent Lot 1 had a variety of occupants through the years, none of whom stayed for very long. The boardinghouse was torn down in 1954.

Structures on Lot 1

The 1883 Sanborn Fire Insurance map reveals that a house was present on Lot 1 at that time (Figure 4.75). The adobe structure is called "old" and appears to have had two rooms. The structure is not present on the 1886 map, however. The 1889 map also indicates that the lot was vacant, with the Dodge family constructing a house on the adjoining Lot 3 to the south. Between 1889 and 1896, the Dodges built a two-story apartment house along the eastern side of Lot 1. The boardinghouse was divided into four separate living units.

By 1901, a small outbuilding and stables had been constructed at the southwestern corner of Lot 1 (Figure 7.76). These structures were demolished by 1909. An automobile garage was present along the western side of the lot prior to 1944. This garage was demolished prior to 1954. The boardinghouse was torn down in 1954.

AN OVERVIEW OF THE PRESIDIO-OCCUPATION FEATURES

Northeastern Presidio Corner

The largest of the three test excavations within the presidio were at a parking lot located at the southwestern corner of Church Avenue and Washington Street. This area had been examined in 1954, and a primary goal was to relocate the previously excavated area and to determine if the thick wall found at that time was the exterior presidio wall, or a tower that was reported to have stood at this corner.

The area was still needed for parking after work was completed, so only a small number of individual spaces could be examined. Archaeologists excavated 15 parking spaces (each measuring about 4.5 m by 2.7 m) in December 2002 and January 2003, revealing a wealth of features dating from the Hohokam Colonial period to the American Territorial period. Among these were many presidio-occupation features, including architectural remains and pits filled with large numbers of artifacts and food materials (Figures 4.77-4.78).

A backhoe was used to strip away asphalt from the parking lot surface. The thick adobe wall found in 1954 was quickly re-exposed, almost directly beneath the pavement. The wall was designated Feature 351 during the current project. Instead of being the exterior perimeter wall of the presidio, the wall turned out to be the eastern wall of a square tower that projected out from the presidio walls. This tower, as described by several people who saw it while it standing, was about 6 m (20 ft) tall and had gun ports, or slots, in the upper portions, allowing soldiers to fire their muskets down the length of the walls.

The foundations of the tower were made from adobe bricks and measured between 0.98 m and 1.15 m wide. The bricks ranged from pink to brown in color, and many seemed to be irregular in size and shape. Only one course survived along the south wall, Feature 377 (Figure 4.79). The eastern and northern walls, Features 351 and 374, had one course that was in turn covered with a thick layer of dirt that was molded into place while wet (Figure 4.80). This type of construction method was also found in the western presidio wall in the City Hall lawn. Its use and the presence of irregularly sized bricks suggested an attempt to speed construction of the wall and tower, perhaps after the 1782 Apache attack. Only a small portion of the western wall of the tower, Feature 443, was found. This wall had been cut into by an American Territorial period pit that had destroyed a portion of the foundation.

The southern wall of the tower projected 7.59 m from the eastern wall of the fort. The eastern wall of

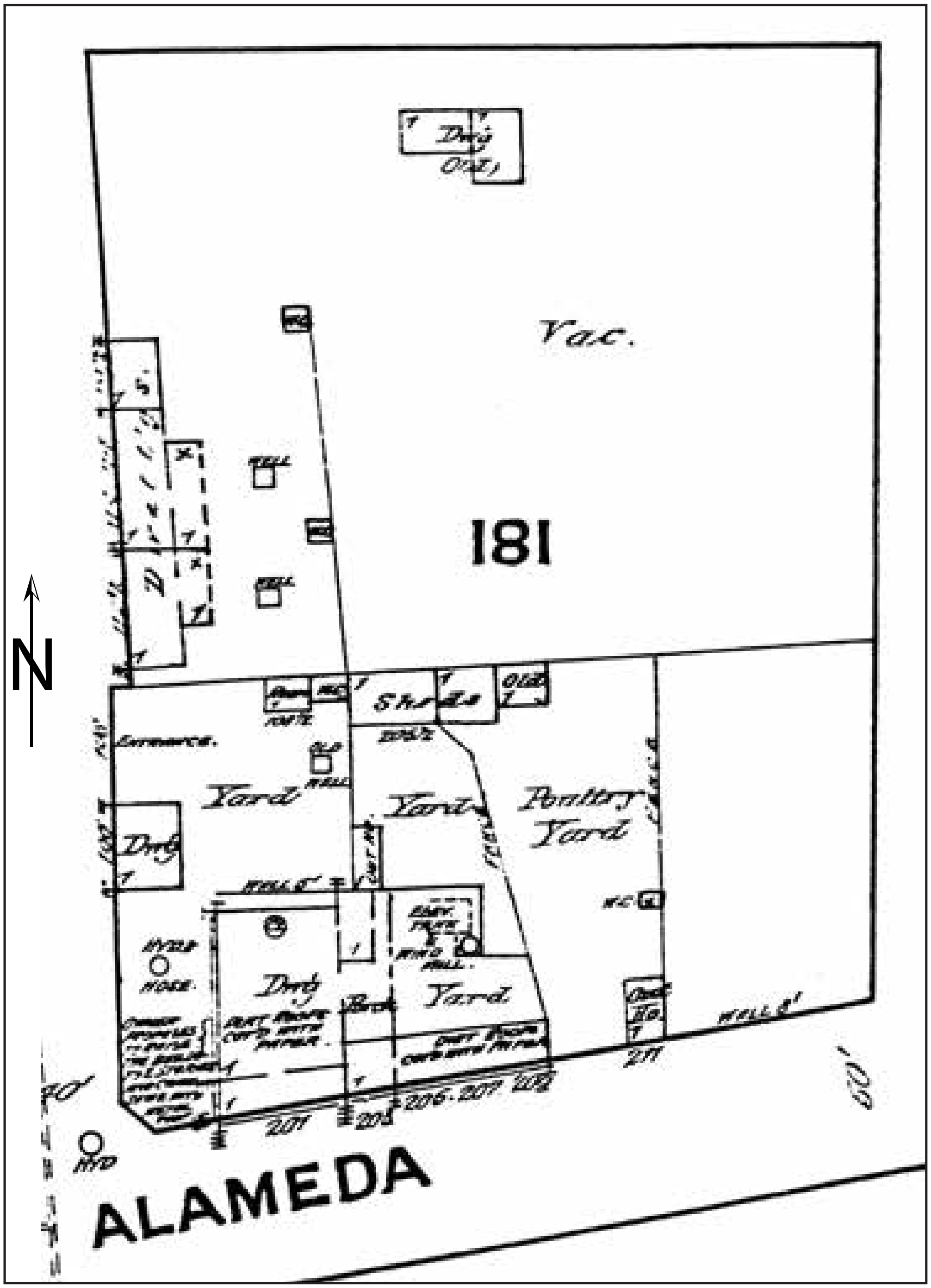

Figure 4.75. The 1883 Sanborn Fire Insurance map for Block 181, Tucson Presidio, AZ BB:13:13 (ASM).

the tower was 17.81 m long and the northern wall was 17.25 m long. The length of the western wall of the tower was not determined, but was probably similar to the southern wall. The tower was basically a square structure projecting outward from the northeastern corner of the fort.

The interior of the tower was lined with a wooden walkway. Two small, round features found just inside the tower foundations probably represent post supports for the walkway. Feature 386 was a small cluster of 10 flat-lying rocks found some 50 cm north of the southern tower wall (Figure 4.81). The rocks lay in a 30-cm-diameter circle. Along the northern wall, archaeologists found Feature 404, a circular adobe area that probably served the same purpose (Figure 4.82). The adobe was 45 cm in diameter and

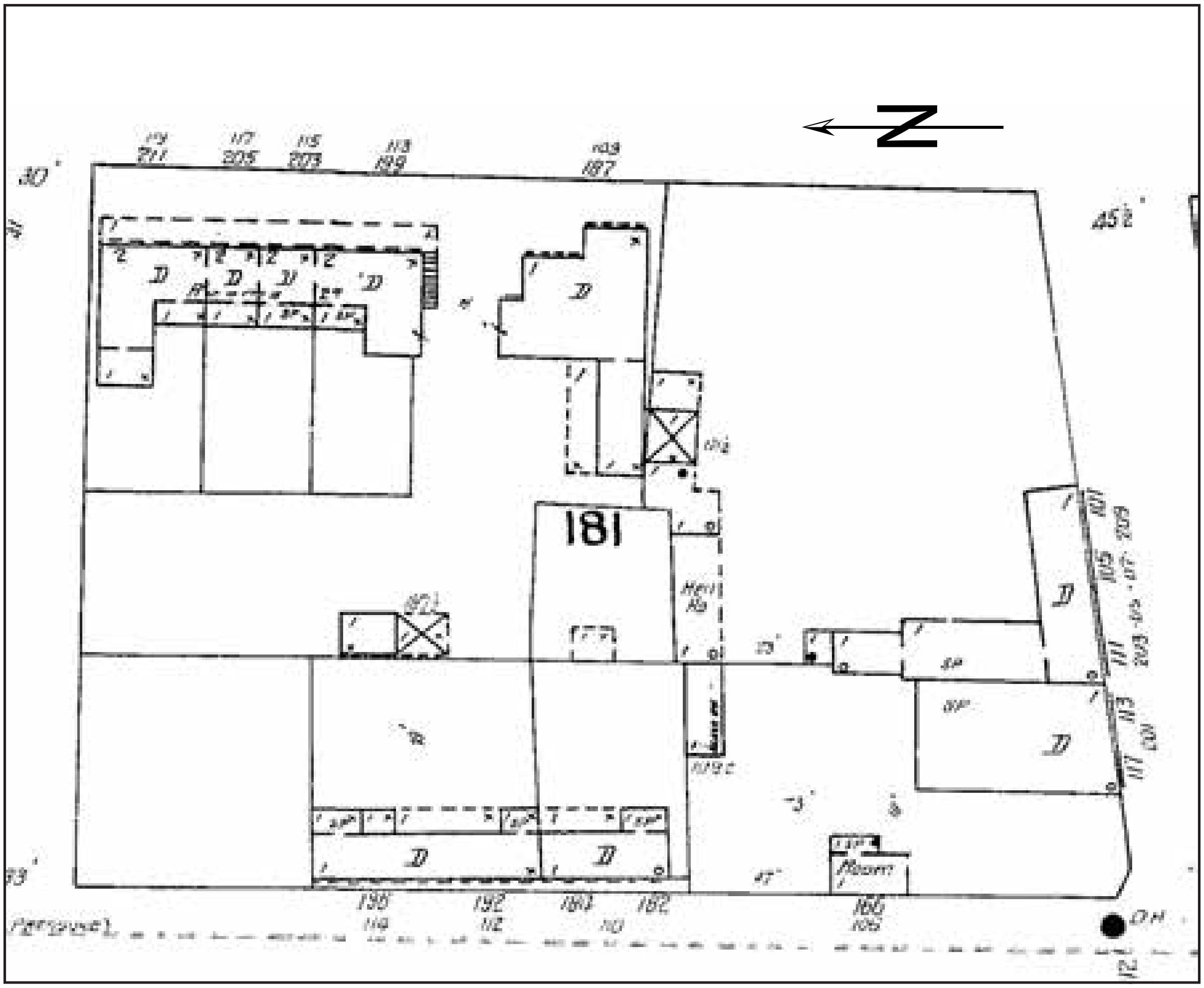

Figure 4.76. The 1901 Sanborn Fire Insurance map for Block 181, Tucson Presidio, AZ BB:13:13 (ASM).

18 cm thick. It is unknown if additional support features were once present. Many may have been accidentally removed during the 1954 excavation.

The only other features that directly relate to the tower were a pair of adobe walls, Features 399 and 403, that extended from the southern side of the northern wall of the tower (see Figure 4.82). Feature 399 was 1.04 m wide, and a 1.09-m-long segment was uncovered, with the wall running into an unexcavated area. The wall was made from adobe bricks of varying sizes and colors, indicating it was probably built from recycled bricks. The function of the wall is uncertain, although it may have been the eastern wall of a small structure built inside the northwestern corner of the tower. Another possibility is that a staircase up to the wooden walkway lining the tower may have been located in this area. A third possibility is that it was a buttress built to help hold up the tower wall at this location. The second wall, Feature 403, it was at least 1.02 m long, mostly extending into an unexcavated area, and it was at least 49 cm tall. In 1954, this wall was uncovered and called a puddled adobe wall. This wall may represent a portion of a small structure built along the interior of the tower.

Some details about construction of the tower remain unknown due to either the incomplete excavation of the area, or because the 1954 excavations may have removed small internal features.

The eastern wall of the presidio had been previously located within the Pima County Courthouse courtyard in 1992, and at the southern side of Alameda Street in 1991. The location of this wall was projected north into the parking lot, and a new segment was found within 41 cm of where it was expected (Figure 4.83). The surviving portion, Feature 400, had been badly damaged by American Territorial period pits, but enough survived to verify that it was also 56 cm (22 inches) wide, the length of a standard Spanish period adobe brick. Unfortunately, the juncture between the wall and the tower had been disturbed, making it impossible to determine how they

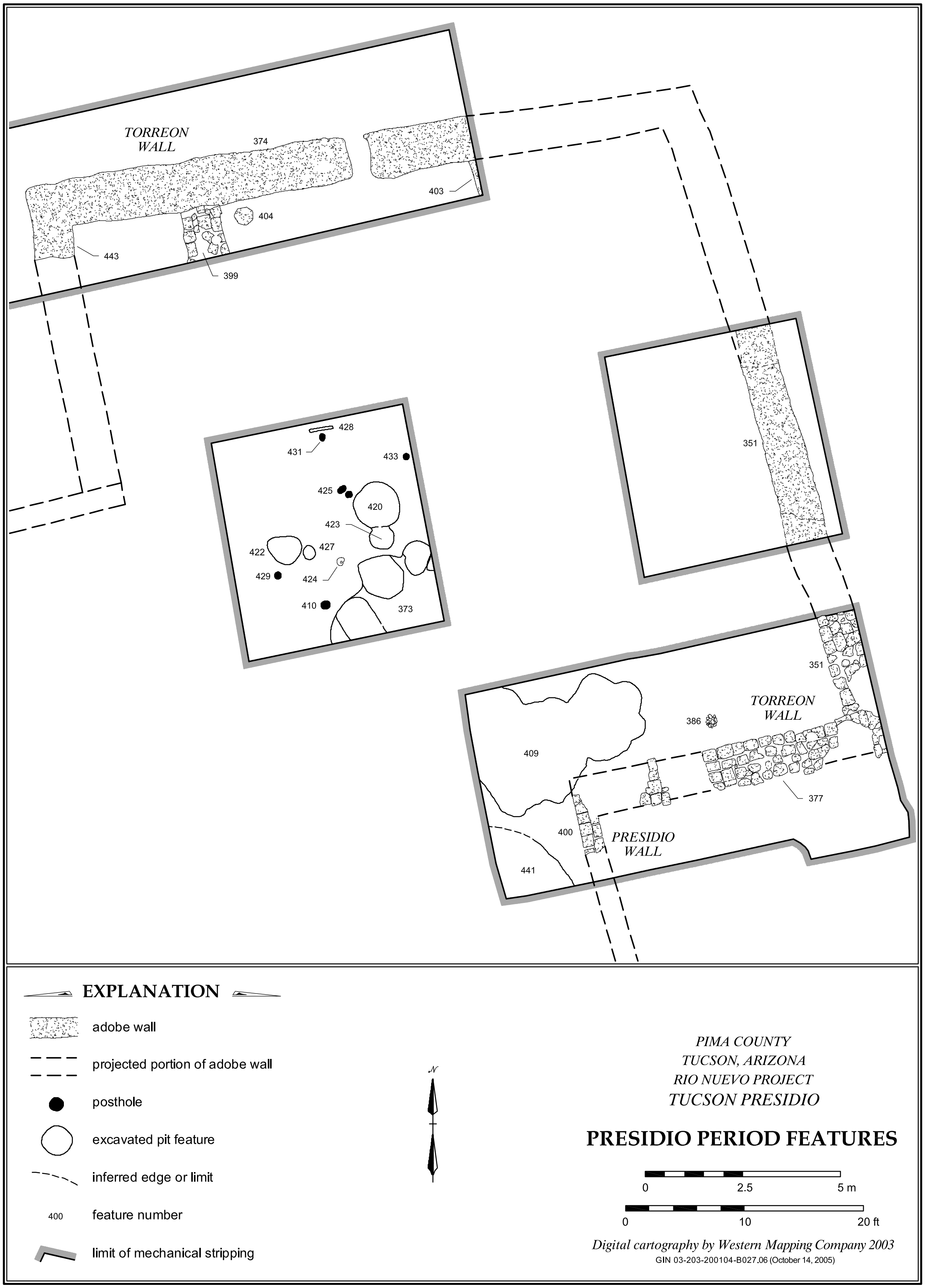

Figure 4.77. Presidio features found beneath the parking lot, Tucson Presidio, AZ BB:13:13 (ASM).

Figure 4.78. An overview of the presidio corner excavations, Tucson Presidio, AZ BB:13:13 (ASM).

Figure 4.79. Feature 377, the southern foundation of the tower, looking to the west, Tucson Presidio, AZ BB:13:13 (ASM).

were joined. The eastern exterior wall did not extend northward inside the tower. The location of the northern exterior wall of the presidio was not determined during the excavations, and at least some of this wall had probably been removed by a large American Territorial period borrow pit present in that area.

Other Presidio Features

A number of presidio features were found inside the area within the tower and the wall. In one excavation block measuring 5.6 m by 5.0 m, archaeologists uncovered a compacted ground (see Figure 4.77). This ground surface was formed either on purpose by people pounding the ground to harden it, or by accident as people and animals walked over the area. Four pits, Features 373, 420, 422, and 423; an area of puddled adobe, Feature 387; and six postholes, Features 410, 425, 428, 429, 431, and 433, cut through the surface. The postholes were probably for a ramada-like structure, although it was impossible to determine the size or shape of the building. The puddled adobe area was an enigma. Measuring 64 cm in length by at least 48 cm in width, it was only 7 cm high and had a circular depression in its center. The function of the adobe remains unclear, especially because much of the feature lies outside the excavated area. An iron canteen or bowl, Feature 424, was found impressed into the surface and likely dates to the presidio occupation.

The four pits found cutting through the surface and three other pits found nearby were probably dug to collect dirt to make adobe bricks, or for material to repair and plaster adobe walls (Figures 4.84-4.85). The pits were subsequently filled with soil with a large number of artifacts and food materials dating to the Spanish and Mexican periods. These are among the handful of presidio pits excavated in Tucson.

Although all these pits were probably dug to obtain dirt to make adobe bricks or mud plaster, they were too small to produce the substantial amounts of material that would have been necessary to build the wall and tower. Other borrow pits are likely present in nearby unexcavated areas. Historic accounts suggest dirt was mined just outside the perimeter of the fort, creating a "moat-like" depression that filled with water during the monsoon season. Excavations within the Pima County Courthouse courtyard found that the area on the exterior of the wall dipped down, suggesting the stories are true.

American Territorial Period Features

Once the asphalt was stripped away from the parking spaces on Lot 1 of Block 181, a large number of American Territorial period features were found (Figure 4.86). The areas excavated were mostly located in the backyard areas of the two houses, the

Figure 4.80. Feature 374, the northern foundation of the tower, looking to the southwest, Tucson Presidio, AZ BB:13:13 (ASM).

Figure 4.81. Feature 386, a cobble column support base within the southern foundation of the tower, Tucson Presidio, AZ BB:13:13 (ASM).

Figure 4.82. Features 404 and 495, an adobe column base and an interior room wall within the northern foundation of the tower, Tucson Presidio, AZ BB:13:13 (ASM).

apartment building, and the stables that stood on the lot. The features uncovered were created as a result of activities that occurred outside these buildings.

Borrow Pits

The largest features were a trio of borrow pits that were dug to for dirt from which to make adobe bricks. Borrow pits have been found in several other excavations in downtown Tucson. Builders likely sometimes found it convenient to make adobe bricks on site using the closest available material. Afterward, the large holes left behind were used for trash disposal (Ciolek-Torrello and Swanson 1997:149).

The borrow pit found at the southwestern corner of the lot, Feature 376, is the oldest of the three (Figure 4.87). This pit was at least 3.15 m long by 3.05 m wide. The fill of the pit extended beyond the excavation units, and its overall dimensions remain unknown. In the excavated portion, it was 1.08 m deep. The pit was filled with layers of soil and ash. Screening of the dirt in the excavated portion resulted in the recovery of 9,279 artifacts. Datable artifacts indicated the filling of the pit began in the late 1870s, and probably continued into the 1890s.

A second borrow pit was found in the center of the lot. The eastern and northern portions of the pit were found in separate excavation areas and assigned different feature numbers. Feature 359 was the eastern portion and was quite irregular, cutting into earlier American Territorial period ground surfaces and the underlying caliche hardpan layer. In another excavation area, the northern portion of the pit was uncovered and was assigned Feature 437 before it was determined that this was the same borrow pit. The overall borrow pit was at least 96 m long north-south, and at least 5 m wide. The actual length and width of the pit are not currently known. The pit was at least 84 cm deep, with the pit continuing to slope downward into an unexcavated area. The pit was filled with domestic trash in the 1880s to early 1900s. A total of 5,717 artifacts was found in the two excavated areas.

Feature 385, the third borrow pit, was found at the northwestern corner of the property and was sampled by excavation of a 2-m-wide trench along a 4.83-m-long segment of the pit, which was found to be 46 cm deep. Portions of the pit to the west and north have been destroyed by modern grading activities. The southern edge of the pit lies in an unexcavated area, while the eastern margin was located and was quite irregular. Unlike the other two borrow pits, this pit appears to have been slowly filled and contained artifacts that had been broken into small pieces by trampling. The soil in the pit consisted of

Figure 4.83. Feature 400, a small fragment of the eastern presidio wall, Tucson Presidio, AZ BB:13:13 (ASM).

Figure 4.84. Feature 409, a presidio borrow pit, Tucson Presidio, AZ BB:13:13 (ASM).

layers of brown silty loam, decomposed adobe bricks, and red silty sand. The pit appears to have been filled in the early 1900s. A total of 2,864 artifacts was found in the excavated portion of the pit.

Borrow pits are a common feature found during archaeological projects within the historic Tucson townsite. Previous excavations on Block 180, immediately to the east, located three large and five small borrow pits. The largest was 23.0 m in diameter and was at least 1.2 m deep. Another was 22.0 m in diameter and was about 1.0 m deep. A third oval-shaped pit was 18.0 m by 14.0 m, and was roughly 50 cm deep (Ciolek-Torrello and Swanson 1997). Other borrow pits have been found on Blocks 136, 138, 139, 172, and at the León farmstead (Thiel 2002, Thiel 2003, Thiel 2005; Thiel and Desruisseaux 1993). These pits, along with photographic evidence that bricks were manufactured in the downtown area, indicate many adobe structures were constructed from bricks made on location.

American Territorial period adobe bricks came in a variety of sizes, but were typically smaller than Spanish and Mexican period bricks. American Territorial period adobe bricks found on the block to the east measured 20 inches by 10 inches by 4 inches in size (roughly 50.8 cm by 25.4 cm by 10. 2 cm)—about the average size for adobe bricks for this time period (Ciolek-Torrello and Swanson 1997). An average brick contained a maximum of 13,110 cm^3 of soil. In reality, the bricks would have contained a certain amount of organic material, such as straw, reducing the amount of soil used. The excavated portion of Feature 376 would have yielded about 10 million cm^3 of dirt, which would have made at least 781 bricks. Feature 359/437 would have yielded over 44 million cm^3 of dirt, which would have made at least 3,377 bricks. Finally, Feature 385 would have yielded a minimum of 4.5 million cm^3 of dirt, which would have made about 338 bricks.

Approximately 4,500 bricks could have been made from the dirt from the three borrow pits. This is a minimum number of bricks, as the actual size of the pits could not be determined because they extended into unexcavated areas of the lot. Other borrow pits are probably present in unexplored portions of the lot.

The house depicted on the 1883 Sanborn map had two rooms. One measured 6.4 m by 4.4 m, and the other measured 6.1 m by 3.7 m. The structure had over 41 linear meters of wall. Bricks would probably have been placed with the short side facing outward, with a maximum of 162 3.1-cm-wide bricks required for each adobe brick course. The actual number of bricks would have been somewhat less, however, because there would have been door and probably window openings. The height of the house is unknown. Other houses of this time period range from 3-4 m tall. For a 4-m-tall house, a maximum of 29 courses of bricks would have been needed if each course consisted of a 10-cm-thick brick and a 2.5-cm-thick mortar layer. About 4,700 bricks would have been necessary to construct the house, a number fairly close to the estimate for the excavated portions of the three pits.

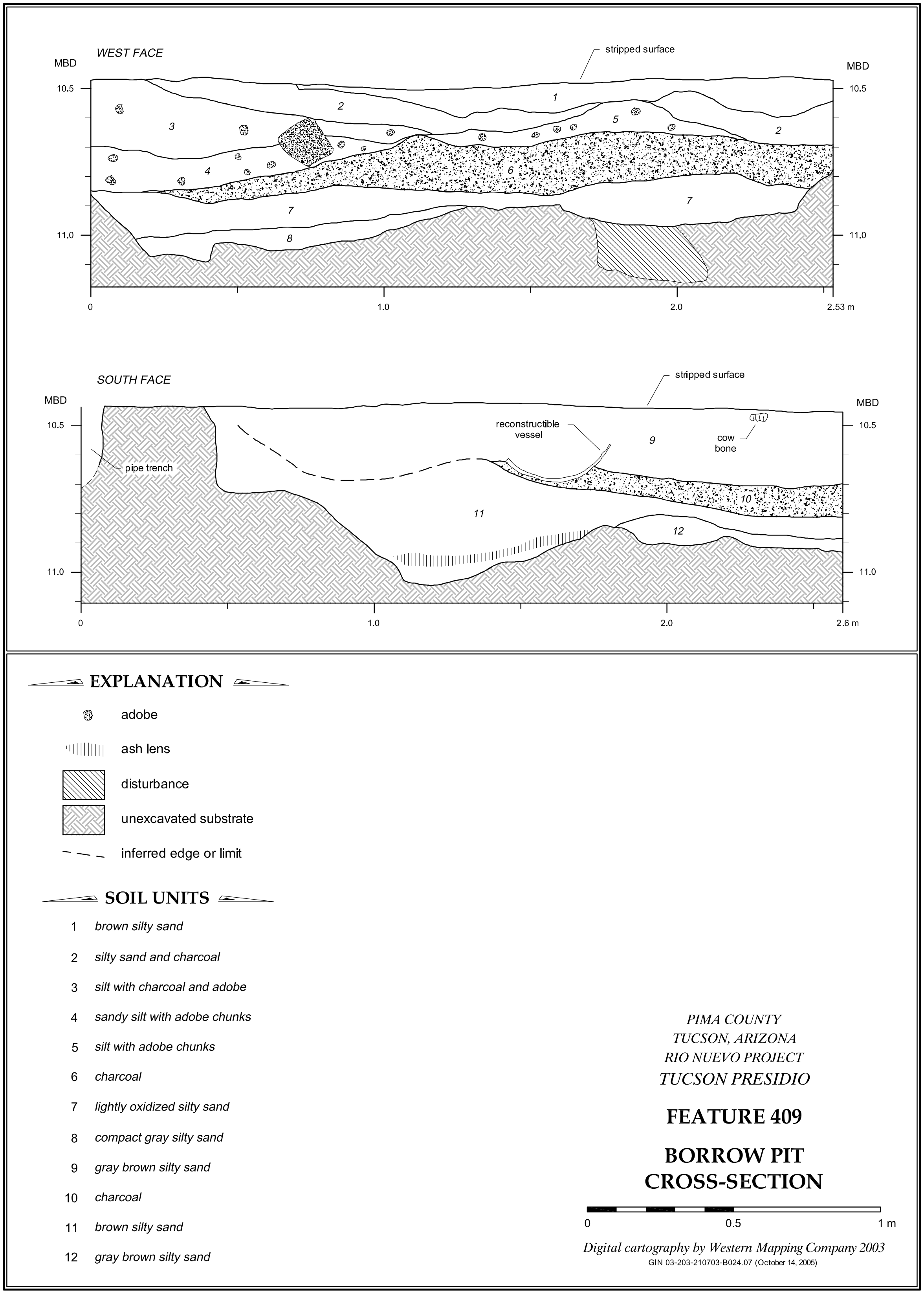

Figure 4.85. Profile of Feature 409, a presidio-occupation borrow pit, Tucson Presidio, AZ BB:13:13 (ASM).

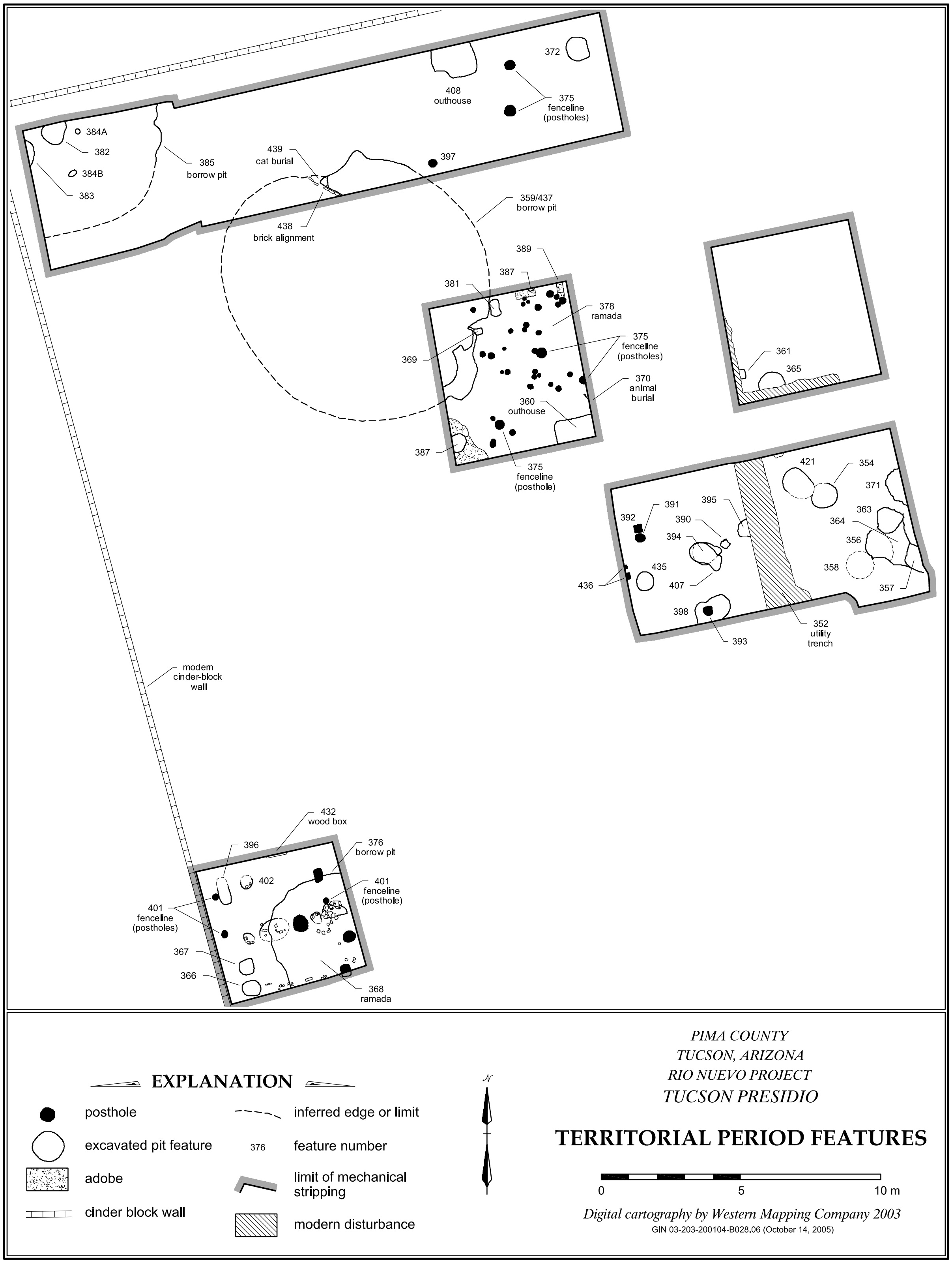

Figure 4.86. American Territorial period features found beneath the corner parking lot, Tucson Presidio, AZ BB:13:13 (ASM).

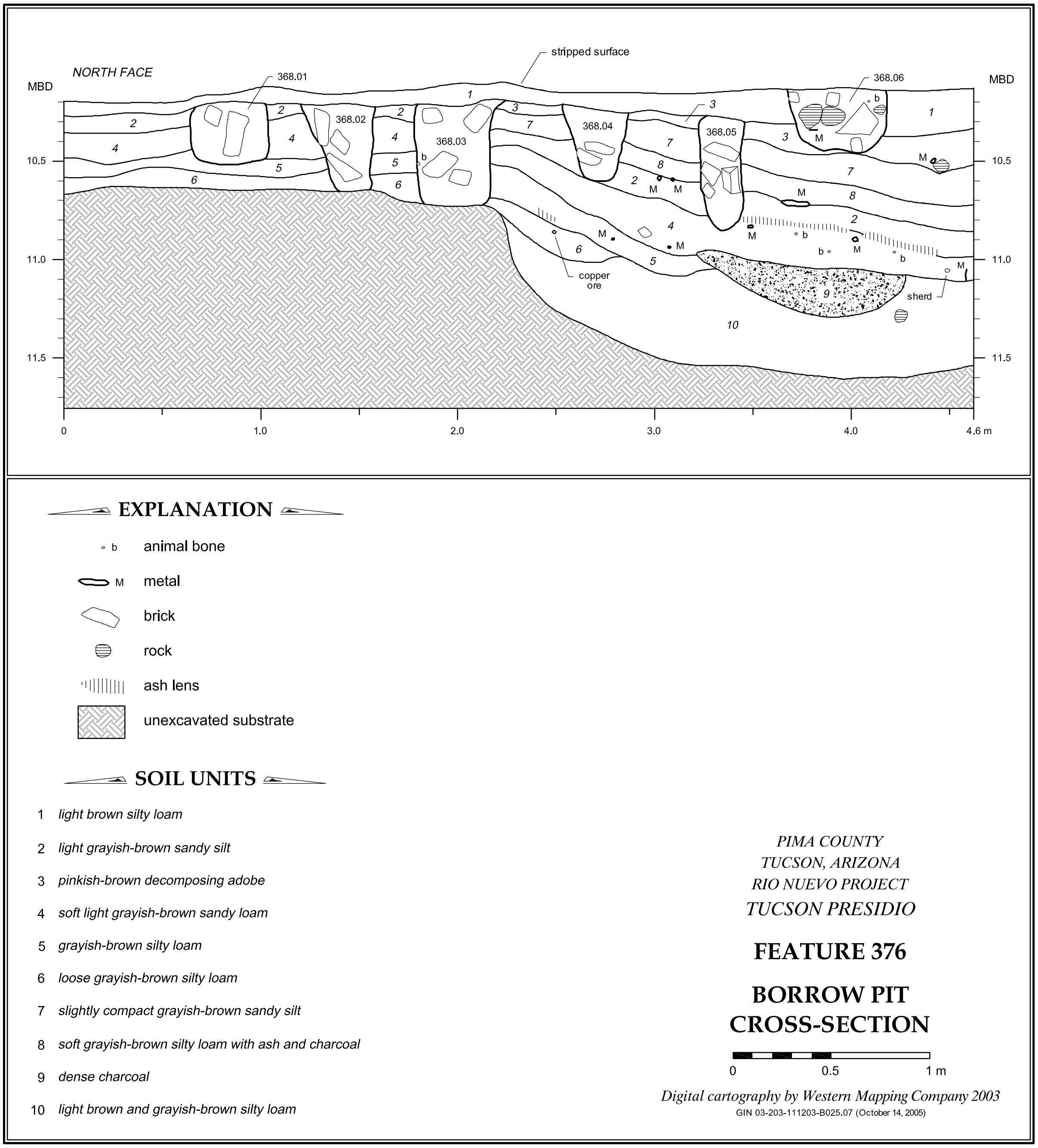

Figure 4.87. Profile of Feature 376, an American Territorial period borrow pit, Tucson Presidio, AZ BB:13:13 (ASM).

One caveat to this exercise is that the location of the house on the 1883 Sanborn map is also the location of the Feature 359/437 borrow pit, which was probably dug in the 1890s to provide material to build the two-story boardinghouse. Therefore, this large pit would not have provided material for the pre-1883 house. Given the location of the pit, the adobe walls of that early house may have been smashed and the material recycled into new bricks incorporated into the boardinghouse.

Outhouses or Wells

Indoor plumbing was not available in Tucson until the 1890s. For most people, outdoor outhouses or privies served as bathrooms. Excavations at other Tucson city blocks suggested outhouses remained in use until the 1910s, with poorer areas of town continuing their use into the 1930s. These excavations have also revealed that many city lots have multiple outhouse pits. Residents apparently used an outhouse for only a few years and then excavated a new hole and moved the superstructure. Afterward, the old hole was used for trash disposal and quickly filled in. As a result, outhouse pits serve almost as time capsules, frequently containing sets of artifacts that can be linked with specific households and families.

This was not the case for the excavated portion of Lot 1 of Block 181, where two outhouse pits were found. Both contained trash discarded by boardinghouse residents, who remain mostly anonymous.

Feature 360 was found in the center of the lot and was only partially excavated (Figure 4.88). The hole was 1.56 m long and at least 86 cm wide in plan view, extending beyond the walls of the unit into the unexcavated parking area. The upper 2.03 m of fill inside the pit was excavated, and probing revealed that the outhouse extended down at least another 76 cm below this point.

When excavation began, the upper portion of the pit was found to have been dug by bottle hunters in the early 1950s. Unfortunately, bottle hunters often target outhouse or well pits because they were used for trash disposal after they were no longer used as an outdoor bathroom. This sort of looting damages or destroys the archaeological value of the outhouse contents, because bottle hunters remove artifacts and disturb the various soil layers. In this case, the looters only excavated the upper portion of the pit, which was subsequently refilled with fine gravel. Beneath the gravel was a layer of redeposited fill that was dumped back in after the upper portion had been looted. Below this were undisturbed layers of dark brown sandy loam and ash. This feature probably started out as a well and was later used as an outhouse. After excavation was completed, the fill inside the pit subsided about 7 m, suggesting the original function was as a well.

Artifacts were common once the disturbed material was removed. A total of 3,736 artifacts was found. Datable items suggested the outhouse was filled in the 1900s to late 1910s.

The second outhouse was found along the northern side of the lot and was probably located just inside a fence that would have screened the wooden structure from view along Washington Street. Feature 408 first appeared as a dark irregular stain, contrasting in color from the surrounding soil (Figure 4.89). Subsequent excavation revealed that the stain was an outhouse pit 1.38 m long and at least 94 cm wide. It extended into the unexcavated area to the north. The upper 2.02 m of fill was excavated, and probing suggested it extended at least 76 cm below this point. The upper fill was mostly light brown silty loam with pockets of ash and charcoal. The lower fill was a mottled green, tan, and dark brown loam with pockets of fecal material and ash. A total of 4,409 artifacts was found in the excavated fill. The remaining portion of this outhouse was extended during fieldwork conducted in 2005-2006.

The two outhouses were probably filled in after the large boardinghouse that fronted Church Avenue installed indoor bathrooms in the late 1910s to early 1920s. Recent excavations in Tucson have located some 36 outhouses, ranging in date from the 1880s to the 1950s. Most predate 1920, except a few built by poor Mexican families who lived in the Barrio Libre (Thiel and Desruisseaux 1993). The excavated privy pits vary dramatically in shape and size, averaging about 2 m in depth. While some examples have been very shallow, only about 30 cm deep, an example from Block 80 was discovered to be almost 5.5 m deep (Mabry et al. 1994), and several outhouses on Block 139 were over 6 m deep. Some of the deeper pits may have started out as wells that were converted into outhouses after the water table dropped or indoor running water was installed.

Most of the excavated outhouses have been found to have several distinct layers. The base of the pits typically contained decomposed human waste and a small number of artifacts—often items that fell into the pits during use—coins, watches, and other pocket contents. A thick layer of trash is usually above this layer representing items discarded by nearby households. Sometimes household cleanout events will be represented, with numerous whole artifacts dropped into the pit. As an example, Feature 18 on Block 80 contained several complete ceramic and glass vessels, including expensive glassware, presumably thrown out when a household moved out and new residents discarded unwanted items. Finally, a layer of fill dirt is often found capping the outhouse, dropped in place to level the ground and to prevent the area from being a hazard. As the contents of the outhouse settle, more dirt may be dumped in.

Outhouses fell out of favor once indoor plumbing was installed. This process began in the early 1890s, and appears to have accelerated in the 1910s. Having indoor plumbing became standard in new construction by the late 1910s, and outdoor bathrooms were common only in poorer neighborhoods.

Other Features

Scattered across the excavated portion of Lot 1 were a number of other American Territorial period features. The excavation of a large block in the center of the parking lot was mostly conducted in stratigraphic levels, peeling back layer after layer of dirt that had built up in the area. Eventually, a very hard ground surface, designated Feature 378, was discovered, probably dating to the 1850s to 1860s, based

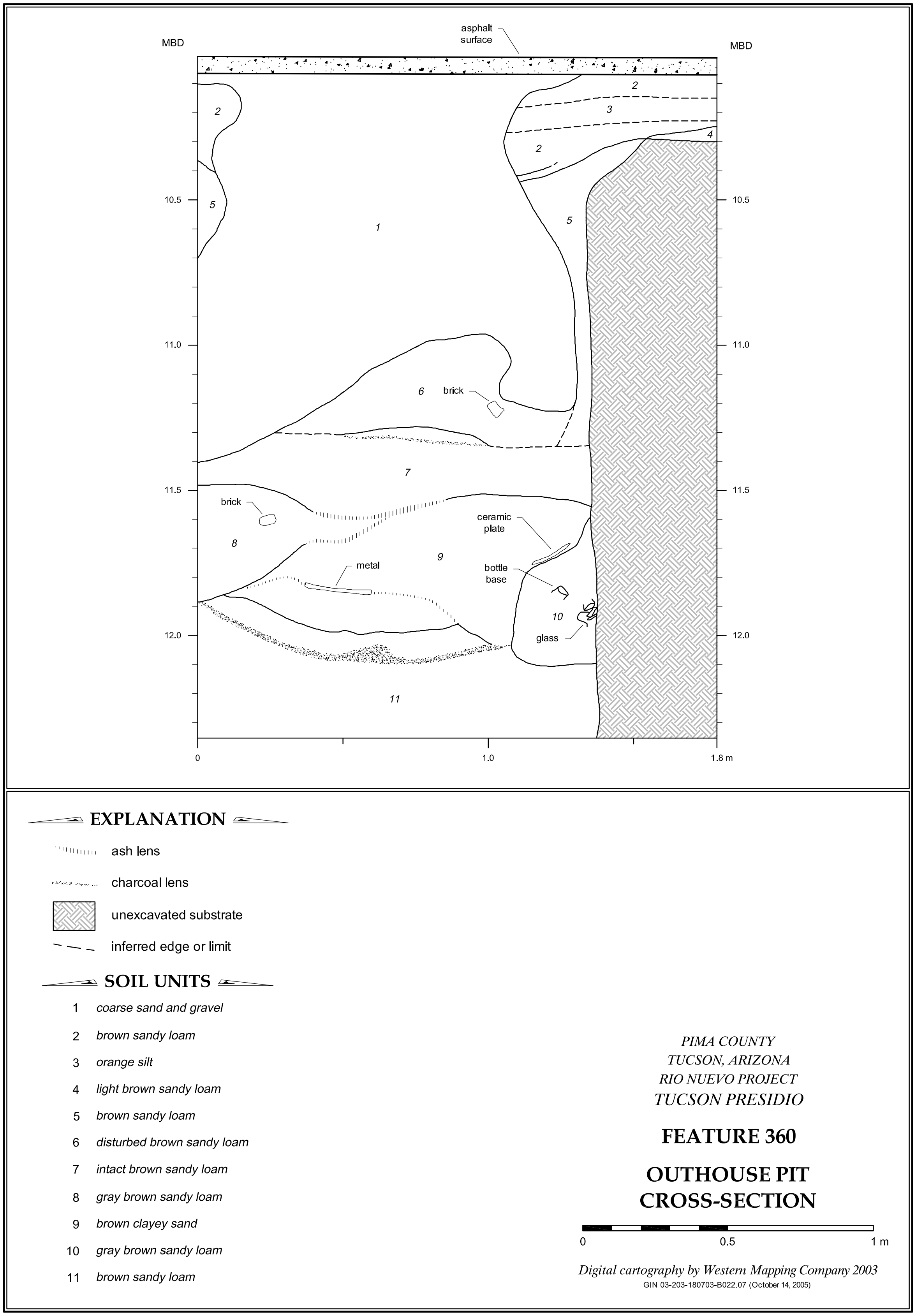

Figure 4.88. Profile of Feature 360, an American Territorial period outhouse, Tucson Presidio, AZ BB:13:13 (ASM).

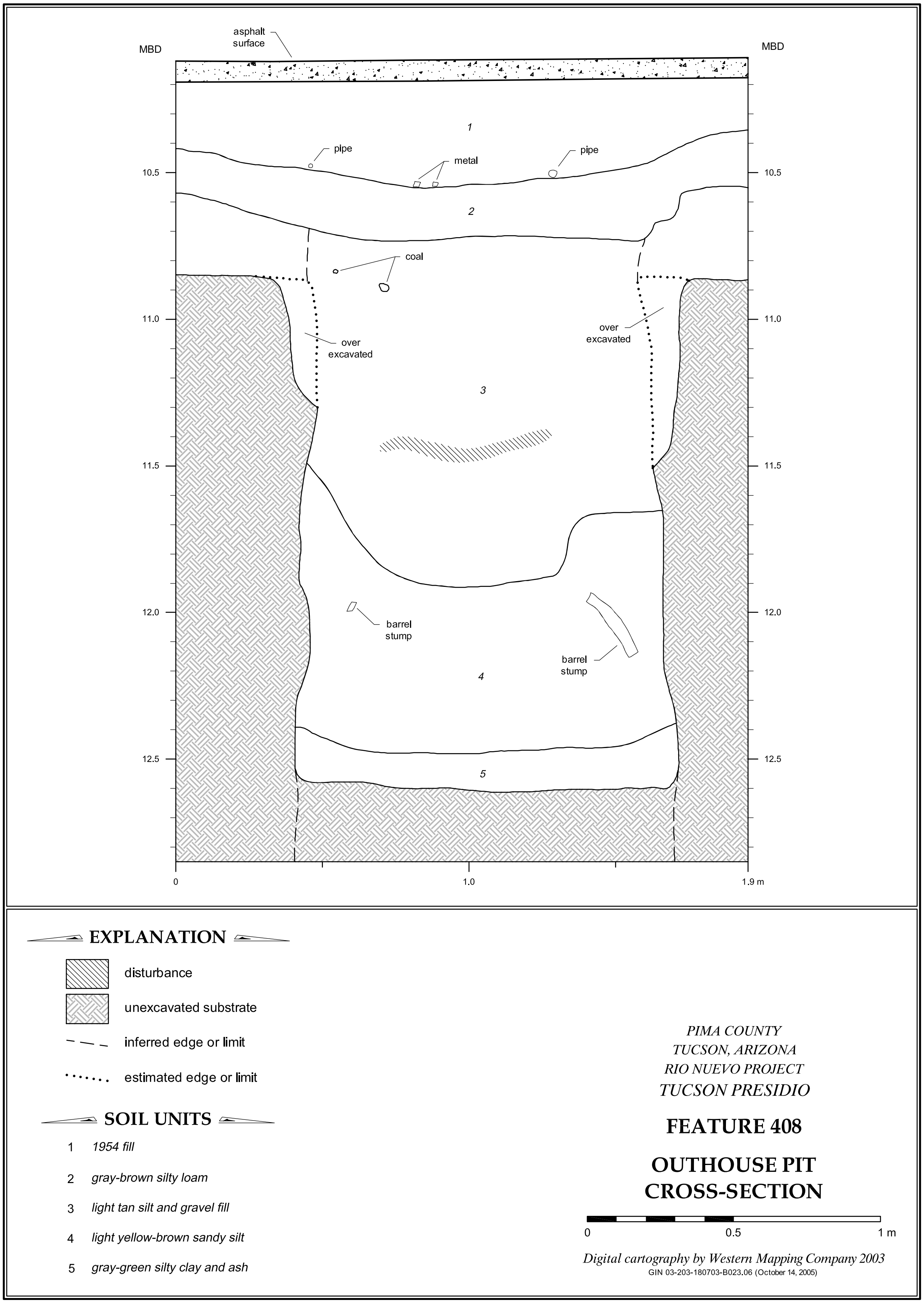

Figure 4.89. Profile of Feature 408, an American Territorial period outhouse, Tucson Presidio, AZ BB:13:13 (ASM).

on the types of transfer-print ceramics found in the soil on top of the surface (Figures 4.90-4.91). This surface extended across the entire exposed area, about 5.6 m by 5.0 m, except where it had been cut by later features. Thirty postholes cut through the surface and appeared to represent one or more ramada structures. These simple structures had a framework of wooden posts and were probably covered on the outside with thatching made from grass or other materials. Many of the posts of the ramada had been replaced as they deteriorated, with new posts positioned next to the old ones. A fragmentary adobe wall, Feature 389, was found in the northeastern corner of the excavation Unit and appeared to also rest on the surface. It probably represents a portion of another early American Territorial period structure, perhaps a building depicted on the 1862 Fergusson map of Tucson (Figure 4.92).

Later American Territorial period features included a cluster of planting pits in the center of the lot. This area was directly behind the boardinghouse, and the pits probably represent places where trees or bushes were planted. They contained relatively few artifacts, a result of the pits being immediately refilled soon after they were dug.

Other post-1880 features included a small portion of a brick walkway, a dog burial, a cat burial, a large trench in which utilities (gas, water, and sewer) had been placed, postholes from a shed at the southwestern corner of the lot, and postholes from a fenceline found running through the center of the lot. Dozens of other American Territorial features likely remain to be found in the unexcavated portions of the site.

DETAILED HISTORIC ERA FEATURE DESCRIPTIONS

Detailed descriptions of the Historic era features discussed above are presented below.

Feature 351

This adobe wall was discovered during mechanical stripping. The wall had been previously excavated in 1954, by Alan Olson, who recorded it as the northeastern corner of the presidio. This subsequent excavation revealed that this portion of wall was, in fact, part of the eastern wall of the *torreón*, or tower, that stood at the northeastern corner of the presidio.

Excavation exposed 17.61 m of this wall that measured about 98 cm in width along its length. The basal course of adobe bricks for the wall had been laid directly on the ground, and no evidence for a foundation trench or stone foundation was discovered. Puddled adobe had been placed on top of the basal course of adobe bricks before another course of bricks would have been laid on top. The bricks of the wall varied dramatically in size. The remaining base of the wall stood at a height of roughly 30 cm. No evidence was found that the wall had been plastered or stuccoed.

When originally completed, the eastern wall of the tower was about 17.81 m long and between 0.98 m and 1.15 m wide. The tower wall was constructed sometime in the early 1780s, and historical accounts suggest at least portions of the wall were still standing until they were dismantled in the 1850s.

Feature 352

This utility trench was discovered during mechanical stripping of the area. The trench was excavated sometime between 1910 and 1940, to provide water, sewer, and gas service. Pipes for these three utilities still remained in the trench, although they were out of service. The excavated portion of the trench measured approximately 5.0 m in length and 3.4 m in width. The trench disturbed portions of the Hohokam pit structure, Feature 350, excavated by Olson, and the southern *torreón* wall, Feature 377.

Feature 353

This feature appeared as a ring of adobe some 1.28 m in diameter. The center hole measured about 60 cm in diameter, and appeared to be filled with cultural fill that resembled the matrix surrounding the ring. The adobe that composed the ring measured between 35 cm to 43 cm along its circumference and was roughly 10 cm in depth. The western portion of this feature was disturbed, although no pit or other feature could be identified as the source of the disturbance. This adobe ring did overlie the northwestern portion of Feature 354, a trash-filled pit that dated to the 1900s. No artifacts were observed in Feature 353, and its function was unknown.

Feature 354

This small pit was discovered during mechanical stripping, just below the asphalt surface. It appeared as a pit filled with sand and gravels in the silty loam matrix. When excavated, the pit was roughly circular, with a basin-shaped profile. The northwestern portion of the pit was capped by an adobe ring of unknown function, Feature 353.

The pit measured roughly 1 m long, 96 cm wide, and 26 cm deep. Artifacts recovered from the pit included Native American sherds, metal, unworked

Figure 4.90. Feature 378, a set of American Territorial period postholes for a probable ramada structure, Tucson Presidio, AZ BB:13:13 (ASM).

Figure 4.91. Photograph of the Feature 378 postholes and other features, Tucson Presidio, AZ BB:13:13 (ASM).

animal bone, flaked stone, glass, historic ceramics, buttons, some worked animal bone, and a charred fruit pit. This feature probably dated to the early 1900s.

Feature 356

This large oblong pit was discovered during mechanical stripping under the lot's asphalt surface. It had vertical sidewalls and measured 2.05 m in length, 1.06 m in width, and 46 cm in depth. The pit intruded on the fill of Features 363 and 364, two earlier pits. The southeastern edge of this feature was itself disturbed by an intrusive pit, Feature 357.

Fill of the pit was grayish-brown sandy silt with abundant amounts of charcoal and ash. Both the percentage of sand in the matrix and the concentration of charcoal decreased with depth. Artifacts recovered from the fill included Native American sherds, historic ceramics, glass, flaked stone, metal, a few buttons, and some fragments of red brick. One brown glass alcohol bottle was embossed on the base with the letters "R & Co." Toulouse (1971:438) dates use of this marking to between 1879 and 1888. A few brick-like chunks of adobe were also discovered in the fill at about mid-depth. This pit was thought to date to the late 1800s.

Feature 357

This irregular pit was discovered during excavation of Feature 356, a large historic pit upon whose eastern edge it intrudes. Only a portion of the irregular pit was excavated, as it extended out of the stripping unit to the east. The excavated portion of the pit measured 1.08 m in length, 68 cm in width, and 55 cm in depth.

Two distinct strata were visible. The upper 35 cm of fill was gray sandy silt with moderate amounts of charcoal and ash. Artifacts recovered from this upper fill included Native American sherds, metal, unworked animal bone, flaked stone, and some glass. The lower 20 cm of fill was of similar composition, but was yellowish-brown in color. The concentration of charcoal and ash decreased considerably, and numerous chunks of adobe were present. Artifacts recovered from this fill included Native American sherds, historic ceramics, metal, flaked stone, unworked animal bone, and some glass. Medium-sized cobbles and fragments of red brick were present throughout both layers of fill. This pit was thought to date to the late 1800s.

Feature 358

This small pit became visible during mechanical stripping just under the asphalt surface. It was circular, with a basin-shaped profile, and measured 1 m in length, 97 cm in width, and 37 cm in depth. Fill of the pit was grayish-brown loam of loose compaction. Artifact density was high throughout the fill, although especially in the northern half of the pit. Artifacts recovered from the pit included Native American sherds, historic ceramics, unworked animal bone, glass, metal, numerous nails, some eggshell, a glass bead, a shell button, and a fragment of chalkboard slate. Charcoal and charcoal flecking were present throughout the fill. Rodent and root turbation were evident in the margins of the pit, especially in the southern half. This pit probably dated to the early 1900s.

Feature 359

The southeastern corner of this large, irregularly shaped borrow pit was discovered during mechanical stripping. The pit extended out of the stripping unit to the north and west. The excavated portion measured 4.0 m in length, 2.5 m in width, and about 84 cm in depth. Another edge of this borrow pit was discovered in a stripping unit to the north, suggesting this borrow pit may have measured more than 10 m in diameter. This northern portion of the feature was excavated as Feature 437.

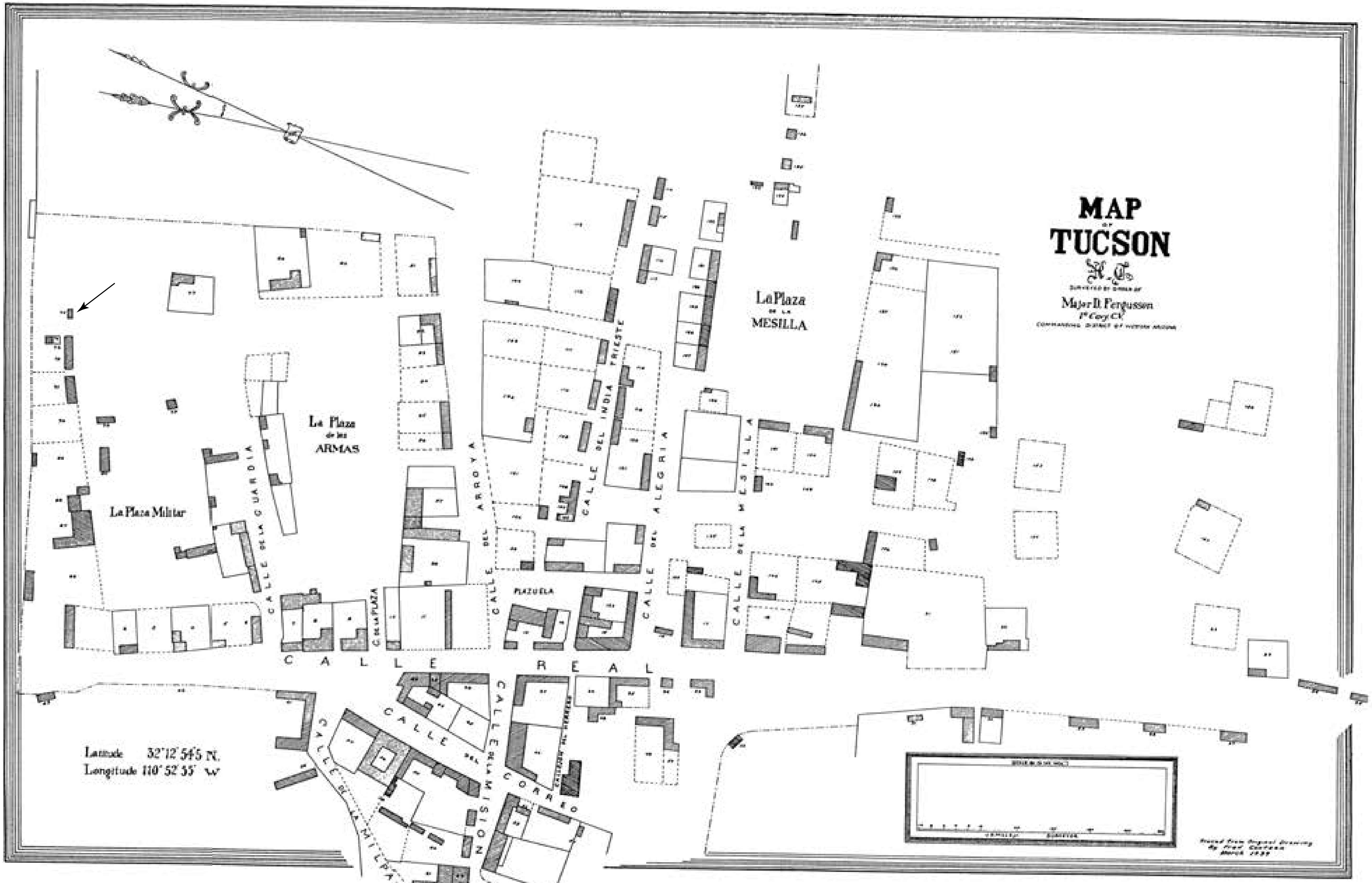

Figure 4.92. A structure depicted on the 1862 Fergusson map of Tucson (see arrow) may be represented by adobe bricks found in the project area, Tucson Presidio, AZ BB:13:13 (ASM).

Fill of the pit was in three distinct strata. The borrow pit was capped by a thin layer of coarse pinkish sand with no artifacts. The next stratum averaged about 30 cm in depth, and was composed of a gray sandy loam with large concentrations of charcoal and ash. Several separate dumping episodes were visible in this stratum. This layer of ashy trash contained most of the artifacts recovered from the borrow pit.

Artifacts recovered from this stratum included very high concentrations of Native American sherds, historic ceramics, glass, and metal. Many domestic items were also discovered, including toy wheels, eyeglasses, ceramic doll parts, buttons, two horseshoes, a door lock, pieces of a hurricane lamp, fragments of school slate, pencil leads, two Chinese coins, worked bone and shell, a pipe stem, and whole infant food bottles.

The lower 54 cm of fill in the borrow pit was composed of degraded adobe blocks and adobe melt. This fill was thought to represent a dump of construction materials, prior to the use of the pit as a dump for the domestic trash. These construction materials contained much lower concentrations of artifacts than the ashy layer above. Artifacts recovered from this stratum included some rusty metal, flaked stone, some unworked animal bone, glass, and a few Hohokam sherds. A small pocket of stones of the type used in building foundations was located within the adobe.

Feature 369, a small, square historic posthole, intruded on the very eastern edge of this feature. Many datable artifacts were recovered from the fill of the borrow pit. Several aqua glass bottles were found embossed with "MELLIN'S INFANT'S FOOD/ DOLIBER-GOODALE CO BOSTON/LARGE SIZE." Fike (1987:57) dates these bottles to circa 1888. An aqua glass medicine bottle reading "Trask's Magnetic Ointment" dated from between 1846 and 1915 (Wilson 1981:48). Also found was a brown glass beer bottle, embossed on its base with the letters "R & Co." Use of this marking dates between 1879 and 1888 (Toulouse 1971:439). A whiteware saucer from Alfred Meakin Pottery dated to between 1897 and 1930 (Godden 1971:425). This borrow pit was thought to date to the late 1890s or early 1900s. An additional portion of this pit was excavated in 2005-2006.

Feature 360

This privy pit or well was discovered during mechanical stripping under the asphalt surface of the lot. The pit was rectangular in shape and measured 1.56 m in length and 86 cm in width. A small portion of the privy extended out of the stripping unit to the south and was left unexcavated. The pit had straight sidewalls and was excavated to a depth of approximately 2.3 m. The remaining fill could not be excavated for safety reasons, but a 1-m-long probe pushed into the fill did not hit bottom. This privy pit intruded into the fill and through the base of an underlying presidio-occupation borrow pit, Feature 373.

The upper 1.3 m of fill of the privy pit was found to have been bottlehunted sometime prior to construction of the parking lot in 1955. This was evidenced by a stratum of clean white sand and gravel that had been redeposited into the pit. This fill was removed without screening down to the intact fill of the privy pit. The remaining 1 m of excavated fill was brown sandy loam with large lenses of charcoal and ash. Artifact density was very high throughout the fill. Artifacts recovered from the fill consisted of metal, burned animal bone, a piece of ground stone, some glass, buttons, battery cores, some newspaper, Native American sherds, and historic ceramics. Several whole or reconstructable glass bottles and a partially reconstructable ceramic chamber pot were also recovered from the fill. The unexcavated fill below this stratum appeared to also be brown sandy loam. After excavation concluded, the fill inside the feature subsided approximately 7 m.

Several datable artifacts, including two bottles and two whiteware saucers, were also found. One aqua glass bottle bore the "AB" mark of the Adolphus Busch Glass Manufacturing Company of Belleville, Illinois, on its side. Toulouse (1974:24) dates the use of this bottle mark to 1904-1907. The second bottle, a brown glass alcohol bottle, was embossed on its base with the letters "R & Co." Use of this marking dates between 1879 and 1888 (Toulouse 1971:438). The whiteware saucers were from two separate sources, the first bearing a maker's mark reading "HALL CHINA" and the second reading "K. T. & K. CO. SEMI VITREOUS PORCELAIN." The first mark dates to between 1903 and 1911 (Gates and Ormerod 1982:56), and the second dates to between 1890 and 1905 (Gates and Ormerod 1982:125). Both pieces were from companies based in East Liverpool, Ohio (Gates and Ormerod 1982).

This privy was thought to date to the early 1900s, and was probably used by occupants of a nearby boardinghouse.

Feature 361

This ash-filled hearth was discovered during mechanical stripping. The hearth appeared oblong in plan view, had a basin-shaped profile, and measured 49 cm in length, 22 cm in width, and 11 cm in depth. Fill of the pit was almost pure gray ash, mixed with small amounts of silty loam. The fill contained several small chunks of oxidized daub and abundant amounts of charcoal and charcoal flecking. Artifacts recovered from the fill consisted of a few pieces of unworked cow bone and one piece of historic ceramic. Pit base showed some slight oxidization and blackening.

Disturbance to the feature was moderate. Two trenches intruded on portions of the feature: one a gas line trench and the other a test trench excavated by Alan Olson in 1954. A small rodent disturbance also intersects the southwestern edge of the hearth.

The historic ceramic recovered from the fill suggested the hearth probably dated to either the Mexican or American Territorial period.

Feature 363

This small circular pit was discovered during excavation of a larger pit, Feature 356. Feature 363 was intruded on by Feature 356. The upper 40 cm of fill was removed along with the fill of the larger pit. It was not until the fill of this smaller feature became more distinctive that it was recognized as a separate feature. Feature 363 was circular in plan, had straight walls with a rounded bottom, and measured about 1 m in diameter. It had an overall depth of 57 cm, including the portion removed with Feature 356.

Feature 363 appeared to cut into the southeastern corner of the *torreón* wall conjunction of Features 351 and 377. The profiles of several adobe bricks were visible in the profile of the northern side.

This pit was located in a cluster of other pits—Features 356, 357, 358, and 364. The lower 17 cm of fill was tannish-brown sandy silt with few artifacts. Artifacts recovered included Native American sherds, unworked animal bone, metal, and construction debris (red brick and cement). Feature 363 probably dates to the late 1800s.

Feature 364

This small, oval-shaped pit was discovered during excavation of Feature 356, a larger pit. Feature 356 intruded on Feature 364, destroying the eastern half. The remaining portion of Feature 364 measured 1.25 m in length, 65 cm in width, and 46 cm in depth. Portions of the southern, Feature 377, and eastern, Feature 351, walls of the *torreón* were visible in the margins of this pit.

Fill of the pit was grayish-brown sandy silt with some charcoal chunks and flecking. Artifacts recovered from the fill included Native American sherds, a few pieces of flaked stone, historic ceramics, metal, glass, and some unworked animal bone. A few pieces of concrete and fragmentary red bricks were also discovered. Feature 364 was thought to date to the late 1800s.

Feature 365

This small pit was discovered during excavation around a Hohokam pit structure, Feature 350. The pit appeared circular in plan view and had a basin-shaped profile. It measured 95 cm in length, 60 cm in width, and 18 cm in depth. The pit was slightly truncated on its southern end by a utility trench, leaving about two-thirds of the pit intact.

Fill of this feature was brown sandy loam with chunks of burned daub, charcoal, and some ash. Artifacts recovered from the fill included Native American sherds, unworked animal bone, glass, historic ceramics, and metal. Similarities were noticed between the fill of this feature and the redeposited fill of Feature 350, the Hohokam pit structure originally excavated by Olson. The mixing of both prehistoric and historic materials in the fill raised the possibility that this pit had also been previously excavated. No documentation exists to confirm this possibility.

Feature 366

This small pit was discovered during the excavation a 2-m by 2-m control unit. It was an ovate pit with vertical sidewalls that measured 64 cm in length, 51 cm in width, and 40 cm in depth. Fill was grayish-brown sandy silt with some small chunks of charcoal. Artifacts recovered from the fill included Native American sherds, animal bone, pieces of flaked stone, some glass, historic ceramics, and metal.

The pit was thought to date to the early 1900s. The function of the pit was unclear.

Feature 367

This posthole was discovered during mechanical stripping. It contained an intact but poorly preserved wooden timber that measured 29 cm long and 2 cm wide. The hole itself was 56 cm long, 48 cm wide, and 48 cm deep, much larger than what was needed to hold the wooden post. The hole was likely originally dug for another use, but was then later reused to hold the post. Several other postholes were located in this area, although the function they served was unknown.

Fill was brown silty sand that was very loosely compacted. The artifact density of the fill was moderate, and increased slightly with depth. Artifacts recovered from the posthole included Native American sherds, unworked animal bone, some glass, historic ceramics, rusty metal, and a piece of a school slate. Many rusted nails were present at the base of the wooden post. This posthole was thought to date to the 1900s.

Feature 368

Feature 368 consisted of a series of 12 brick-lined postholes thought to represent supports for a small outbuilding. The postholes varied greatly in size and depth. Measurements ranged from: 7-80 cm long, 7-32 cm wide, and 23-98 cm deep. Only three of the postholes—Features 368.07, 368.08, and 368.12—were completely excavated, although six others—Features 368.01-368.06—were visible in profile. Two postholes, Features 368.10 and 368.11, remained completely unexcavated.

Artifacts recovered from the three excavated postholes included Native American sherds, historic ceramics, metal, some unworked animal bone, and pieces of glass. Four of the postholes, Features 368.08-368.12, contained in situ wooden post fragments. Features 368.07 and 368.08 intruded into the fill of Feature 376, a large borrow pit.

All the postholes had at least one brick lining the sides, although one or two shared bricks. The postholes were thought to be supports for an outbuilding or roofed area. This feature probably dated to the early 1900s.

Feature 369

This posthole was discovered during excavation of a historic borrow pit, Feature 359. It was intrusive to the fill of the earlier borrow pit and extended through the original base of the pit. The posthole was roughly square and measured 26 cm in length and width and 30 cm in depth. Fill was loose brown sand, and the artifact density of this fill was lower than that of the fill of the borrow pit. Artifacts recovered from the posthole included Native American sherds, unworked animal bone, a few historic ceramics, some glass, and rusty metal. The function of this posthole was unknown. Feature 369 was thought to date to sometime between 1900 and 1955.

Feature 370

This modern dog burial was discovered in the eastern profile of a mechanical stripping unit. No pit was visible, but the area containing visible bone measured 50 cm in length and 2 cm in depth. A portion of the dog burial extended into a hand-excavated control unit. A few leg bones were recovered and collected. The main concentration of the burial extended into an unstripped area and remained unexcavated.

Feature 371

This small pit was discovered during hand-stripping of the eastern wall of the *torreón*. This roughly circular pit cut through the adobe bricks that formed the remaining base of the wall. Roughly two-thirds of the pit lay outside the stripping unit, and therefore, remained unexcavated. Walls of the pit were vertical where visible. The complete measurements of the pit were estimated to be 1.49 long, 1.38 m wide, and 75 cm deep.

The fill consisted of light brown sandy silt with some ash and charcoal. The upper fill of the pit originated above the intact bricks of the *torreón* wall, although this fill had probably been disturbed by the construction of the lot's asphalt surface. The highest concentration of artifacts was found in the upper 30 cm of fill. Artifacts recovered from the upper fill included Native American sherds, historic ceramics, some animal bone, glass, metal, some flaked stone, an obsidian Sobaipuri projectile point, and some fragments of early plastic.

The artifact density dropped considerably in the remainder of the fill. The lower fill was slightly darker sandy silt with only a few small flecks of charcoal. This lower fill contained a few Native American sherds, rusty nails, and fragments of animal bone. This pit likely dated to the early 1900s.

Feature 372

This small pit was discovered during mechanical stripping. It was roughly circular in shape, and measured 83 cm in length, 75 cm in width, and 12 cm in depth. The walls of the pit sloped sharply and ended in a fairly flat base. Fill of the pit was a dark gray-brown sandy loam with large quantities of ash and pulverized charcoal.

Artifact density of the fill was very high, and all the artifacts showed signs of having been burned. Artifacts consisted of Native American sherds, historic ceramics, some shell, fragments of animal bone, abundant quantities of metal, a metate fragment, a button, and a few pieces of vitrified glass. The trash fill appeared to have been redeposited in this pit after it had burned, as the pit showed no signs of having been oxidized.

One datable green glass bottle was recovered from the fill. It bore the letters "E B & Co" on its base, used by Edgar F. Breffit & Co. of Yorks, England, between 1832 and 1913 (Toulouse 1971:79). This pit was thought to date to the early 1900s.

Feature 373

This large, irregularly shaped borrow pit was encountered during excavation of an American Territorial period privy pit, Feature 360. The privy cut through the fill and base of the underlying borrow pit. The borrow pit was approximately 3.5 m long, 2.2 m wide, and 62 cm deep. It was one large pit at the top, with three separate areas of greater depth. The overlying privy likely disturbed another of these deeper areas. The upper fill of the borrow pit was also slightly intruded on by Feature 375.04, a posthole from a historic fenceline.

Fill of the borrow pit was gray-brown sandy loam with abundant amounts of ash and charcoal, as well as a few chunks of fired adobe. Although the fill was similar in color and composition throughout, several different layers of trash deposition and a small lens of water-lain soil were visible in profile. Artifacts were abundant throughout the fill. They consisted of Native American sherds, presidio-occupation historic ceramics, flaked stone, worked shell, a flaked stone projectile point, some animal bone, a few musket balls, and a gunflint.

This feature appeared to originate at a presidio-occupation ground surface, Feature 418, and probably dated to that period—the 1820s.

Feature 374

This adobe wall was discovered during mechanical stripping under the asphalt surface of the lot. The wall was the northern wall of the *torreón*. The exposed section of wall measured 11.43 m in length and 1.25 m in width. It was intruded on by a modern posthole, Feature 375.02, and a modern utility trench.

The wall was constructed of adobe bricks laid directly on the presidio ground surface, with no constructed foundation or foundation trench. Puddled adobe found atop the basal course of bricks suggested the wall was built of alternating layers of adobe bricks and puddled adobe. The remaining wall stood an average of 27 cm in height.

When originally constructed, the northern tower wall was about 17.25 m long and 0.98-1.15 m wide. The tower wall was constructed sometime in the early 1780s, and historical accounts suggest at least portions of the wall were still standing until they were dismantled in the 1850s.

Feature 375

This was a series of five postholes discovered across the site. They were given a single feature number despite their range due to similarities in appearance and fill. All originated just below the asphalt surface of the lot at the 1950s ground surface. They ranged in size from 26 cm to 37 cm in length, from 20 cm to 33 cm in width, and from 30 cm to 60 cm in depth. All contained loosely compacted coarse orange sand. No artifacts were recovered from any of the postholes. The postholes were thought to represent a fence or utility line that dated to the mid-1900s.

Feature 376

This was a large, irregularly shaped borrow pit discovered during mechanical stripping beneath the asphalt surface. Three posts—Features 368.04, 368.05, and 368.08—from a possible structure, Feature 368, intruded on the top layers of pit fill. The excavated portion of Feature 376 measured 3.15 m in length, 3.05 m in width, and 1.07 m in depth. The pit continued out of the stripping unit to the east and south. During excavation, the sloping edges of the pit were defined on the northern and eastern sides. The fill was grayish-brown sandy loam with ash lenses and moderate amounts of charcoal. A few distinct dumping episodes were visible as the stratigraphy of the pit, including a large lens of almost pure charcoal.

Artifacts were very abundant throughout the fill. Materials recovered included Native American sherds, various historic ceramic vessels and dolls, flaked stone, several pieces of ground stone, shell, glass, metal, leather, jewelry, a coin, pencil leads, buttons, and both worked and unworked animal bone. The artifacts near the bottom of the pit appeared burned, especially the sherds and animal bone. No oxidation was visible on the pit margins. This suggested the fill had been burned elsewhere before being deposited into this pit.

Datable artifacts recovered from the fill included two whiteware plates. One bore the impressed maker's mark "STONE CHINA / J. T. CLOSE & CO./ STOKE UPON TRENT," used by Close & Co. between 1855 and 1864 (Godden 1991:153). The second plate also had an impressed maker's mark that read, "TRADE MARK T. & R. BOOTE ROYAL PATENT IRONSTONE / T. & R. BOOTE IRONSTONE." This mark was used by T. & R. Boote Ltd., between 1842 and 1890 (Godden 1991:84). One brown glass bottle found in the fill was also datable. The base of the bottle was embossed with "M. G. Co," used by the Millgrove Glass Company, of Millgrove, Indiana, between 1898 and 1911 (Toulouse 1971:359). These artifacts suggested the borrow pit dated to the late 1800s. An additional portion of this borrow pit was excavated in 2005-2006 as Feature 624.

Feature 377

This adobe wall was revealed during mechanical stripping and was found to be the southern wall of the *torreón*. It consisted of a single course of adobe bricks laid directly on the ground surface. No evidence of a foundation or foundation trench was discovered. The wall was composed of irregular bricks of varying sizes. Bricks were mostly subrectangular, and averaged roughly 25 cm on a side. The puddled adobe found intact on the other two walls of the *torreón*, Features 351 and 374, was not present on this portion.

The wall was heavily disturbed by several overlying features and by construction of the parking lot. The intact portion measured roughly 6.45 m in length, 1.15 m in width, and about 10 cm in height. Two pits, Features 394 and 407, cut the intersection of this wall with the adobe wall of the presidio, Feature 400. The intersection of this wall with the eastern wall of the *torreón* was also cut by two pits, Features 363 and 364. Feature 352, a utility trench, also cut a portion of the wall. Based on the locations of these other two walls, the southern wall of the *torreón* was estimated to have been nearly 7.9 m in length when first constructed. Abutment/bonding details of the wall connections were destroyed by these overlying features.

When originally constructed, the southern tower wall was some 7.59 m long and 1.10-1.25 m wide. The tower wall was constructed sometime in the early 1780s, and historical accounts suggest at least portions of the wall were still standing until they were dismantled in the 1850s.

Feature 378

This extramural surface was discovered during hand-excavation in several adjacent control units. All the units were excavated to expose this extremely compacted surface. A series of postholes was visible in the surface and thought to be a wattle-and-daub or ramada structure associated with the use of the surface. Both the surface and the postholes share the same feature number. The postholes covered an area that measured 3.6 m in length and 1.9 m in width. The compact surface was present around the postholes except where overlying intrusive features cut through it. Two adjacent adobe bricks, Feature 389, appeared to be sitting on the surface in the extreme northeastern corner of the unit.

Thirty postholes that appeared to originate at this surface were revealed. They were numbered Features 378.01-378.11, A-E, and G-T. The postholes ranged in size from: 9-23 cm in length, 8-23 cm in width, and 6-61 cm in depth. Artifacts recovered from the postholes included Native American sherds, historic ceramics, flaked stone, glass, animal bone, metal, and a porcelain button. Several of the postholes were located in clusters, suggesting that some of the posts may have represented remodeling or repair of the structure.

No artifacts were recovered from the ground surface. This surface capped lower features that originated at the presidio ground surface, Feature 418. This possible structure and associated surface were thought to date to the 1850s or 1860s. An additional section of this surface was excavated in 2005-2006.

Feature 381

This small pit was discovered during hand-excavation of a control unit. It was elliptical in shape and had vertical walls. The northern edge of the pit appeared to have been disturbed by a rodent burrow, although measurements could only be estimated at 60 cm in length, 35 cm in depth, and 36 cm in depth. Fill was a brown sandy loam with some sand and small gravels. Artifacts recovered from the fill included Native American sherds, some animal bone, historic ceramics, glass, and a few pieces of metal. The pit originated above, and intruded through, a surface from presidio times, Feature 378. Feature 381 probably dated to the early 1900s.

Feature 382

This small pit was discovered during excavation of a 2-m by 2-m control unit. The pit extended out of the control unit to the north, and only a portion was excavated. That portion was 97 cm long, 26 cm wide, and 28 cm deep. The pit appeared circular in shape, based on the visible area and the profile revealed in the unit wall.

The fill was a light brown silty loam with some light charcoal flecking. Light caliche flecking, fragments of red brick, and a few medium-sized rocks were also observed. Artifacts recovered from the fill included Native American sherds, historic ceramics, metal, glass, unworked animal bone, and some plastic. The pit ended atop a 3- to 4-cm-thick lens of charcoal-rich silty loam, but did not intrude through it. This pit was thought to date to the 1910s.

Feature 383

This small pit was discovered during hand-excavation of a control unit. Only a portion of the pit, 91 cm long and 71 cm wide, was visible in the unit. The pit extended out of the unit to the north, but appeared oblong in shape. Fill of the pit was light brown sandy loam with some light charcoal flecking. The pit may have actually started a bit higher, but was disturbed by construction of the 1955 asphalt surface. Artifacts recovered from the remaining 20 cm of fill included Native American sherds, historic ceramics, unworked animal bone, flaked stone, some glass, metal, and a piece of plastic. Feature 383 probably dated to the early to mid-1900s.

Feature 384

Two postholes were revealed during hand-excavation of a control unit. They appeared to originate at the same surface and were recorded together. The fill of both postholes was brown silty loam with some light charcoal flecking. Posthole A measured 18 cm in length, 16 cm in width, and 22 cm in depth. It contained some glass, a few rusty nails, one piece of fragmentary animal bone, and an ammunition cartridge. Posthole B was 30 cm long, 18 cm wide, and 24 cm deep. It contained one rusty nail and fragments of a deteriorated wooden post. None of the artifacts were collected from either posthole. These postholes were thought to date to the 1920s.

Feature 385

This portion of a very large borrow pit was found during mechanical stripping. The excavated portion of the pit measured 4.83 m in length, 2.00 m in width, and 46 cm in depth. Only the eastern edge of the pit was revealed, and the pit appeared to have once continued to the north, west, and south. On the northern and western sides, however, stood the retaining walls for the parking lot. These walls cut well below the base of the borrow pit, and suggested that whatever existed beyond these walls had been destroyed. The pit may still be intact to the south, but this area was left unexcavated.

Several distinct strata were discovered in the fill. The pit was capped by a very thin, <1-cm-thick, layer of compact dark brown silty loam with adobe melt and numerous clay brick fragments. Under this thin cap was a 39-cm-thick layer of loose brown silty loam with some light charcoal flecking. Adobe and clay brick fragments were also present in this stratum, but not as much adobe melt was present. In the lower 5 cm of this layer, a new stratum of red silty sand began in the western third of the pit. The sand appeared to continue to the west into an unexcavated portion of the feature. The lowest 6 cm of fill gradually became light brown clayey silt that underlay both the strata above.

Artifacts were present in all four strata of the pit but were most numerous in the brown sandy loam. Material types were consistent across all strata, and only the frequency of artifacts differed. Artifacts recovered from the fill included Native American sherds, historic ceramics, pieces of flaked stone, some ground stone, glass, leather, metal, buttons, clay marbles, ceramic doll parts, battery cores, and some pieces of plastic. This borrow pit was thought to date to the early 1900s.

Feature 386

This rock column was discovered during hand-excavation just north of the southern *torreón* wall, Feature 377. It was a roughly circular course of 10 cobbles, 31 cm long, 26 cm wide, and 10 cm high. The individual cobbles varied from 4-12 cm in diameter. Some of the cobbles may have been removed during excavation of the surrounding fill.

This feature had no fill of its own but instead, was within a matrix of dark brown sandy silt. It did not appear to be a roasting feature, as none of the cobbles were fire cracked, and no signs of oxidization were present. This feature was thought to represent the base of a support post for the inner walkway of the *torreón*. An area of puddled adobe, Feature 404, found along the northern wall of the *torreón* was thought to serve the same purpose. No artifacts were recovered from the rock column. Feature 386 probably dated to the presidio occupation.

Feature 387

Feature 387 was an area of puddled adobe sitting on a compacted dirt surface, Feature 378, thought to date to the 1850s-1860s. The area measured 64 cm in length, 48 cm in width, and 7 cm in height. A circular depression was in the center of the puddled adobe. The fill of the depression was laminated sand and clay with no artifacts. The purpose of this feature was unknown. The puddled adobe was thought to date to the late 1800s.

Feature 389

This feature consisted of two adobe bricks laid directly on a hard ground surface, Feature 378, thought to date to the 1850s-1860s. The bricks were in the extreme northeastern corner of the stripping unit and may continue to the north or east. The bricks measured 25 cm in width and 12 cm in depth. The limited exposure of the bricks made their function difficult to determine. Several postholes that originated at the same ground surface lay directly to the south. It is unknown if the bricks and the postholes were related. The adobe bricks probably dated to the mid- to late 1800s.

Feature 390

This partially reconstructable *olla* was found during hand-excavation of a control unit. When first discovered, the vessel seemed to be in a pit, as the soil matrix surrounding the vessel was primarily ash. Upon excavation, however, no pit could be identified. The vessel and the ash appeared to have been part of a trash lens discarded on the surface that was then buried. This ash and trash may have originated from Feature 394, a possible hearth just to the northeast; this did not seem likely, however. Part of this trash lens appeared to have been cut by the fill of the hearth. The vessel probably dated to the late 1800s.

Feature 391

This posthole was discovered during hand-excavation of a control unit. It was slightly ovate in shape, and measured 32 cm in length, 27 cm in width, and 29 cm in depth. The sides of the posthole were vertical. The fill was dark brown silty sand; artifacts recovered from the fill included Native American sherds, historic ceramics, some unworked animal bone, glass, and pieces of metal.

Another posthole, Feature 392, was found directly adjacent. It was not known how or if the two were related. Both of these postholes cut into the fill of an older presidio borrow pit, Feature 409. The posthole was thought to date to the early 1900s.

Feature 392

Feature 392 was found during hand-excavation of a control unit. It was located directly adjacent to Feature 391, another posthole. It was not known if the two were related. Both of these postholes cut into the fill of an older presidio borrow pit, Feature 409.

This posthole was roughly square in shape, and measured 26 cm in length, 25 cm in width, and 25 cm in depth. Walls of the posthole were vertical. It contained a fill of dark brown silty sand. Artifacts recovered from the fill included unworked animal bone, pieces of glass, and some metal. At the base of the posthole, a circular area 15 cm in diameter was discovered. This was thought to represent the base of the post the posthole once held. Feature 392 was thought to have dated to the early 1900s.

Feature 393

This posthole was discovered during hand-excavation of a small pit, Feature 398. It was found to be intrusive to the fill of the pit. The posthole measured 30 cm in length, 28 cm in width, 22 cm in depth. Fill was grayish-brown clayey silt that did not contain any artifacts. A small bit of decaying wood was present in the upper 5 cm of fill, but was not collected. This posthole was thought to have dated to the late 1800s or early 1900s.

Feature 394

This possible hearth was discovered during excavation of a reconstructable *olla*, Feature 390. The hearth was a roughly circular pit, with a basin-shaped profile. It measured 90 cm in length, 70 cm in width, and 28 cm in depth. The hearth was constructed into the fill of Feature 407, an earlier pit. The fill was composed almost completely of a greenish-gray ash with abundant amounts of charcoal. Artifacts recovered from the fill included Native American sherds, historic ceramics, pieces of flaked stone, some shell, unworked animal bone, metal, and pieces of glass. The animal bone discovered in the fill had burned intensely. Oxidization of the margins of the pit suggested one or more episodes of burning, and that the burning of the fill had occurred in situ.

This hearth may have been the source for the lens of ash and trash observed during excavation of the *olla*, Feature 390. This scenario did not seem likely however, as the fill of the hearth appeared to have cut the ash deposit. This possible hearth was thought to date to the late 1800s or early 1900s.

Feature 395

This small pit was discovered during excavation of a utility trench, Feature 352. The utility trench appeared to have removed most of the fill and the eastern side of the pit. The pit was estimated to have measured 60 cm in length, 38 cm in width, and 40 cm in depth. It would have been ovate in shape, and the remaining walls sloped sharply toward the rounded base. The fill of the pit was brown sandy loam. Artifacts recovered from the fill included Native American sherds, historic ceramics, and a few pieces of unworked animal bone. One large river cobble and some fragmentary red bricks were also discovered, but were not collected. Feature 395 was thought to have dated to the late 1800s or early 1900s.

Feature 396

Feature 396 was discovered during hand-excavation of a control unit. Only a portion of the pit was excavated, however, as it extended north out of the control unit. The excavated portion measured 61 cm in length, 44 cm in width, and 80 cm in depth. The pit appeared to become deeper to the north where it was visible only in profile.

Fill of the pit was brown silty loam with abundant amounts of charcoal. The concentration of charcoal increased with depth, while the amount of artifacts decreased. Artifacts recovered from the fill included Native American sherds, historic ceramics, unworked animal bone, pieces of glass, and some metal. This pit was thought to date to the early 1900s.

Feature 397

This is a posthole or small pit that was revealed during hand-excavation of a control unit. It was circular in plan view, and measured 25 cm in diameter and 37 cm in depth. The fill was reddish-brown sandy silt with many small gravels. The color of the fill suggested it might have been construction debris. Artifacts recovered from the fill consisted of Native American sherds, pieces of flaked stone, and some very degraded metal.

This posthole cuts through an adobe wall, Feature 399, that abuts the northern wall of the *torreón,* Feature 374. Two other postholes, Feature 375.01 and 375.02, thought to be from utility poles, were found nearby. This posthole could be related to the other two, although the smaller diameter made this seem unlikely.

This posthole or small pit was thought to date to the early 1900s.

Feature 398

This small pit was discovered during excavation of a control unit. It intruded a portion of Feature 400, an adobe wall thought to be the eastern wall of the presidio. The pit was 1.27 m long, 90 cm wide, and 69 cm deep. The fill was moderately compacted sandy loam. Artifacts recovered from the fill included Native American sherds, historic ceramics, shell, unworked animal bone, some glass, and pieces of metal. The function of the pit was unknown. This pit was thought to date to the late 1800s or the early 1900s.

Feature 399

This section of adobe wall was discovered during excavation around the northern wall of the *torreón*, Feature 374. It measured 1.09 m in length, 1.04 m in width, and 13 cm in height. When excavated, it was composed of a single course of adobe bricks of varying sizes. The upper courses of the wall were thought to have been torn down. A small posthole, Feature 397, from the early 1900s intruded on the remaining course of bricks.

This wall abutted the northern wall of the *torreón*, Feature 374. Feature 404, an adobe column base thought to be a support for the tower walkway, lay just to the east. The original purpose of the wall was unknown, but it may have functioned as an internal wall of the *torreón*. It was not clear how far to the south the wall continued. This wall was thought to date to presidio times.

Feature 400

This adobe wall was discovered during hand-excavation of a control unit and was found to be the eastern wall of the presidio. It was composed of a single course of adobe bricks of varying size. Two pits, Features 398 and Feature 407, destroyed both the northern and southern ends of the exposed wall, as well as the junction of this wall with the southern wall of the *torreón,* Feature 377. The destruction of this junction made it impossible to determine any construction details about the intersection of the two walls. Only five adobe bricks from the wall remained in situ. The wall section measured 1.5 m in length, 57 cm in width, and 12 cm in height.

The wall was composed of adobe bricks laid directly on the ground surface, and no evidence of a foundation or foundation trench was discovered. This wall did not have a course of puddled adobe above the bricks, as did other adobe walls discovered at the site. The puddled adobe had likely been disturbed during construction of the asphalt surface of the lot. No artifacts were collected when the wall was exposed.

When originally constructed, the eastern presidio wall was approximately 181 m long and 56 cm wide. The presidio wall was constructed sometime in the early 1780s. The last standing segment of the eastern wall was torn down in 1918 (Thiel et al. 1995).

Feature 401

This set of four postholes was exposed during excavation of a hand-stripping unit. The postholes were thought to have been a single fenceline or similar feature. Fill of the postholes was loosely compacted brown silty sand. They ranged in size from 15-20 cm long, 12-18 cm wide, and 17-26 cm deep. No artifacts were recovered from any of the postholes. The postholes were thought to date to the early 1900s.

Feature 402

Feature 402 was discovered during hand-excavation of a control unit. The pit appeared circular in plan and basin shaped in profile, but only about half could be excavated because it extended out of the control unit to the north. The excavated portion of the pit measured 45 cm in length, 30 cm in width, and 22 cm in depth. The fill was brown silty loam with abundant amounts of charcoal and ash. The margins of the pit were not oxidized. Artifacts recovered from the fill included Native American sherds, unworked animal bone, glass, and metal. The function of the pit was unknown. This pit probably dates to the late 1800s or early 1900s.

Feature 403

This small section of adobe wall was discovered during hand-excavation around the northern wall of the *torreón*, Feature 374. It was originally excavated by Olson and recorded as a puddled adobe wall. Only a small section of the wall was re-excavated. The re-exposed portion measured 1.02 m in length and 49 cm in height, but only 14 cm in width. It extended into the unit profile to the south and east.

The wall makes an unclear contact with the northern wall of the *torreón*, Feature 374. The contact between the two adobe walls is blurred by erosion, and it made defining their relationship difficult. The small wall is definitely younger, or at least contemporaneous with the northern *torreón* wall. The small wall may have actually cut the wall of the *torreón*. This small section of wall dated to the presidio occupation or later. Its function was unclear.

Feature 404

This small circular adobe feature was discovered during excavation around the northern *torreón* wall, Feature 374. It was thought to be the remnants of an adobe column or column footing. The adobe was roughly circular in shape, and measured 45 cm in diameter and 18 cm in depth. It was unclear if the feature was constructed with puddled adobe or an adobe brick. The adobe was thought to be the remnant of a support for the walkway of the *torreón*. Both the northern *torreón* wall, Feature 374, and another smaller adobe wall, Feature 403, lay nearby. This adobe column was thought to date to presidio times.

Feature 407

This large, irregularly shaped pit was exposed during excavation of Feature 394, a possible hearth. The overlying hearth cut into the upper fill of this feature. The pit measured 1.25 m in length, 69 cm in width, and 17 cm in depth. It was intrusive to the junction of the eastern presidio wall and the southern *torreón* wall, and it completely destroyed the intersection of the two.

The fill of the pit was dark brown sandy loam with abundant amounts of charcoal and a small ash lens. The margins of the pit were not oxidized. Artifacts recovered from the fill included Native American sherds, historic ceramics, pieces of flaked stone, unworked animal bone, pieces of glass, some metal, a piece of leather, and a button. The function of this pit was unknown. This feature was thought to date to the late 1800s or early 1900s.

Feature 408

This privy pit was discovered during mechanical stripping. It was rectangular in shape, 1.38 m long and at least 94 cm wide. The pit extended into the northern profile of the excavation unit, and this portion of it remained unexcavated. Excavation stopped at a depth of about 2 m for safety reasons. A probe pushed into the remaining fill went an additional 80 cm. The privy intruded through Feature 442, a small pit that lay just to the south.

The upper 1.52 m of fill consisted of light brown sandy loam mottled with both dark brown and white ashy silt. Pockets of charcoal and ash were abundant throughout. Artifacts recovered from the fill included Native American sherds, historic ceramics, pieces of flaked stone, shell, unworked animal bone, glass, mattress springs, and pieces of metal. Several fired clay bricks, adobe brick fragments, and intact bottles were also discovered. At the base of this fill, a metal basin sink was found lying upside down atop the lower fill.

The lower 48 cm of fill was greenish-brown soil with a high level of decomposed human excrement, mixed with lenses of whitish lime. Artifacts recovered were similar to those from the stratum above, but also included large concentrations of whole bottles and intact metal cans. Charcoal and ash pockets remained abundant throughout this fill. Excavation ceased at 2 m per safety regulations. This privy was thought to date to the 1910s. The rest of the feature was later mechanically excavated during the 2005-2006 fieldwork.

Feature 409

This large borrow pit was found during mechanical stripping. It was highly irregular in shape, and measured 4.40 m in length, 3.25 m in width, and 74 cm in depth. The fill of the borrow pit was cut slightly on its southern end by a small pit, Feature 435. Features 391 and 392, two postholes, also intruded on the upper fill of the borrow pit. The fill was brown sandy loam with abundant charcoal and ash. Several distinct dumping episodes were visible in the fill.

An almost 1-cm-thick band of charcoal was present at approximately 20 cm below the top of the fill across most of the borrow pit. It appeared to be from a single dump of material that, judging from the oxidization of the soil beneath, was still burning when it was thrown in the pit. Small delicate fibers were visible in the charcoal, and suggested the burned material was plant fiber from roofing material or woven matting.

Artifact density was fairly high throughout the fill. Artifacts recovered from the fill included Native American sherds, historic ceramics, shell, some unworked animal bone, a few rusty nails, pieces of glass, some flaked stone, and fragments of ground stone. The nature of the artifacts recovered from the fill of Feature 409 suggested that the pit dated to presidio times.

Feature 410

This posthole was revealed during hand-excavation of a control unit. It appeared as a small, roughly circular posthole in the southern end of a small ovate depression. The posthole measured 43 cm in length and 28 cm in width. The surrounding depression was about 24 cm in depth, and the posthole measured 39 cm in depth from the base of the depression. The posthole was lined with approximately 20 small rocks along the southern side.

The fill of the posthole was brown sandy loam with some charcoal and caliche inclusions. Artifacts recovered from the fill included a Native American sherd, a few fragments of unworked animal bone, and one piece of flaked stone. This posthole probably dated to presidio times.

Feature 414

This small pit was found during hand-excavation of a control unit. It was originally thought to be a disturbance, and the fill was not screened. After excavation, the pit appeared to be intrusive to a larger disturbed area. It measured 58 cm in length, 45 cm in width, and 32 cm in depth. The fill was brown sandy loam with some small charcoal and caliche inclusions. No artifacts were recovered from the fill of the feature. This pit was thought to date to the late 1800s.

Feature 418

This extramural surface was exposed during hand-excavation in several adjacent control units. All the units were excavated down to expose this extremely compacted surface. The exposed extent of the surface was 5.63 m long and 5.02 m wide, and it covered the entire stripping unit except where disturbed by intrusive and associated features.

Four pits, Features 373, 420, 422, and 423, and five postholes, Features 410, 425, 428, 431, and 433, originated at this surface. A metal object, Feature 424, possibly a canteen, was also found embedded in this surface. This metal object was the only artifact collected directly from the surface.

The artifacts from the features originating at this surface all appeared to date to presidio times, suggesting the surface itself also dated to that time. An additional portion of this surface was excavated in 2005-2006.

Feature 420

This large pit was discovered during the clearing of a presidio ground surface, Feature 418. It was roughly circular in shape and measured 1.18 m in length, 1.12 m in width, and 36 cm in depth. This pit appeared to originate at the presidio ground surface and may have functioned as a small borrow pit. The southern edge of Feature 420 intruded on the northern edge of Feature 423, another small pit.

The fill of the pit was brown sandy loam with some charcoal flecking and a few pieces of adobe. The fill became lighter with depth, due to ash lenses being present just above the base of the pit. The margins of the pit were not oxidized and were cut into the sterile calcic layer. Artifacts recovered from the fill included Native American sherds, historic ceramics, pieces of flaked stone, a possible ceramic figurine fragment, a button, unworked animal bone, some glass, and pieces of metal. This pit probably dated to presidio times.

Feature 421

This small pit was discovered during excavation of a hand-stripping unit. Only a portion of the pit was excavated, as it continued out of the stripping unit to the south. The overall dimensions of the pit were estimated to be approximately 1.2 m in length, 90 cm in width, and 29 cm in depth. The fill was yellowish-brown silty loam with caliche nodules and small amounts of charcoal.

Artifacts recovered from the fill included Native American sherds, historic ceramics, metal, glass, pieces of flaked stone, and some animal bone. A large rodent burrow was apparent at the base of the pit. This pit was thought to date to the American Territorial period; is function was unknown.

Feature 422

This small, irregularly shaped borrow pit was discovered during hand-clearing of a presidio-occupation surface, Feature 418. It was 86 cm long, 70 cm wide, and 26 cm deep. This pit appeared to originate at the presidio ground surface.

The fill of the pit was brown sandy silt with abundant amounts of ash and charcoal. Ash and charcoal density, as well as artifact density, decreased toward the base of the pit. Artifacts recovered from the fill included Native American sherds, historic ceramics, flaked stone, unworked animal bone, and fragments of ground stone. This pit likely dated to presidio times.

Feature 423

This small pit was discovered during excavation of Feature 420, a large pit intrusive to the northern edge of this feature. It appeared to originate at the presidio surface, Feature 418, and measured 65 cm in length, 61 cm in width, and 70 cm in depth. The fill of the pit was sandy brown loam. Artifacts recovered from the fill included Native American sherds, historic ceramics, pieces of flaked stone, and some unworked animal bone. The pit is cut into the sterile calcic layer. Feature 423 probably dated to presidio times.

Feature 424

This metal artifact was found in the natural layer of sediment lying just above the presidio-occupation ground surface, Feature 418. It was circular in shape and appeared to be made of iron. About half the object was intact and measured 22 cm in diameter and 5 cm in depth. The artifact was thought to be a metal bowl or canteen. A circle of iron was lying near its center and may have been an opening or a lid for the object. The object had crimped edges and may have been “tinned.” This artifact was thought to date to the American Territorial period.

Feature 425

This possible posthole was discovered during hand-clearing of a presidio ground surface, Feature 418. It was found in a depression in the ground surface formed by bioturbation and appeared square in shape with vertical sides. The posthole was 16 cm long, 14 cm wide, and 20 cm deep. The fill was brown sandy loam of loose compaction. Artifacts recovered from the fill included Native American sherds, unworked animal bone, and pieces of metal. Feature 425 probably dated to presidio times.

Feature 427

This possible small pit was discovered during hand-clearing of a presidio-occupation ground surface, Feature 418. It measured 32 cm in length, 30 cm in width, and 8 cm in depth. The fill was grayish-brown silty sand. Only two pieces of fire-cracked rock were present in the fill, and no artifacts were found or collected. The base of the pit was very irregular and appeared to have been disturbed by bioturbation. Due to the lack of artifacts and the irregularity of the pit base, it was unknown if this feature was actually a pit or if it was a large rodent disturbance.

Feature 428

This small rectangular groove was revealed during hand-clearing of a presidio-occupation ground surface, Feature 418. It measured 59 cm in length, 8 cm in width, and 16 cm in depth. A small area of puddled adobe lay just to the east. The function of the rectangular groove was unknown, although it may have served to hold a post or a board. The fill of the groove was tan sand with some small gravel inclusions. Only two Native American sherds were recovered from the fill. This groove appeared to originate at the presidio-occupation ground surface and likely dated to that time.

Feature 429

This small round posthole was exposed during hand-clearing of a presidio-occupation ground surface, Feature 418. It measured 16 cm in diameter and 25 cm in depth. The fill of the posthole was grayish-brown sandy silt. Artifacts recovered from the fill included Native American sherds, pieces of flaked stone, and unworked animal bone. This posthole was thought to date to presidio times.

Feature 431

Posthole Feature 431 was found during the hand-clearing of a Presidio-era ground surface, Feature 418. It was slightly ovate, with vertical walls, and it measured 17 cm in diameter and 25 cm in depth. Fill of the posthole was a brown sandy loam. Four Native American sherds were recovered from the fill. This posthole was thought to date to Presidio times.

Feature 432

This wood-lined pit was discovered during hand-excavation of a control unit. It became visible as a thin piece of wood some 97 cm long and 20 cm high. A small amount of grayish-brown silty sand fill was visible between the wood and the unit profile. This fill was excavated separately, and Native American sherds, some flaked stone, unworked animal bone, glass, historic ceramics, and some metal were recovered. Only a small part of this feature was excavated, but the remainder was plainly visible in the profile of the stripping unit. The function of the feature was unknown. This wood-lined pit probably dated to the late 1800s.

Feature 433

This posthole was found during hand-clearing of a presidio-occupation surface, Feature 418. It was slightly ovate in shape with vertical walls, and measured 16 cm in length, 15 cm in width, and 26 cm in depth. Fill of the posthole was brown sandy loam with some light charcoal flecking. No artifacts were discovered in the fill. This posthole likely dated to presidio times.

Feature 435

This small pit was revealed during excavation of a borrow pit, Feature 409, into which it intruded. The pit was round, basin shaped in profile, and measured 60 cm in length, 59 cm in width, and 19 cm in depth. It was first noted as a number of fire-cracked rocks and a lens of white ash in a brown silty sand matrix. Some of the artifacts from this pit were removed with the fill of Feature 409, the borrow pit. Artifacts recovered from the fill included some fire-cracked rock, unworked animal bone, three pieces of historic ceramics, and two pieces of metal. The pit margins did not appear oxidized, and the fill was probably deposited here after it had been burned elsewhere. This pit likely dated to the early 1900s.

Feature 436

This set of three wooden posts was discovered during mechanical stripping. They were partially exposed in profile during excavation of a borrow pit, Feature 409. Four-inch by four-inch wooden posts were visible in situ, extending down from the 1950s ground surface, just under the asphalt of the lot. The posts reached a depth of 47 cm below the asphalt. No artifacts were found or collected. These posts likely dated to the 1940s-1950s.

Feature 437

This portion of a large borrow pit was revealed during hand-stripping around the western *torreón* wall, Feature 443. Feature 437 was originally excavated as a separate feature, although during excavation, it was found to be the northern edge of a borrow pit already excavated in another mechanical stripping unit, Feature 359. The stratigraphy and artifact contents of this edge of the borrow pit were identical to those of the eastern edge, Feature 359. Therefore, based on these two edges, the borrow pit was estimated to be more than 10 m in diameter. Refer to the description of Feature 359 for more detailed information.

Feature 437 was intruded on by a historic gardening feature, Feature 438. The borrow pit intruded on the western wall of the *torreón*, Feature 443, and a small adobe wall, Feature 399, that abutted the northern wall of the *torreón*. This borrow pit was thought to date to the late 1890s or early 1900s.

Feature 438

This line of fired bricks was exposed during hand-clearing around the western wall of the *torreón*, Feature 443. The bricks were lain on their long ends over the fill of Feature 437, a large borrow pit. The line measured 1.35 m in length, 6 cm in width, and 7 cm in depth. The bricks were thought to be the edge of a garden or walkway. They extended under the unexcavated asphalt to the southeast. No artifacts were collected from around the bricks. This brick feature was thought to date to the mid-1900s.

Feature 439

The skeleton of a cat was discovered in the fill of Feature 437, a large borrow pit just below a line of fired clay bricks, Feature 438. The cat appeared to have been interred in the fill of the borrow pit, because no discrete burial pit was visible. Some of the skeleton was removed with the fill of the borrow pit, Feature 437, and collected as a separate feature. The remaining skeletal elements visible in the profile were left in situ. This cat burial probably dated to the late 1800s or early 1900s.

Feature 441

This large, irregularly shaped borrow pit was found during hand-excavation of a control unit. Only a portion of this pit was excavated, however, because it continued outside the unit to the south and west. The excavated portion measured 1.8 m in length, 1.3 m in width, and 77 cm in depth. Two distinct strata are visible in the fill of the pit. The upper fill consisted of a brown sandy loam with moderate amounts of charcoal flecking. The lower fill was mottled gray and orange sandy clay with only light charcoal flecking.

Artifacts recovered from the 47 cm of sandy loam included Native American sherds, historic ceramics, some shell, a few ground stone fragments, flaked stone, and pieces of unworked animal bone. The lower 30 cm of sandy clay fill contained some unworked animal bone, Native American sherds, and historic ceramics. The artifact density was much lower in the lower fill than in the upper fill. This borrow pit was thought to date to the 1820s.

Feature 442

This small pit was discovered during the excavation of a privy pit, Feature 408. It appeared as a dark stain of gray-brown silt loam that was intruded on by Feature 408, the privy pit. The stain measured 48 cm in length and 34 cm in width, but the privy appeared to have removed a large portion of the northern end of this feature. The small pit was not excavated, and no artifacts were discovered or collected. The function of this pit was unknown. It was not clear to what time period Feature 442 belonged.

Feature 443

This adobe wall was exposed during mechanical stripping around the northern wall of the *torreón*, Feature 374. The wall was a portion of the western wall of the *torreón*. Only about 80 cm of the length of the wall was discovered, from its corner with the northern *torreón* wall, Feature 374, to where it was truncated by a large borrow pit, Feature 437, to the south.

The wall was 1.05 m thick and about 15 cm high. Construction was similar to the other walls of the *torreón*, with a course of adobe bricks laid directly on the ground surface and a course of puddled adobe above them. The western wall was bonded to the northern wall at the corner. This wall dated to presidio times.

PREHISTORIC FEATURES

Beneath the presidio features were the remnants of a prehistoric site (Figure 4.93). The 1954 University of Arizona excavations had previously located a Hohokam pithouse on the site (Olson 1985). Other work throughout the downtown area has resulted in the exposure of pithouses, pits, and human remains dating to the Snaketown phase of the Hohokam Pioneer through the Sedentary periods, roughly from A.D. 700 to 1150 (Thiel et al. 1995). The 2002-2003 fieldwork at the Tucson Presidio area revealed that occupation of the downtown extends back into the Early Agricultural period, probably beginning between 400 B.C. and A.D. 50. Excavations uncovered four pithouses, a borrow pit, and four other prehistoric features beneath the parking lot.

Feature 350

Description

This pit structure was originally excavated by students supervised by Alan Olson in 1954. During the current project, a 5.70-m by 5.05-m unit was opened to expose the pit structure and a portion of the eastern *torreón* wall that had also been previously recorded

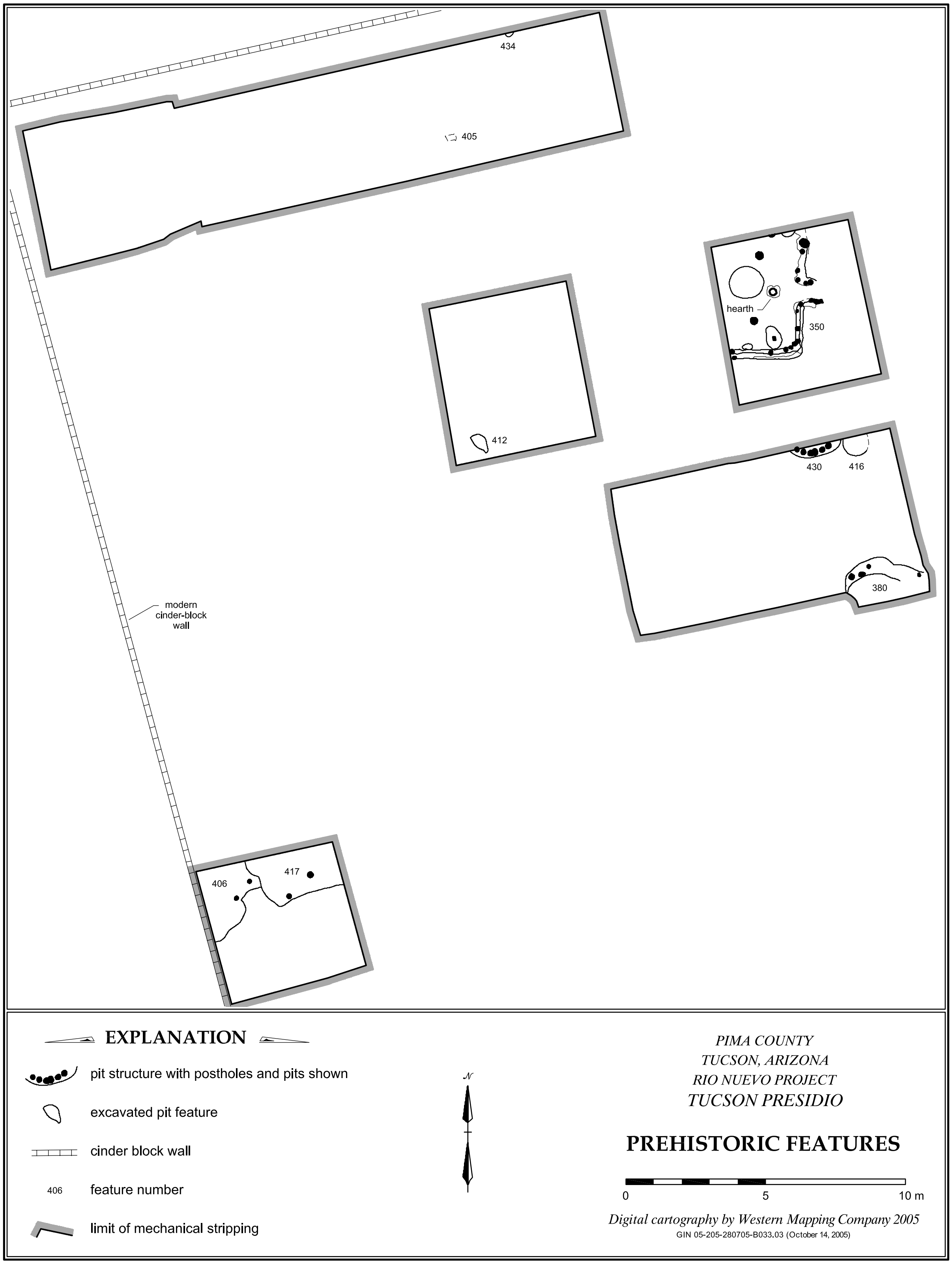

Figure 4.93. Prehistoric features located in the corner parking lot, Tucson Presidio, AZ BB:13:13 (ASM).

(Figure 4.94). The unit did not expose the western and northern walls of the structure. The eastern *torreón* wall, Feature 351, covered, but did not intrude on, the entrance of the pit structure. The structure was rerecorded and portions of intramural pit fill left intact in 1954 were excavated.

The pit structure was rectangular in shape, and measured 4.8 m in length, 2.7 m in width, and 24 cm in depth. Four intramural pits, 19 postholes, 3 floor grooves, and a hearth were discovered in the floor. An entry was identified in the eastern wall of the structure. As this structure had already been excavated in 1954, no artifacts remained on the floor. Inspection of the walls of the structure indicated it had been remodeled, and both the original and later structures had burned.

Internal Features

Nineteen postholes were exposed in the floor. Two of the postholes, Features 350.06 and 350.07, were larger than the others and centrally located within the pit structure. Feature 350.06 was 26 cm long, 25 cm wide, and 60 cm deep, while Feature 350.07 was 29 cm in diameter and 58 cm deep.

Thirteen of the smaller postholes, Features C through N and V, were arranged around the interior perimeter of the puddled adobe wall from the remodeled house. They varied in size from 8-31 cm in length, 7-26 cm in width, and 9-42 cm in depth.

Three of the other smaller postholes, Postholes P, Q, and R, were arranged within the entryway of the house. They ranged in size from 11-19 cm in length, 9-17 cm in width, and 12-27 cm in depth. Posthole W was located in the floor groove, Feature U, along the southern wall of the structure. It measured 12 cm in length, 9 cm in width, and 40 cm in depth.

Three floor grooves were also discovered along the interior of the puddled adobe walls. One was located within the entryway, Feature S, and measured 45 cm in length, 10 cm in width, and 12 cm in depth. Floor groove T ran along the interior of the eastern wall, and measured 1.8 m in length and 12 cm in width. Floor groove U ran along the southern wall, and measured 2.45 m in length and 18 cm in width. Neither Feature T nor Feature U was excavated in an attempt to preserve the puddled adobe walls of the structure. At least one posthole, Feature W, was located in a floor groove, and more likely remained undiscovered.

An entryway was discovered in the eastern wall of the structure. It was a ramped entrance with at least one floor groove for support posts on the southern side. A disturbance north of the entryway removed any evidence of a second groove on that side. The entryway was visibly 70 cm long, although the end ran under the wall of the *torreón*, Feature 351. It measured 88 cm in width. A patch of poured adobe 40 cm long and 20 cm wide was discovered on the southern side of the entryway. This adobe was thought to represent a repair or remodeling of the entryway, perhaps made when the structure was remodeled.

Feature 350.01 was a hearth that measured 24 cm long, 22 cm wide, and 13 cm deep. It was originally excavated in 1954. The margins of the hearth were oxidized, and it had a plaster collar and apron.

Figure 4.94. Feature 350, a Hohokam pithouse originally exposed in 1954, lies adjacent to the eastern wall of the northeastern tower, Feature 351, Tucson Presidio, AZ BB:13:13 (ASM).

Feature 350.02 was a large pit that measured 1.18 m in length, 1.10 m in width, and 11 cm in depth. Only the southern half the pit was originally excavated in 1954, while the fill of the northern half was left in situ. The in situ fill of the pit was brown sandy loam with a few small charcoal flecks and pieces of oxidized daub. Artifacts recovered included sherds and unworked animal bone. A single historic ceramic was also discovered.

Feature 350.03 was a small pit originally excavated in 1954. It measured 85 cm in length, 60 cm in width, and 26 cm in depth. A pickle jar “time capsule” was left in this pit by George Chambers before it was backfilled in on 29 December 1954. The jar contained an *Arizona Daily Star* from 26 December 1954, a letter from George Chambers, and three U.S. coins from 1954.

During the original excavation in 1954, Features 350.02 and 350.03 were identified as separate presidio or American Territorial period features intrusive to the pit structure (Olson 1985). The lack of overlying stratigraphy and the small amount of intact fill in Feature 350.02 made it impossible to either support or refute this assessment.

Feature 350.04 was a small intramural pit, 49 cm long, 20 cm wide, and 21 cm deep. The fill of this pit appeared to be redeposited backfill, and contained historic artifacts such as glass and metal. The pit was not, however, on the map made of the structure in 1954. The reason for this discrepancy was unknown.

Feature 350.05 was a small intramural pit, 42 cm long, 26 cm wide, and 29 cm deep. This pit was neither excavated nor mapped during the original excavation. The fill was brown sandy loam with pieces of charcoal, daub, and caliche flecking. This pit was constructed into the fill of the original structure, and bottomed out on plaster thought to originate from the walls of the original structure. Artifacts recovered from the fill consisted of pottery sherds and pieces of flaked stone. Artifacts in this feature may have originated from the fill of the original structure.

Internal Strata and Artifact Contents

Approximately 24 cm of fill was removed between the stripped surface and the floor of the structure. Much of this fill was redeposited from the original excavations and was only grab sampled. It contained a mix of historic and prehistoric artifacts. The only in situ fill removed from the structure during this project was from the postholes, floor grooves, Feature 350.05, and from the northern half of Feature 350.02.

Construction and Remodeling Evidence

When the structure was reopened, two sets of walls were visible in the structure. The outer wall was from the original structure and measured 16 cm above the floor. The interior of this wall was covered with some 2 cm of adobe plaster over the sterile substrate into which the structure was cut. The presence of plaster on the walls suggested the original structure had been a true pithouse, with the walls of the pit serving as the walls of the structure.

The second set of walls from the remodeled structure consisted of puddled adobe roughly 8 cm wide. All the perimeter postholes and floor grooves discovered probably belonged to the remodeled structure. They represented wall support posts for the superstructure. The two interior postholes, Features 350.06 and 350.07, probably represented roof support posts for the superstructure. It was not clear if they were present before the structure was remodeled, but they were almost certainly in use after the remodeling took place.

The floor of the structure was prepared and plastered with adobe. This floor was associated with remodeling of the structure, and showed discontinuous areas of heavy oxidization. The original floor may have still been intact below this later floor, but it was not visible in any subfeatures of the structure.

Stratigraphic Relationships

The original pit structure was constructed into the sterile calcic layer. Features 380 and Feature 430, two other pit structures to the south, also originated at this level. A small pit, Feature 365, was found south of the structure. After natural processes had buried the filled foundation pit, the eastern *torreón* wall, Feature 351, was constructed over a portion of the entryway. Feature 352, a utility trench, was excavated through the western portion of the structure during historic times.

Abandonment and Postabandonment

A summary of the 1954 excavation findings (Olson 1985) stated that the pit structure had been cleaned out prior to abandonment. Oxidization of the floor plaster indicated the structure had burned after it was abandoned. The foundation pit was filled and then buried by alluvial and colluvial deposits. The Tucson Presidio and later American Territorial period buildings were constructed over the structure, prior to construction of the parking lot in 1955.

Feature 380

This prehistoric borrow pit was found during excavation of two historic pits, Features 356 and 357, that intruded on the fill of the pit. Only this portion of the pit was excavated because it extended out of the stripping area to the southeast. In 2005-2006, another portion of the feature was excavated. During the 2002-2003 excavation, it was identified as a pit structure; however, this turned out to be incorrect.

The excavated portion of the pit was 2.95 m in length, 1.00 m in width, and 85 cm in depth. Approximately 85 cm of fill was removed between the stripped surface and the floor of the pit. The upper 48 cm of fill consisted of dark brown sandy loam with high concentrations of daub. The chunks of daub varied considerably in size, from 1 cm to 23 cm in diameter. A small amount of daub was oxidized. High concentrations of ash, charcoal, and fire-cracked rock were also present. Artifacts recovered from this fill included prehistoric sherds, pieces of flaked stone, six ground stone fragments, and a possible ceramic figurine fragment.

The concentration of daub, charcoal, ash, and fire-cracked rock all decreased considerably in the lower 37 cm of fill. The fill was grayish-brown sandy loam present only in the deepest portion of the pit. Artifacts recovered from the fill included a few prehistoric sherds and pieces of flaked stone. No artifacts were discovered on the floor of the pit.

Feature 405

This small roasting pit was revealed during excavation around the northern *torreón* wall, Feature 374. It was intruded on by both the wall and by an adobe column base, Feature 404. All that remained of the roasting pit were a few rocks in a matrix of grayish-brown silty sand. The base of the pit was oxidized. No artifacts were collected from this pit. This roasting pit was thought to date to either the Prehistoric era or the Protohistoric period.

Feature 406

Description

This small portion of a possible pit structure was discovered during excavation of a large American Territorial period borrow pit, Feature 376. Not enough of the structure remained to determine its shape. The excavated portion measured 2.1 m in length, 1.9 m in width, and 59 cm in depth. Two possible postholes were exposed in the floor, near the southeastern edge of the structure. This was the only edge that could be defined. The structure extended out of the excavation unit to the west, was disturbed to the north, and was cut by another possible pit structure, Feature 417, to the east. No entry was identifiable, and orientation of the pit structure could not be determined. One small flake was recovered from the floor. The structure did not appear to have burned.

Internal Features

Two postholes were discovered just inside the southeastern edge of the structure. They ranged from 12-13 cm in diameter and 6-26 cm in depth. No artifacts were recovered from either posthole.

Internal Strata and Artifact Contents

Approximately 59 cm of fill was removed between the excavated surface and the floor of the pit structure. The upper 39 cm of fill was grayish-brown sandy silt with small chunks of charcoal and pieces of unburned daub. Artifacts recovered from this fill included a few sherds, some unworked animal bone, and pieces of flaked stone.

The lower 20 cm of fill was yellowish-brown silty clay that was very compact. Unburned daub and caliche were present in abundance. Very few artifacts were recovered from this lower fill. These included pieces of flaked stone and unworked animal bone. One small flake was recovered from the floor of the structure.

Construction and Remodeling Evidence

The one edge of this pit structure that could be identified measured roughly 59 cm above the floor. The walls were obviously impacted by disturbance and intrusive features. Neither the walls nor the floor appeared plastered or prepared in any way. The postholes and unburned daub recovered from the fill suggested a wattle-and-daub superstructure. There was no evidence for any remodeling of the structure.

Stratigraphic Relationships

This structure was constructed into the calcic substrate of the area. It was intruded on by another possible pit structure, Feature 417, sometime after its abandonment. After the collapse of the superstructure, the filled foundation pit was buried by natural processes. The area was later used as a trash dump during both historic and modern times.

Abandonment and Postabandonment

The small area of this structure that was discovered intact made details of its abandonment difficult to ascertain. It was unclear if the structure was cleaned out prior to abandonment, but it appeared the structure did not burn. The stratum of roof and wall fall suggested the superstructure was at least partially intact prior to its collapse.

Feature 412

This small pit was discovered during excavation around an area of puddled adobe, Feature 387. Only the eastern half of was exposed, but the pit appeared to be slightly ovate in shape with vertical sidewalls. The puddled adobe feature overlay the western half of the pit and was not removed. The excavated portion measured 78 cm in length, 44 cm in width, and 21 cm in depth. Fill of the pit was brown clayey loam. Artifacts recovered from the fill consisted of a few sherds, one fragment of animal bone, and one small piece of flaked stone. This pit was thought to be prehistoric, probably dating to Hohokam times.

Feature 416

This small pit was discovered during hand-excavation of a control unit. It appeared to be roughly circular with slightly belling sidewalls. Only a portion of pit Feature 416 was excavated, because it extended out of the stripping unit to the north and under the eastern wall of the *torreón*, Feature 351, to the east. The excavated portion measured 76 cm in length, 71 cm in width, and 78 cm in depth. The fill was a light brown silty loam with small chunks of charcoal and caliche included within. Artifacts recovered from the fill included Native American sherds, some ground stone, and pieces of flaked stone. The margins of the pit were oxidized, especially in the southern portion. Pit Feature 416 was thought to be prehistoric.

Feature 417

Description

This portion of a possible pit structure was exposed during excavation of a historic borrow pit, Feature 376. Only the southwestern corner was excavated, and the structure continued out of the excavation unit to the north and east. The excavated portion measured 3.00 m in length, 1.85 m in width, and 42 cm in diameter. It intruded on Feature 406, another pit structure discovered to the west. Two possible postholes and two internal pits were discovered in the floor. The shape of the pit structure could not be determined, and no entry was identified. No artifacts were recovered from the floor, and the structure did not appear to have burned.

Internal Features

Two possible postholes were discovered just inside the southern edge of the house. One measured 14 cm in diameter and 25 cm in depth, and the other 18 cm in diameter and 16 cm in depth. No artifacts were recovered from either posthole.

Feature 417.01 was an oblong pit with a rounded bottom. It measured 43 cm in length, 35 cm in width, and 23 cm in depth. The fill was gray-brown silty loam with no artifacts.

Feature 417.02 was an irregularly shaped pit with a rounded bottom. It was 52 cm long, 43 cm wide, and 31 cm in diameter. The fill was yellow-brown sandy silt with a small amount of charcoal flecking. Artifacts recovered from the fill included sherds and pieces of flaked stone.

Internal Strata and Artifact Contents

Roughly 42 cm of fill was removed between the top of the feature fill and the floor of the structure. The top 19 cm of fill from Feature 417 was grayish-brown silty sand with small chunks of charcoal. Artifacts recovered from this upper fill included sherds, some ground stone, pieces of flaked stone, some shell, a worked sherd, and a fragment of a ground stone palette.

The lower 23 cm of fill was moderately compacted light brown silty loam with large amounts of caliche and unburned daub. The concentration of caliche and daub increased with depth. The charcoal flecking present in the upper level continued but decreased in concentration with depth. Artifacts recovered from the lower fill included sherds, unworked animal bone, pieces of flaked stone, and some ground stone. No artifacts were recovered from the floor.

Construction and Remodeling Evidence

When discovered, the walls of Feature 417 were some 27 cm above the floor of the structure. The walls were probably impacted by construction of the historic borrow pit, Feature 376, that overlay this structure. Neither the walls nor the floor of the pit structure appeared to have been prepared or plastered in any way. The two postholes and the unburned daub discovered in the fill suggested that a superstructure of wattle and daub once existed. Unfortunately, the shape of the structure and its orientation could not be determined.

Stratigraphic Relationships

This structure was constructed into the calcic substrate sometime after a pit structure to the west, Feature 406, had been abandoned. In historic times, a borrow pit, Feature 376, intruded into the upper fill of the structure.

Abandonment and Postabandonment

This structure may have been cleaned out before it was abandoned. The unoxidized daub present in the fill suggested the superstructure did not burn, and it may have been at least partially intact when the structure collapsed. After the collapse, natural processes filled and covered the foundation pit. The filled structure was later intruded on by construction of Feature 376, the borrow pit.

Feature 430

Description

This small portion of a pit structure was discovered during hand-excavation just south of a large Hohokam pit structure, Feature 350 (Figure 4.95). Only this small section of the pit structure was excavated, as it extended out of the larger stripping unit to the north. The excavated portion measured 2.2 m in length and 45 cm in width.

The curvature of this area made it appear that the pit structure was round or ovate. Six postholes were found just within the structure's circumference. No entry was identifiable, and the orientation of the pit structure could not be determined. No artifacts were revealed on the floor, and the structure did not appear to have burned.

Figure 4.95. Feature 430, a partially excavated Early Agricultural period pithouse, Tucson Presidio, AZ BB:13:13 (ASM).

Internal Features

Six postholes were exposed in the floor of the pit structure. They ranged in size from 13-22 cm in length, 11-19 cm in width, and 14-18 cm in depth. All were arranged around the interior perimeter of the structure. One of the postholes, Feature 430.01, contained a piece of flaked stone.

Internal Strata and Artifact Contents

About 9 cm of fill was removed and screened between the visible top of the structure and the floor. After excavation, the profile of the unexcavated portion showed that the walls of the structure actually began at a height of approximately 33 cm. This structure was constructed into the silt fill of the area, and its walls were indistinguishable from the silt fill of the structure. The walls only became visible where they cut the sterile calcic substrate. Only artifacts from the lower 9 cm of fill were collected as originating from the structure.

Fill consisted of flood silt with some light charcoal flecking and one small piece of unburned daub. Very few artifacts were present in the fill. Artifacts recovered from the fill included two Hohokam sherds and three pieces of flaked stone.

Construction and Remodeling Evidence

The profile showed the walls of the structure to be approximately 33 cm above the floor. It is unknown how the walls were impacted by either historic or modern construction at the site. Neither the walls nor the floor of the structure appeared to have been plastered or prepared in any way. Except the six postholes and one small piece of daub, no evidence of a superstructure was found.

Stratigraphic Relationships

This pit structure was found at about the same level as two other Hohokam pit structures at the site, Features 350 and 380. One prehistoric pit, Feature 416, intruded slightly on the fill of this structure, indicating the pit was constructed sometime after the structure had at least partially filled with flood silt.

Abandonment and Postabandonment

With only a small portion of the structure exposed, it was difficult to determine much about the abandonment of this structure. Natural processes filled the foundation pit of the structure with flood silt. This pit structure was subsequently excavated in 2005-2006; based on its architectural style and associated artifact types, this feature dates to the Early Agricultural period.

Feature 434

This was a roasting pit or hearth identified during hand-stripping in a control unit. The feature consisted of five small pieces of fire-cracked rock in a matrix of grayish-brown silty sand. The feature was left unexcavated, and no artifacts were discovered or collected.

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CHAPTER 4

FEATURE DESCRIPTIONS: PART 6. CANALS, AZ BB:13:481 (ASM)

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Archaeological work conducted during the Rio Nuevo Archaeology project resulted in the discovery of hundreds of features—areas in which human activities took place. Descriptions of excavated features and summarized data on unexcavated features are presented in this chapter. Descriptions of human burials found during the project are provided in Chapter 18 (this volume).

Work during this project was conducted at four different archaeological sites. The San Agustín Mission, Mission Gardens, Brickyard, and Congress Street loci were located at the Clearwater site, AZ BB:13:6 (ASM), on the western side of the Santa Cruz River. AZ BB:13:481 (ASM) were the Prehistoric, Protohistoric, and Historic era canals, ditches, and a spillway, also located on the western side of the Santa Cruz River. The Tucson Presidio has been designated AZ BB:13:13 (ASM), and the site includes both prehistoric- and historic-era features. Finally, a portion of a historic-era residential block on the northern side of Clark Street and east of the Interstate 10 (I-10) frontage road was designated AZ BB:13:735 (ASM).

The feature descriptions in this chapter are grouped by locus, except for canals, which are described in Part 6 and which are grouped by time period. All site numbers in this chapter are Arizona State Museum (ASM) numbers. Radiocarbon dates are reported in both uncalibrated radiocarbon years before present (b.p.), and in calibrated calendar years at the 1-sigma range of probability. Excavated and unexcavated features are listed, by site/locus and time period, in Table 4.1 (see Part 1 of this chapter).

During test trenching and excavations at the Clearwater site, AZ BB:13:6 (ASM), numerous irrigation canals were discovered (Figures 4.96 and 4.97). Canals are considered linear features because they typically cross long distances and can transverse other sites. Following Arizona State Museum (ASM) guidelines, canals are assigned a separate site number. AZ BB:13:481 (ASM) had previously been used for the prehistoric- and historic-era canals located on the western side of the Santa Cruz River between 29th Street on the south and Alameda Street to the north. Testing of the Rio Nuevo South property and trenching along Alameda Street in 1995 located numerous irrigation canals (Diehl 1996; Freeman et al. 1999; Thiel 1995). The work conducted for the Rio Nuevo Archaeological project in 2000-2003 resulted in the discovery of additional portions of these previously discovered canals, as well as previously unknown canal alignments. These were also assigned to BB:13:481.

All the canals were buried beneath the current ground surface, and were typically identified in backhoe trenches and exposed in multiple trenches. Archaeologists measured and drew profiles of many of the canal exposures. Ostracode samples were collected from certain canals. In several cases, excavation units were placed inside canals, allowing for the recovery of artifacts and for a better understanding of the constructions and dimensions of the water control features. A total of 36 canals, including 6 Early Agricultural, 13 Hohokam, 4 Protohistoric, and 13 Historic examples, were documented during the project (Table 4.5). Other irrigation canals lie outside the Rio Nuevo project area, buried beneath nearby roads, homes, and yards. Although currently inaccessible, these canals may one day be discovered during future utility replacements and other construction projects.

EARLY AGRICULTURAL PERIOD CANALS

San Agustín Mission Locus

Feature 53

Feature 53 (Figure 4.98) was a small canal that curved from the south to the east before being lost in the 1950s landfill. The canal was traced for 34.2 m. On average, it was 1.3 m wide at the top and narrowed to

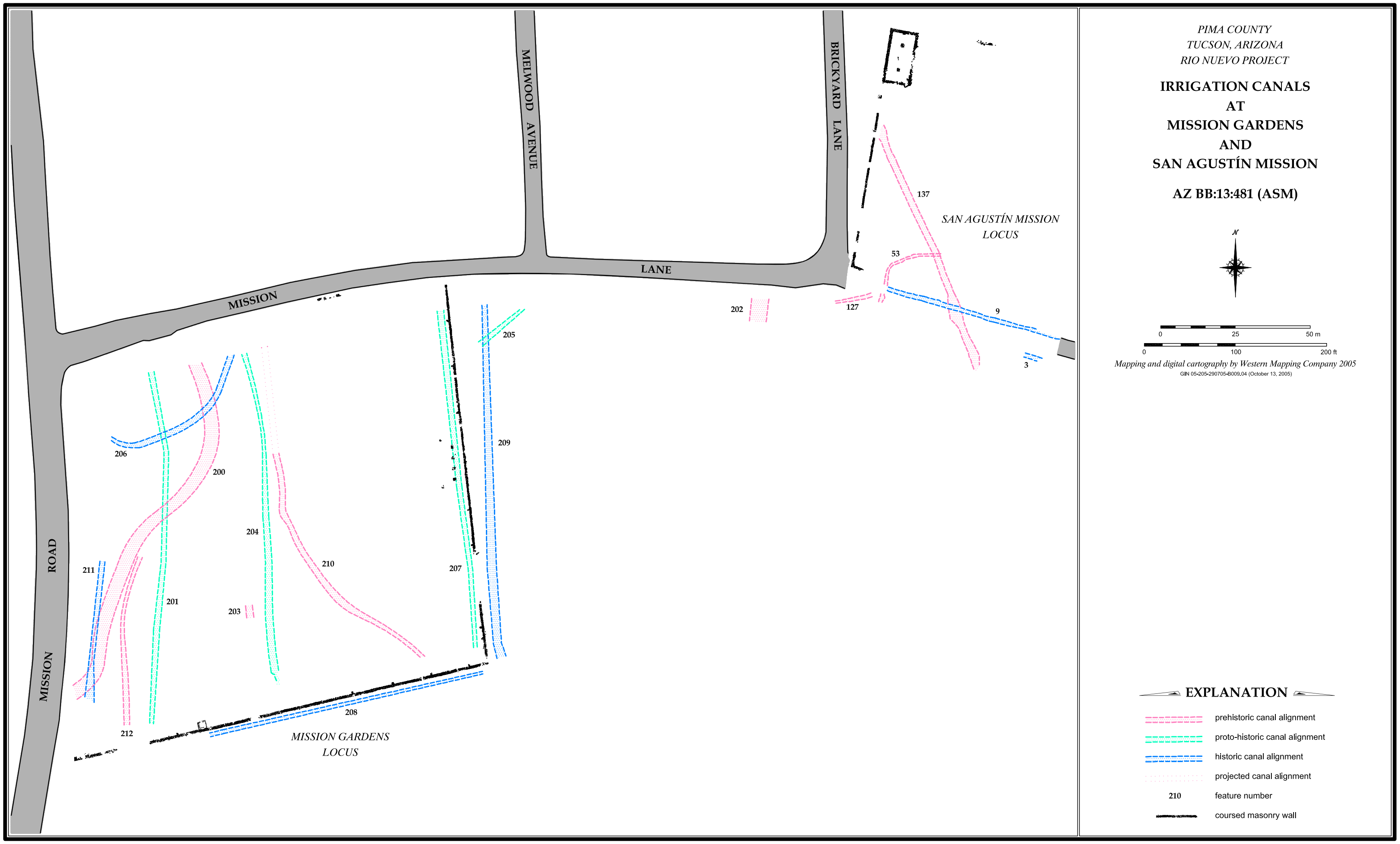

Figure 4.96. Irrigation canals, AZ BB:13:481 (ASM), at the San Agustín Mission and the Mission Gardens loci, the Clearwater site, AZ BB:13:6 (ASM).

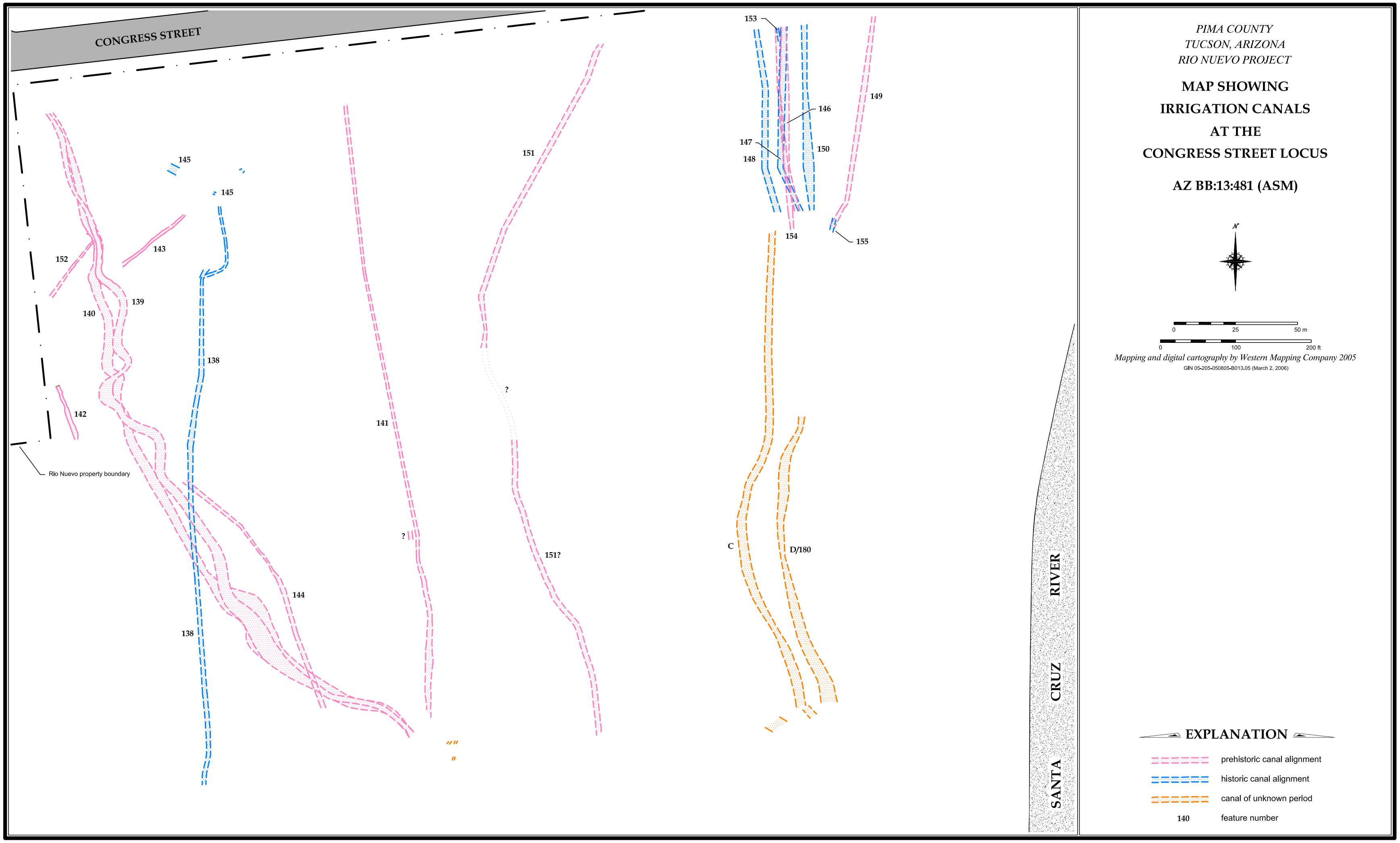

Figure 4.97. Irrigation canals, AZ BB:13:481 (ASM), located at the Congress Street locus, the Clearwater site, AZ BB:13:6 (ASM).

Table 4.5. Canal feature numbers at AZ BB:13:481 (ASM), by locus and period/era.

Locus	Early Agricultural	Hohokam	Protohistoric	Historic
Congress Street/Brickyard	139, 140, 141, 152	142, 143, 144, 146, 149, 151, 154	–	138, 145, 147, 148, 150, 153, 155
San Agustín Mission	53, 127	137	–	3, 9
Mission Gardens	–	200, 202, 203, 210, 212	201, 204, 205, 207	206, 208, 209, 211

Figure 4.98. Photograph of canal Feature 53, AZ BB:13:481 (ASM), at the San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

70 cm wide at the base. The canal was basin shaped in profile and was 43 cm deep. Portions of the canal were apparently lined with fire-cracked rock. Three excavation units were placed in the feature, which was filled with a homogenous light brown to tan silt. The canal appears to have been filled in during a flood event—probably the same flood that dumped light-colored silt into numerous nearby Cienega phase pit structures and pits.

Artifact density was low within the feature and included pieces of flaked stone, ground stone, animal bone, and a few intrusive later ceramics. Ostracode samples were collected from the eastern cross section in excavation Unit 112.

Based on its stratigraphic context, this canal dates to the Cienega phase (800 B.C.-A.D. 50) of the Early Agricultural period.

Feature 127

Feature 127 was located in Trench 19 and appears to be orientated southwest to northeast. It was identified as a 7-cm-thick U-shaped band of yellowish-brown silt. The canal was 1.1 m wide and 40 cm deep, with its top found 30 cm below the existing ground surface. It lies beneath the 5- to 10-cm-thick band of flood-deposited yellowish-brown silt that filled many of the Early Agricultural period features at the San Agustín Mission locus. The base of the canal was lined with a fine yellow silt lens above which was a moderately compact dark brown clayey silt. No artifacts were recovered from the profile.

Based on its stratigraphic context, this canal dates to the Cienega phase (800 B.C.-A.D. 50) of the Early Agricultural period.

Congress Street/Brickyard Loci

Feature 139

Feature 139 was identified in Trenches 201, 203, 205, 207, 210, 211, 213, 214, 215, 216, 223, 225, 231, 232, 233, 234, 267, 275, 276, 277, 278, 279, 280, 284, and 285. It was drawn in Trenches 201, 205, 207, 215, 216, 231, 232, 275, 276, 277, 278, 279, 280, 284, and 285. The canal ran southeast to northwest and was traced for about 260 m. The overall extent of the canal area was 3.02 m wide, a result of the canal moving to the east through time. The last use of the canal resulted in a basin- or U-shaped channel approximately 1.3 m wide and 71 cm deep, originating at between 32 cm and 72 cm below the modern ground surface. The upper surface of this last use was truncated by the plowzone.

A 2-m by 2-m excavation unit was placed in the canal. The fill was moderately compact dark gray-brown silty clay with lenses of yellow silt and highly compacted light gray-brown clay. The base of the

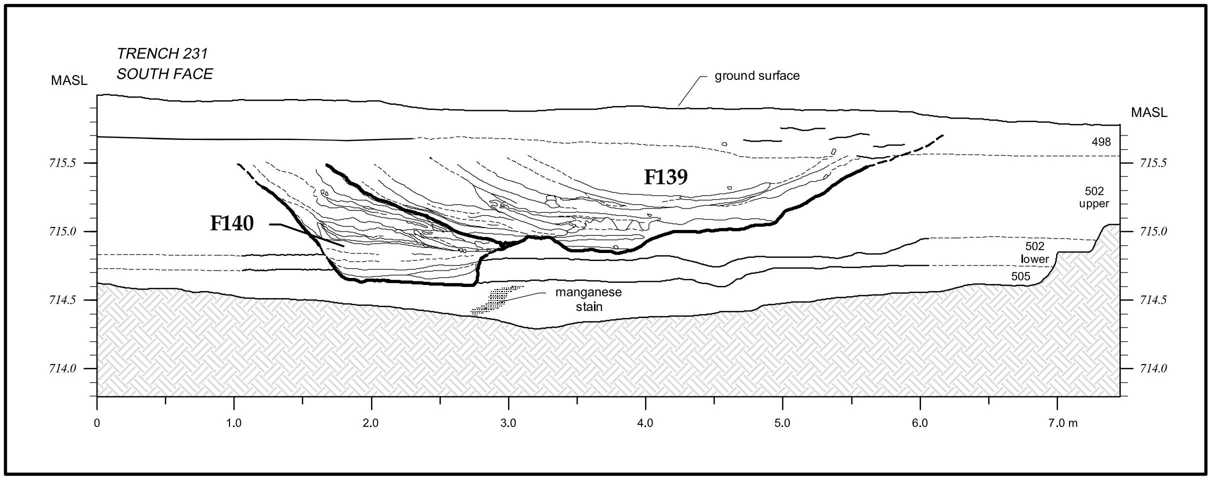

Figure 4.99. Cross section of canal Feature 140, AZ BB:13:481 (ASM), at the Congress Street and Brickyard loci, the Clearwater site, AZ BB:13:6 (ASM).

canal was stained with manganese. Screening of the dirt resulted in the discovery of 18 pieces of fire-cracked rock, as well as sherds, flaked stone, a flaked stone "eccentric," ground stone, shell, and animal bone. Ostracode samples were collected from the northern wall of Trench 201, the southern wall of Trench 203, the eastern wall in Trench 215, and the southern wall of Trench 232. A radiocarbon date on a piece of charcoal revealed the canal dates to 2140±40 b.p. (uncalibrated ^{14}C years), or 200-110 B.C. (at the 1-sigma range of probability). Because canal Feature 139 intruded canal Feature 140, this radiocarbon date also provides a minimum age for Feature 140.

Feature 140

Feature 140 (Figure 4.99) was found in Trenches 201, 203, 205, 207, 216, 267, 275, 276, 277, 278, 279, 284, and 285. It was drawn in Trenches 201, 203, 205, 207, 215, 216, 231, 232, 275, 276, 277, 278, 279, 284, and 285. The canal ran southeast to northwest, and was traced for about 120 m. The canal was between 2.40 m and 3.75 m wide, and was 1.03 m deep, originating at 62 cm below the modern ground surface.

At least two different uses are visible. The first use cuts through cienega clays to the underlying silty clay and sand layers. Manganese staining is present at the base of the canal, with a light gray reddish-brown blocky clay filling the lower portion of the canal. The canal was re-dug into a broad basin shape. The base of this later canal was filled with dark brown blocky clay overlain by a light silty clay. The upper portion of the canal was filled with a reddish-brown silty clay. It is unclear, however, if this was deposited during use of the feature or after it was abandoned. Ostracode samples were collected from the northern wall of Trench 201, the southern wall of Trench 203, the eastern wall of Trench 215, and the southern wall of Trench 232.

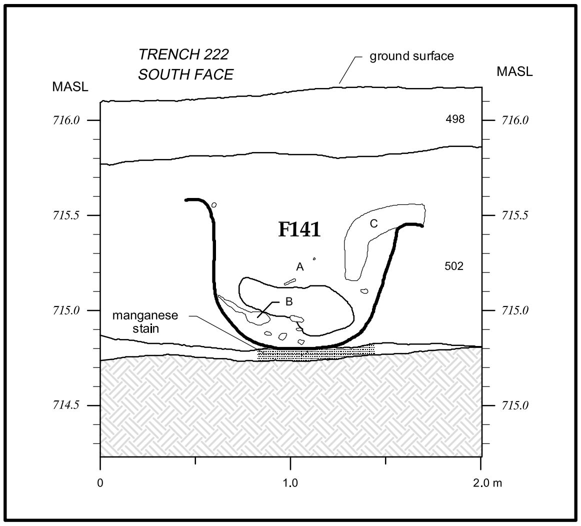

Figure 4.100. Cross section of canal Feature 141, AZ BB:13:481 (ASM), at the Congress Street and Brickyard loci, the Clearwater site, AZ BB:13:6 (ASM).

Based on its stratigraphic context, this canal dates to the Early Agricultural period.

Feature 141

Feature 141 (Figure 4.100) was found in Trenches 114, 219, 220, 222, 229, 236, and 237. It was drawn in Trenches 114, 219, 220, 222, 229, 236, and 237. The broadly U-shaped canal ran south to north and could be followed for 180 m. It was between 94 cm and 1.76 m wide, and was 60 cm to 90 cm deep, originating at 25 cm to 40 cm below the modern ground surface. The canal originated within Stratum 502 and cut through Stratum 503. It was filled with a compact blocky brown clay with some lenses of sandy clay loam to sandy loam to silty clay loam, some of which probably lie at the base of a clean-out. In Trench 222, an area where material had slumped in from the side of the canal was clearly visible. A cluster of fire-cracked rock and charcoal was found at the base of the canal in Trench 114. The top of the canal was truncated by the plowzone. It cut through Feature 545 from BB:13:6, a roasting pit. Ostracode samples were collected from the northern faces of Trenches 219 and 220. A radiocarbon date from a charred maize cupule indicated the canal dates to 2470+40 b.p. (uncalibrated ^{14}C years), or about 770-430 B.C. (at the 1-sigma range of probability).

Feature 152

Feature 152 (Figure 4.101) was located in Trenches 201, 203, and 267, as well as in a stripped area. It was drawn in Trench 267. The canal ran southwest to northeast and was traced for about 27 m. The canal was 1.5 m wide and 39 cm deep. The base of the canal was filled with a medium brown sandy clay loam. Above this were a layer of dark brown blocky clay and a medium brown sandy clay. The canal originated in Stratum 503, and was cut down into Stratum 504.01. Ostracode samples were collected from the Trench 267 cross section. Based on its stratigraphic context, this canal dates to about 1500 B.C.

HOHOKAM CANALS

San Agustín Mission Locus

Feature 137

Feature 137 (Figure 4.102) was a large canal found during backhoe scraping and feature excavation at the San Agustín Mission locus. The canal ran southeast to northwest, passing through the southwestern corner of the later mission compound. It was exposed for a distance of over 88.20 m. On average, it was 1.88 m wide and 1.30 m deep. The top of the canal had been truncated by modern ground disturbance.

The canal was drawn in an area south of Mission Lane, where it cut through a Cienega phase pit structure, Feature 132. The broadly U-shaped canal was cut through cienega clays into the underlying silts. The sediments below the base of the canal had manganese staining. The bottom of the interior of the canal was covered by a sandy loam, above which were layers of silty clay. At least one clean-out was visible. The upper portion of the canal had been filled in by a flood.

Mission Gardens Locus

Feature 200

Feature 200 (Figure 4.103) was a massive canal located in Trenches 302, 308, 310, 311, 324, 325, and 356. It was drawn in Trenches 302, 310, and 311. The canal ran southwest to northeast through the western portion of the garden area before turning in a broad arc toward the northwest. It was traced over a distance of 121.8 m. In terms of overall size, this may be the largest Hohokam canal found to date in the Tucson Basin.

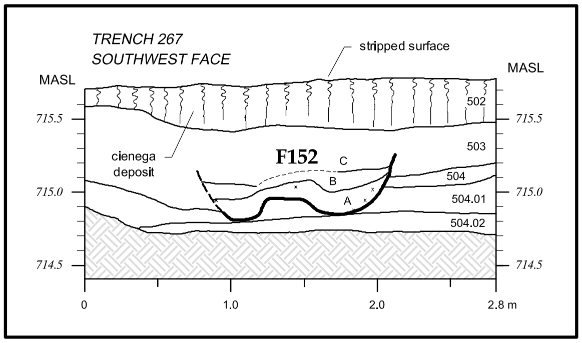

Figure 4.101. Cross section of canal Feature 152, AZ BB:13:481 (ASM), at the Congress Street and Brickyard loci, the Clearwater site, AZ BB:13:6 (ASM).

Figure 4.102. Photograph of canal Feature 137, AZ BB:13:481 (ASM), at the San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

In Trench 302, the canal was 7.58 m wide and 2.20 m deep, originating at 42 cm below the modern ground surface. The canal cut through the dark brown cienega clays that are present within the gardens into an underlying compact light brown sandy-silty clay. The canal was filled with a layer of fine, loosely consolidated sand at its base. Above this was a layer of compact dark brown blocky clay that probably represents fine sediments that were deposited as the canal was in use. Above this was a pale tan sandy clayey silt or sand that filled the canal during a flood. This flood completely filled the canal, and there is no evidence that the Hohokam ever attempted to clean out and re-use the canal. Hohokam sherds were common within the fill. The canal was sampled for ostracodes in the southern face of Trench 310.

The age of this canal is bracketed between about 1000 and 900 ^{14}C years b.p. (uncalibrated), which places it in the Early or Middle Rincon phases (circa A.D. 950-1100) of the Hohokam Sedentary period.

Feature 202

Feature 202 (Figure 4.104) was a large canal located and profiled in Trench 306 south of the corner of Mission Lane and Brickyard Lane. The canal was oriented north-south, perhaps trending toward the northeast, but the limited exposure makes it difficult to determine its exact alignment. The overall canal

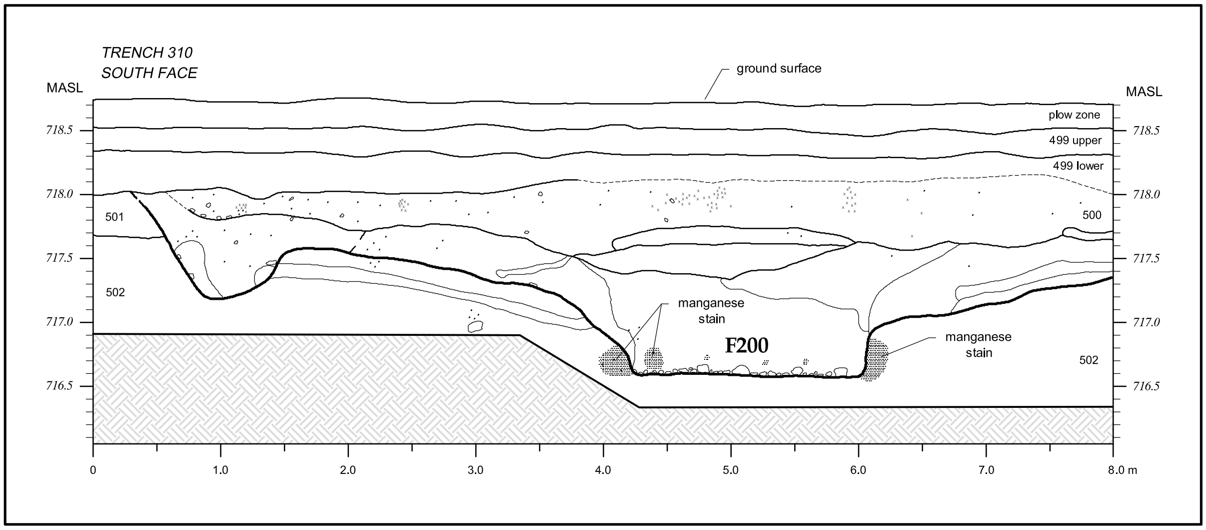

Figure 4.103. Cross section of canal Feature 200, AZ BB:13:481 (ASM), at the Mission Gardens locus, the Clearwater site, AZ BB:13:6 (ASM).

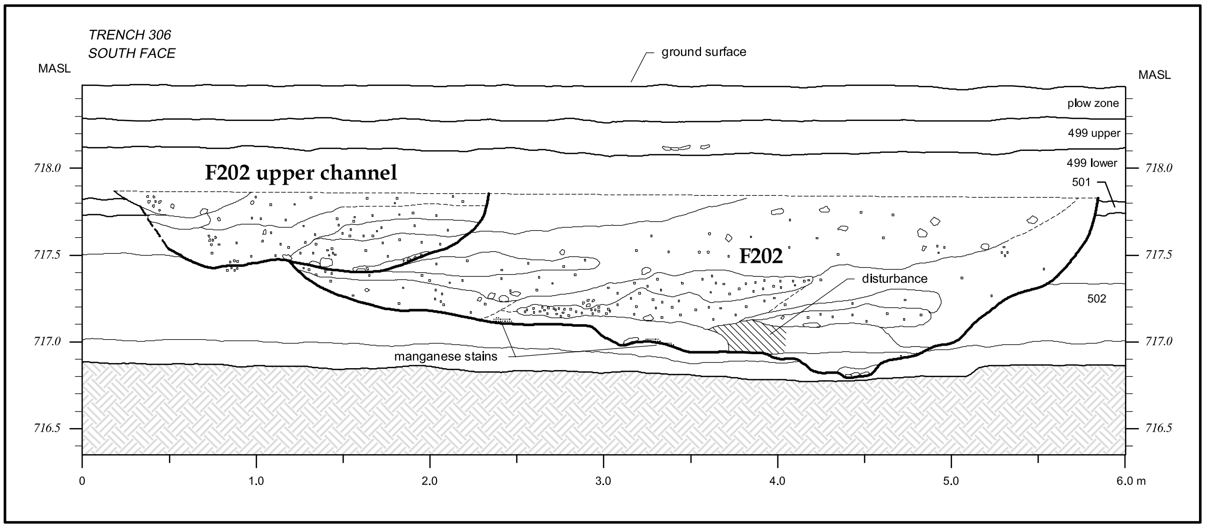

Figure 4.104. Cross section of canal Feature 202, AZ BB:13:481 (ASM), at the Mission Gardens locus, the Clearwater site, AZ BB:13:6 (ASM).

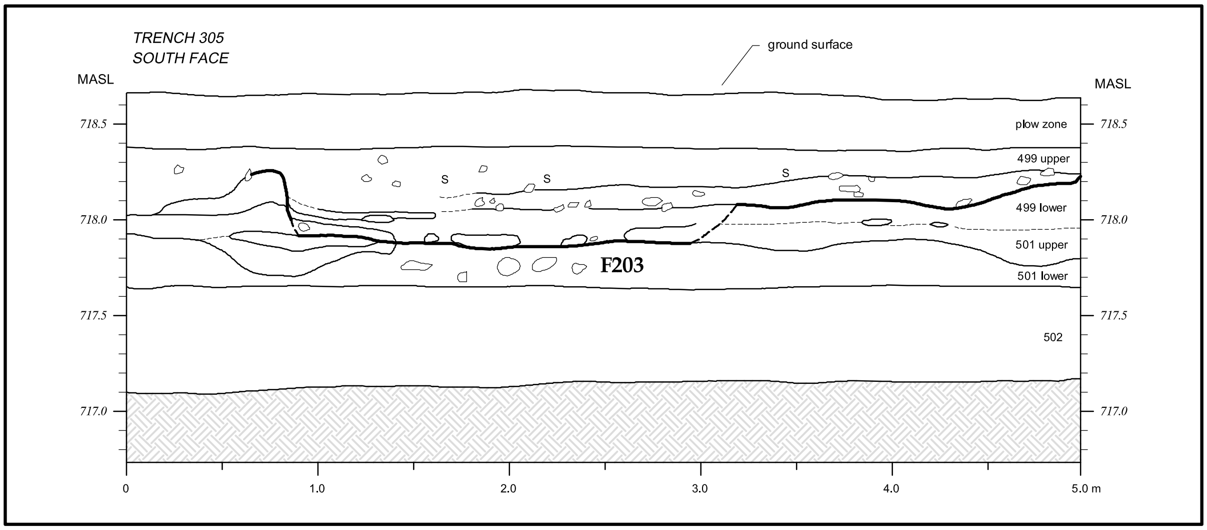

Figure 4.105. Cross section of canal Feature 203, AZ BB:13:481 (ASM), at the Mission Gardens locus, the Clearwater site, AZ BB:13:6 (ASM).

cross section was 5.65 m wide; however, the canal shifted west through time, with the actual canal ranging from 80 cm to 194 cm wide at various times. It was 91 cm deep at its deepest point, with the top of the canal found 69 cm below the modern ground surface. Historic plowing may have truncated the upper portions of the canal. The canal was filled with a variety of sediments ranging from dark gray-brown sandy clay at the base to light brown silty clay near the top. The cutting of sediments within the canal suggested it was cleaned out on several occasions.

Feature 203

Feature 203 (Figure 4.105) was a probable prehistoric-era canal located and profiled only in Trench 305, a few meters west of canal Feature 210. It appeared to run south-north. The top of the canal was truncated by the plowzone. Below this, the canal was 3.8 m wide and 52 cm deep, with its top found 30 cm below the modern ground surface. The base of the canal was lined with intermittent lenses of clay and laminated bands of sand, silty sands, and clay. A berm may have been present along the eastern side of the canal, with some clean-out deposits east of the berm. Several sherds and pieces of fire-cracked rocks were present within the fill.

Feature 210

Feature 210 was located within Trenches 300, 305, 312, 317, 329, 330, 331, 332, and 333. It may also have been found in Trench 303. It was drawn in Trenches 324, 325, 331, 332, and 333. The canal ran southeast to northwest before gradually turning north. It was traced for a total length of 124.7 m. On average, the feature was 1.7 m wide at the top, narrowing to 50 cm wide at the base. It was 90-95 cm deep. The canal had a U-shaped profile and cut a layer of cienega clay. It was filled with a layer of sand at its base. Above this was light brown compact clayey silt that, in turn, lay below a large deposit of medium brown compact sandy clay. The upper portions of the canal had been disturbed by plowing.

Feature 212

Feature 212 was found in Trenches 308, 310, 324, and 325. This Hohokam canal ran south to north, trending slightly to the northeast. It was traced for 55.1 m. The canal was not recorded in the field, but was identified in drawings of trench walls.

Congress Street/Brickyard Loci

Feature 142

Feature 142 (Figure 4.106) was a canal found in Trench 206 and during backhoe scraping. It ran southeast to northwest, and was traced for approximately 20 m, extending west beyond the project area and south into a disturbed area. An excavation unit, 1.30 m long by 1.29 m wide, was placed over the feature. It was filled with blocky clay, with a thin sand lens above the canal base. In profile, the canal was basin shaped with shallow, sloping sides. On average, it was 1.2 m wide and 40 cm deep. Screening of dirt from the unit resulted in the recovery of one small sherd, some flaked stone, a piece of ground stone, and 56 pieces of fire-cracked rock. The canal originated in Stratum 502. Ostracode samples were collected from a south-facing cross section at the edge of Stripping Block 2.

Feature 143

Feature 143 (Figure 4.107) was a canal located in Trench 201, in an unnumbered trench south of Trench 201, and during backhoe scraping. It was drawn in the unnumbered trench segment. Only a 10-m-long segment was documented, running southwest to northeast. The feature was originally thought to be a pit structure. The basin-shaped canal averaged 1.64 m wide and at least 46 cm deep. The base of the canal was reddish-brown lightly compacted sand. Above this was a layer of compact grayish-brown sandy clay loam which was, in turn, covered by compact brown sandy clay. Manganese staining was present below the base of the canal.

An excavation unit measuring 2 m long by 2 m wide was placed over the feature. It was identified as a canal based on the presence of distinctive sediments that consisted of blocky clay similar to Stratum 502. The canal cut into the underlying orange brown sand, Stratum 504. Charcoal flecks and calcium carbonate stringers and nodules were present. Excavation of the unit resulted in the recovery of only a few artifacts—one piece of flaked stone, one sherd, and six pieces of fire-cracked rock. Ostracode samples were collected from the southern cross section in the unnumbered trench.

Feature 144

Feature 144 (Figure 4.108) was found in Trenches 208, 210, 212, 234, 246, 269, and 270. It was drawn in Trenches 212 and 270. The canal ran southeast to northwest, and was traced for about 110 m. On average, the canal was 1.24 m wide in Trench 270, and was 80 cm deep. The base of the canal was filled with light brown clay and compact grayish-yellow silt. Above this were blocky gray clayey silt and very hard, compacted, grayish-yellow-brown silt. In some areas, the sediments had a green hue, perhaps indicating a high organic content or gley (low oxygen) conditions.

Feature 144 was also studied through an excavation unit measuring 1.14 m by 90 cm that was placed in the feature after human bone was discovered. Excavation of a 5-cm level resulted in the recovery of flaked stone, 70 pieces of fire-cracked rock, a possible figurine fragment, 20 sherds, a hammerstone, and additional human bone. A human burial may have eroded into the canal. The fill of the feature was a blocky tan compact clay. Ostracode samples were collected from the northern cross section of Trench 212.

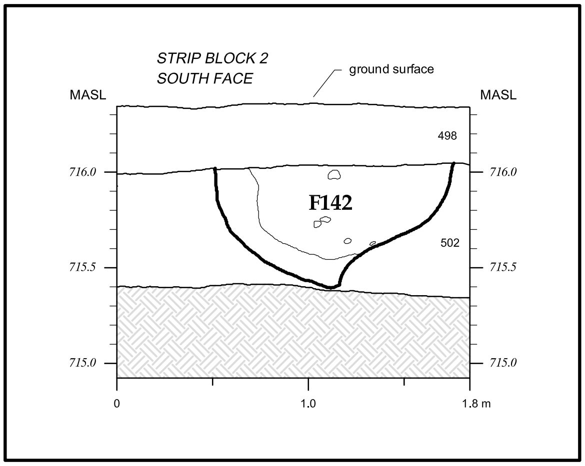

Figure 4.106. Cross section of canal Feature 142, AZ BB:13:481 (ASM), at the Congress Street and Brickyard loci, the Clearwater site, AZ BB:13:6 (ASM).

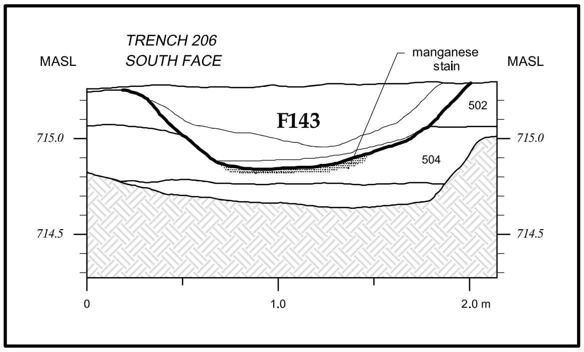

Figure 4.107. Cross section of canal Feature 143, AZ BB:13:481 (ASM), at the Congress Street and Brickyard loci, the Clearwater site, AZ BB:13:6 (ASM).

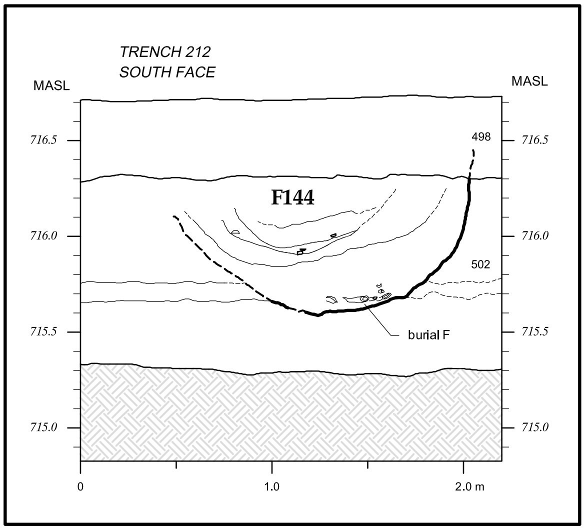

Figure 4.108. Cross section of canal Feature 144, AZ BB:13:481 (ASM), at the Congress Street and Brickyard loci, the Clearwater site, AZ BB:13:6 (ASM).

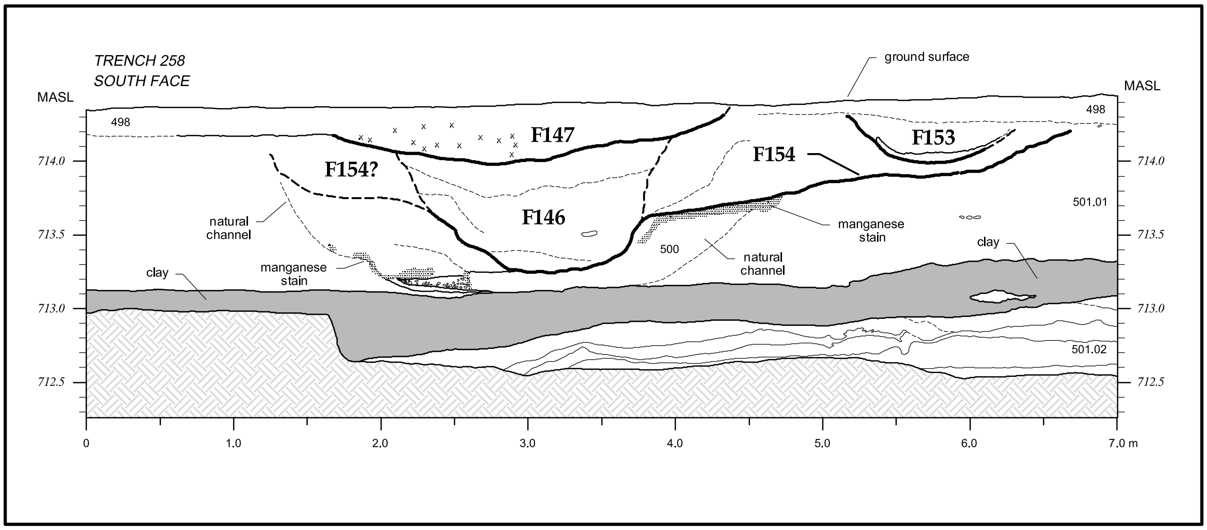

Figure 4.109. Cross section of canal Feature 146, AZ BB:13:481 (ASM), at the Congress Street and Brickyard loci, the Clearwater site, AZ BB:13:6 (ASM).

Feature 146

Canal Feature 146 (Figure 4.109) was located in Trenches 248, 253, 255, 258, 260, and 274. The canal was drawn in Trenches 253, 255, and 258. It ran southwest to northeast and was traced for roughly 90 m. On average, the canal was between 1.16 m and 3.16 m wide, and was 66 cm deep. It was filled with dark brown compact silty sand at its base, with tan compact clayey silt above. Manganese staining was visible at the base of the feature. Feature 146 was cut into by another canal, Feature 147. It intruded into the eastern side of canal Feature 154 in Trenches 258 and 271. Ostracode samples were collected from the southern cross section of Trench 253 and from Trench 258. This canal contained pottery sherds of the Late Rincon and Tanque Verde phases (circa A.D. 1100-1300).

Feature 149

Feature 149 (Figure 4.110) was found in Trenches 253, 258, 260, and 274. The canal was drawn in Trenches 253, 258, 260, and 274. It was traced for approximately 90 m. The broad, basin-shaped canal averaged 2.5 m wide at the top, narrowing to 1.1 m at the base. It was about 1.0 m deep. The canal had been dug through the dark brown, blocky cienega clay into the underlying light tan-brown sandy silt. The base of the canal was filled with water-deposited sands, above which were blocky, dark brown clay with coarse sands mixed in. A re-excavation of the canal was visible, with the clays dug out to make a U-shaped canal that was 1.6 m wide and 64 cm deep. Some overbank deposits were visible in the profile of Trench 274. This latter canal was filled with a thick band of tan-yellowish sands deposited during a flood. Above this was a layer of brown cienega clays that developed after the canal was filled in by the sandy flood deposit. This canal contained sherds of the Tanque Verde phase (circa A.D. 1150-1300).

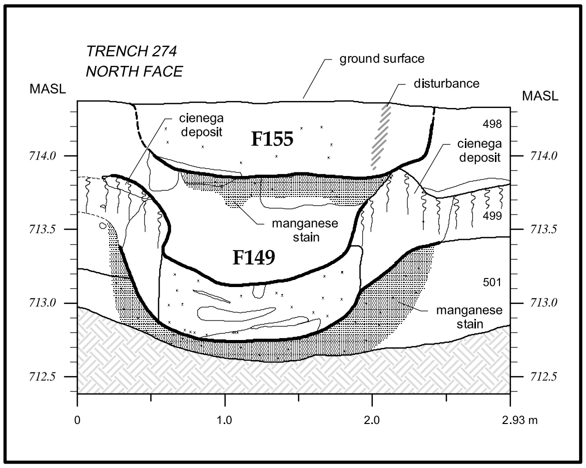

Figure 4.110. Cross section of canal Feature 149, AZ BB:13:481 (ASM), at the Congress Street and Brickyard loci, the Clearwater site, AZ BB:13:6 (ASM).

Feature 151

Canal Feature 151 (Figure 4.111) was located in Trenches 246, 249, 256, 257, 261, 262, 263, 264, and 265. It was drawn in Trenches 257, 261, 265, and 354. It ran in a broad arc from southeast to northwest and then northeast over a distance of 300 m, having been located in previous trenching in 1995. On average, the canal was 2.2 m wide at the top,

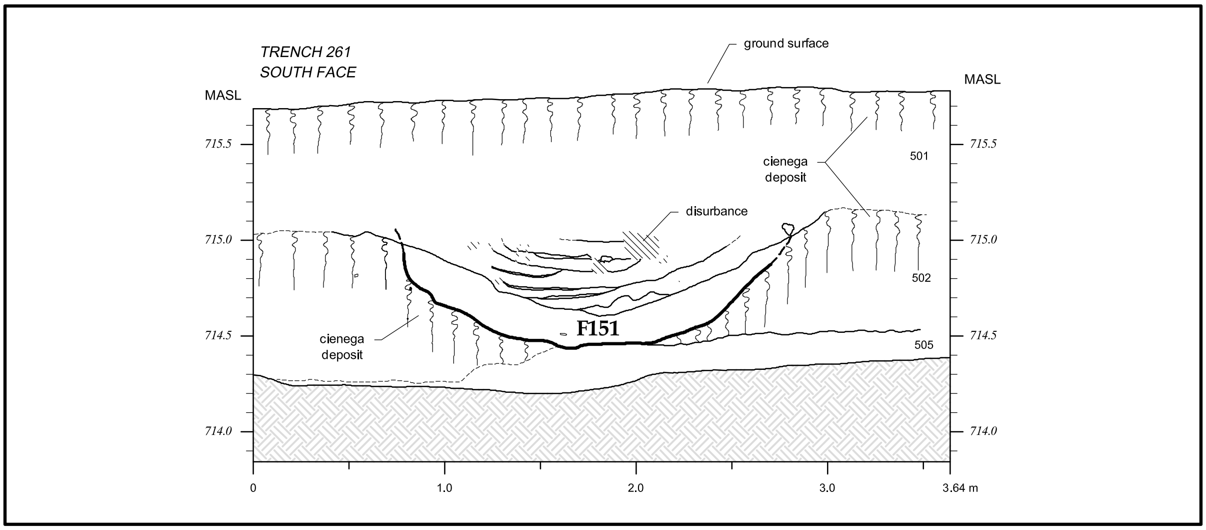

Figure 4.111. Cross section of canal Feature 151, AZ BB:13:481 (ASM), at the Congress Street and Brickyard loci, the Clearwater site, AZ BB:13:6 (ASM).

narrowing to 86 cm at the base. The canal averaged 84 cm deep, originating at roughly 78 cm below the modern ground surface. The feature was filled with layers of brown clay, sand, tan silty clay, and bands of sand and clay. Some evidence for cleaning out and re-use of the canal is suggested by the basin-shaped fill layers. Manganese staining was present below the base of the canal. Ostracode samples were collected from the southern faces of Trenches 265 and 354.

Feature 154

Feature 154 (see Figure 4.109) was located in Trenches 255, 258, 271, 272, and 273. It was drawn in Trenches 255, 258, 271, 272, and 273. The feature ran north-south and was traced for about 85 m. This canal was between 1.0 m and 1.2 m wide, and ranged in depth from 16 cm to 91 cm in Trenches 272 and 271, respectively. The shallow depth in Trench 271 is a result of the top of the feature being cut into by canal Feature 146. In Trench 258, the canal was cut by canal Features 146 and 153. In Trench 273, the canal was also disturbed by a large pit.

The lower fill of the canal was dark brown, compact silty clay. The canal was re-dug, shifted to the east, and made 20 cm deeper. This re-dug portion was filled at the base by a tan compact clayey silt. Above this was dark brown compact blocky clay that was capped by a light brown compact clayey silt. In Trench 255, a flood event filled much of the canal in that area. Ostracode samples were collected from the Trench 255 cross section. This canal contained pottery sherds of the Late Rincon and Tanque Verde phases (circa A.D. 1100-1300).

PROTOHISTORIC PERIOD CANALS

Mission Gardens Locus

Feature 201

Feature 201 (Figure 4.112) was a canal found in Trenches 302, 308, 310, 311, and 324. Cross sections of the canal were drawn in Trenches 302, 308, 310, and 311. The canal ran in a south-to-north direction. It was traced for 116 m. The canal ranged from 1.35-4.80 m wide at the top, narrowing to between 60 cm and 1.3 m at the base. It was between 84 cm and 1.22 m deep, with the top of the canal 39 cm below the modern ground surface. Examination of the cross section of the canal suggested it was re-dug several times. Most of the fill was a light brown-brown clayey silt. Bands of fine sands and silts were present within the feature. The base of the canal contained a light gray-brown sandy clayey silt with some coarse sands and numerous small shells. Just above the base was a lens of bedded medium sands. Through time, as the canal was filled and re-dug, it became progressively more narrow and shallow.

Many sherds, flaked stone, and pieces of fire-cracked rocks were present in the fill. Excavation was conducted within the base of the canal in backhoe Trench 302. Sherds, flaked stone, and shell were collected, as was a flotation sample. The canal was sampled for ostracodes in the southern walls of Trenches 308 and 310.

Feature 204

Feature 204 (Figure 4.113) was located within Trenches 300, 302, 305, 312, 317, 332, 333, and 352. It

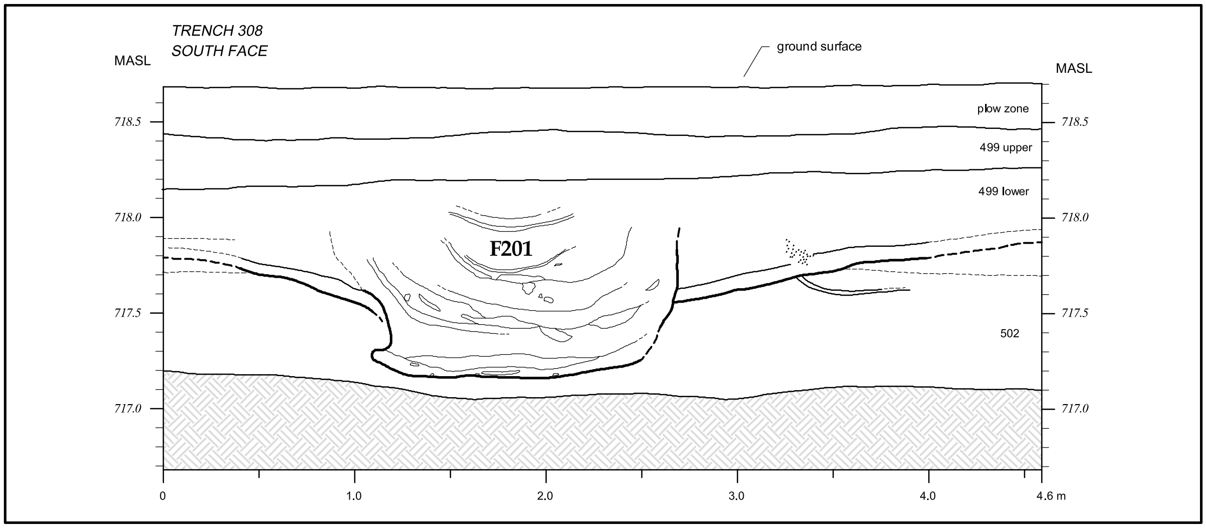

Figure 4.112. Cross section of canal Feature 201, AZ BB:13:481 (ASM), at the Mission Gardens locus, the Clearwater site, AZ BB:13:6 (ASM).

was drawn in Trenches 302, 305, and 312. The canal ran south to north, gradually turning northwest through the portion documented within the Mission Gardens. It was traced for 103.6 m. The canal averaged 2 m wide and 50 cm deep, with the top of the feature found at 30 cm below the modern ground surface, probably truncated by historic plowing. The fill of the U-shaped canal consisted of laminated lenses of brown silty sands and clays. A small amount of manganese staining was present along the base, just above a clay band. Several pieces of fire-cracked rock were noted in the cross sections.

Feature 205

Feature 205 (Figure 4.114) was a canal found in Trenches 307, 316, and 334; it was drawn in Trench 307. This canal ran southwest to northeast, and it was traced for 20.3 m. On average, it was about 90 cm wide and 31 cm deep, with the top of the canal found at 41 cm below the modern ground surface. The fill of the canal was a blocky clay with a layer of fine sands above. In one area, a concentration of small freshwater mollusks was visible in the cross section.

Feature 207

Feature 207 (Figure 4.115) was a canal found in Trenches 300, 301, 302, 304, 305, and 350. It was drawn in Trenches 300, 301, 325, and 304. The canal

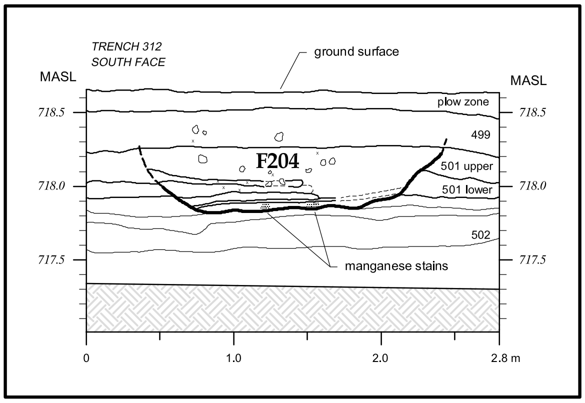

Figure 4.113. Cross section of canal Feature 204, AZ BB:13:481 (ASM), at the Mission Gardens locus, the Clearwater site, AZ BB:13:6 (ASM).

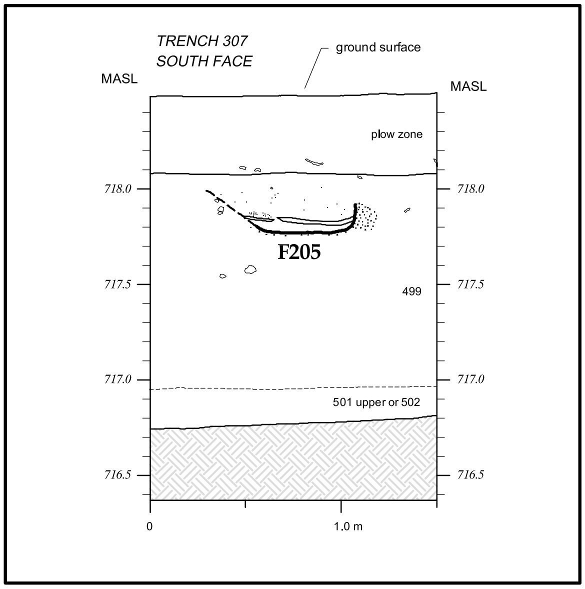

Figure 4.114. Cross section of canal Feature 205, AZ BB:13:481 (ASM), at the Mission Gardens locus, the Clearwater site, AZ BB:13:6 (ASM).

ran south to north and was located immediately west of the eastern Mission Gardens wall. This suggested the canal existed when the wall was built, perhaps in the 1790s. However, the structure located on the interior of the eastern wall, Feature 3083, was positioned above the canal, indicating the canal was no longer in use when the dwelling was built. The exact date of construction for this building is unknown, although it appears on the 1862 Fergusson Field map, and excavation within the floor area of the building located English transfer-print ceramics that may date to the 1840s. The canal had cut into Feature 3106, a large unexcavated bell-shaped pit.

The canal was traced for 110.2 m, and ranged between 1.34 m and 2.40 m wide and 13 cm to 53 cm deep, originating at 32 cm below the modern ground surface. It had been truncated by historic-era plowing. The base of the canal was filled with a gray-brown, silty sand that, in turn, was overlain by a light grayish-brown, sandy silt with some sands and a fair amount of charcoal staining and small mollusk shells. Many fire-cracked rocks, sherds, and small shells were visible in the fill. The canal cut through the cienega clays present within the site. Ostracode samples were removed from the southern cross section in Trench 300.

HISTORIC ERA CANALS

San Agustín Mission Locus

Feature 3, Millrace or Spillway

Feature 3 (Figure 4.116) was the millrace, or spillway, for Solomon Warner's grist mill, which began operating in 1875. It ran down the southern side of Mission Lane, and the excavated portion was lined with stones. Most of the interior of the millrace had been previously excavated by Jack Williams in 1986; unfortunately, Williams has not published a description of what he found. The surviving portion is at least 6.35 m long and 60 cm wide, with rock and mortar walls at least 22 cm high. The interior was filled with layers of brown to gray-brown, silty sandy clay. An ostracode sample was taken from one cross section of the feature.

Feature 9

Feature 9 was a historic-era *acequia* (canal) that ran along the northern side of Mission Lane. The *acequia* is visible on a photograph thought to have been taken in the mid-1870s. The photograph reveals that the canal was spanned by a plank footbridge in the area north of the Leopoldo Carrillo house. The canal was probably dug sometime in the 1860s, because it cuts Feature 61, a pit with European ceramics that date to the 1850s to 1860s.

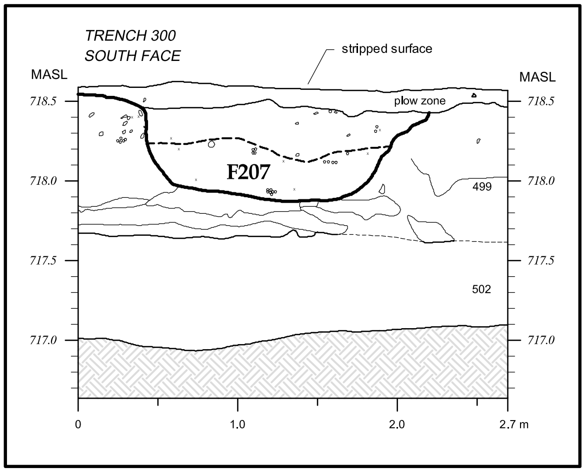

Figure 4.115. Cross section of canal Feature 207, AZ BB:13:481 (ASM), at the Mission Gardens locus, the Clearwater site, AZ BB:13:6 (ASM).

Figure 4.116. Feature 3, Solomon Warner's millrace; the northern wall of the millrace has been severely damaged by modern roadwork, San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

Four excavation units were placed in the *acequia* to allow recovery of artifacts and samples. The canal was traced for 59.4 m, extending into unexplored areas to the west and east. It averaged 2 m wide and 47 cm deep. The construction of Mission Lane over the feature likely resulted in the removal of the upper portions of the feature. The sediment filling the *acequia* was a light brown loam that was moderately compact. It included a number of large rocks that probably came from the foundation of the southern mission compound wall that would have been located immediately to the north. The canal was basin shaped, and the internal stratigraphy suggested it was cleaned out at least once while in use.

Mission Gardens Locus

Feature 206

Feature 206 (Figure 4.117) was found in Trenches 302, 309, 311, and 328. It was drawn in Trench 302, where it was cut at an oblique angle, and in Trenches 309 and 328. The canal arcs from west to north through the northwest corner of the Mission Gardens. It was traced for 55.1 m. The canal was 1.36 m wide in Trench 309 and averaged 33 cm deep, with the top of the canal found at 44 cm below the ground surface. The top of the canal had been cut by the historic plowzone. The canal had a fairly flat base with gradually sloping sides. It was filled with a compact light brown fine sandy silt with charcoal flecks, fire-cracked rocks, sherds, and snail shells. Ostracode samples were collected from the western wall of Trench 309.

Feature 208

Feature 208 (Figure 4.118) was located in Trenches 315 and 319; it was drawn in both trenches. This canal ran along the exterior of the southern Mission Gardens wall. It was traced for 92.8 m. In Trench 315, the canal was 1.3 m wide and 58 cm deep, originating at the base of the historic plowzone, 30 cm below the modern ground surface. The U-shaped canal was filled with water-lain, brown clay and dark brown, sandy silty clay at its base. Immediately above this was a dark brown, sandy silty clay that included pieces of rusted metal. Berms were visible on each side of the canal. The canal had been cut into the medium brown, clayey silt band that overlies the compact cienega clays at the gardens.

Feature 209

Feature 209 was a canal found in Trenches 301, 302, 305, 316, and 320. It was drawn in Trenches 301, 305, and 320. The south-to-north running canal was located east of the eastern wall of the Mission Gardens. It was traced for 118.9 m. Two separate uses of the canal were evident, with the canal moving east through time in Trench 320, and east to west in Trench 305.

The first phase was a canal that was at least 1.5 m wide and 26 cm deep excavated into the underlying, tan-brown, silty loam. This original canal was filled with a grayish-brown, clayey silty sand with bits of charcoal and occasional small gastropod shells. During the second phase of the canal, it averaged about 1.8 m wide and 60 cm deep. The base of the feature was filled with water-lain sands with many sherds, pieces of flaked stone, and fire-cracked rock. Above this was a thick layer of dark brown, sandy clayey silt that also contained numerous artifacts.

Feature 211

Feature 211 was located in Trenches 324, 325, and 327; it was drawn in Trenches 325 and 327. The canal

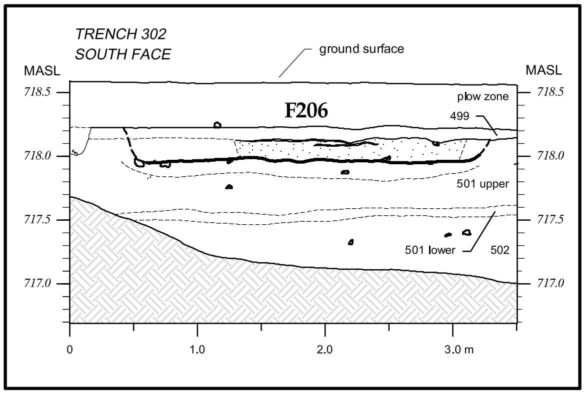

Figure 4.117. Cross section of canal Feature 206, AZ BB:13:481 (ASM), at the Mission Gardens locus, the Clearwater site, AZ BB:13:6 (ASM).

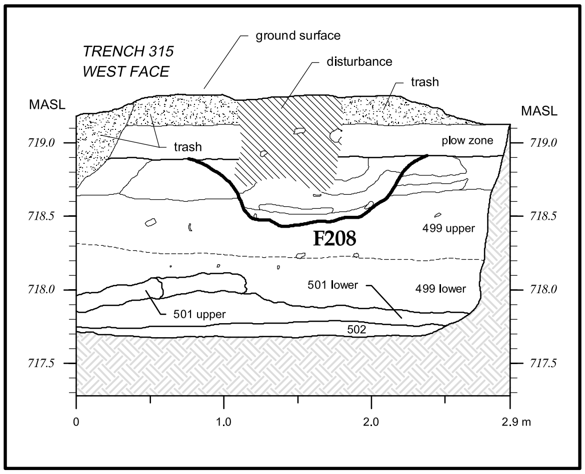

Figure 4.118. Cross section of canal Feature 208, AZ BB:13:481 (ASM), at the Mission Gardens locus, the Clearwater site, AZ BB:13:6 (ASM).

ran along the western side of the Mission Gardens, approximately 9 m or so inside the western wall. It was traced for 46.4 m. The canal ranged from 1.55 m to 1.80 m wide and 1.05 m to 1.20 m deep. It was filled with light gray clay at its base, trending toward gray silts above. Some historic-era trash was present in the upper fill, with the upper portions of the canal truncated by the modern plowzone. A possible re-use of the canal was noted in Trench 327, where a separate channel was present along the western side of the main channel.

Congress Street/Brickyard Loci

Feature 138

Feature 138 (Figure 4.119) was discovered in Trenches 102, 200, 202, 204, 208, 209, 211, 227, 228, 239, 243, 250, 281, and 282. It was drawn in Trenches 102, 200, 202, 204, 209, 227, 228, 239, 243, 250, 281, and 282. The canal ran north-south for 210 m turning directly east, and then turning back north for another 30 m, until finally turning northeast. This canal appears on the 1862 field map (see Figure 1.2) and was the Acequia Madre Primera, one of the primary irrigation canals during the American Territorial period.

The basin-shaped canal ranged in width from 80 cm to 1.58 m. On average, it was 50 cm deep, originating at ground surface to 40 cm below the ground surface. It had been truncated by the historic-era plowzone, and had been disturbed by the brickyard operations in some areas. The base of the canal was filled with a light reddish-brown clayey sand, above which were layers of compact grayish-brown clayey silt, reddish-brown clay, and very compact blocky light reddish-brown silt. The canal cut into the underlying cienega clay, Stratum 502.

An excavation unit was placed within the canal. The fill was primarily a blocky, gray-brown, sandy clay that was uniform until just above the base of the canal, where a thin layer of sand or silty sand was present. Small bands of clays and sands were present in other profiles, and the canal was cleaned out and re-used on at least one occasion. Artifacts found in the canal included fired bricks, glass, flaked stone, historic ceramics, Native American sherds, paper, shell buttons, and leather. Ostracode samples were collected from the southern wall of Trench 202 and the southern wall of Trench 204.

Feature 145

Feature 145 (Figure 4.120) was documented only in Trench 240. The canal was 96 cm wide and 60 cm deep. The lower portion was U-shaped, expanding outward slightly along the top 26 cm. The lower fill was a light brown compact sandy clay. Above this was a light brown, very compact, silty clay and a medium brown, moderately compact, clay loam. A piece of metal was in the upper fill. Historic plowing may have removed the upper portion of the feature, with the disturbed zone extending 28 cm from the modern ground surface. The exact orientation of the canal could not be determined, but it appeared to be from southeast to northwest.

Feature 147

Feature 147 (see Figure 4.109) was found in Trenches 248, 253, 255, 258, 271, 272, and 273, and was drawn in Trenches 253, 255, 258, 271, and 272. The canal ran southeast to northwest before turning due north. It was traced for 75 m. On average, the canal was 2.4 m wide and was about 30 cm deep, originating at 43 cm below modern ground surface.

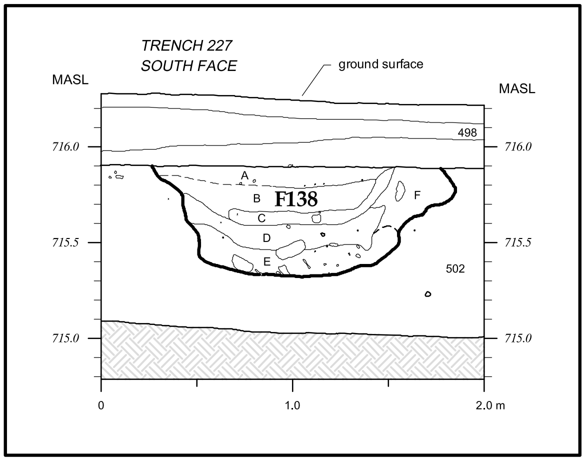

Figure 4.119. Cross section of canal Feature 138, AZ BB:13:481 (ASM), at the Congress Street and Brickyard loci, the Clearwater site, AZ BB:13:6 (ASM).

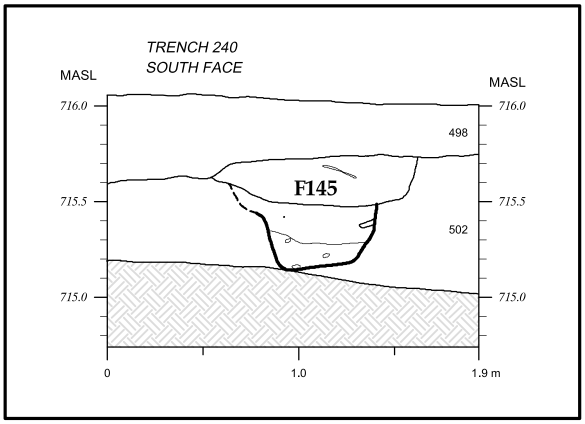

Figure 4.120. Cross section of canal Feature 145, AZ BB:13:481 (ASM), at the Congress Street and Brickyard loci, the Clearwater site, AZ BB:13:6 (ASM).

It was filled with a red-brown, silty sand that was moderately compact. Inclusions were small amounts of coarse sand, caliche flecks, and bits of charcoal. One sherd lay on the base of the canal in the profile of Trench 255. The top of this canal was truncated by the plowzone. It cut into the top of Feature 146, a prehistoric canal. Ostracode samples were collected from the southern wall of Trench 253.

Feature 148

Feature 148 (Figure 4.121) was located in Trenches 248, 253, 255, 258, 259, 271, 272, 273, and 286. It was drawn in Trench 253, 255, 258, 273, and 286. This canal was possibly documented during the trenching in 1995, and as a result, may have been traced for roughly 275 m. It ran on a fairly south-to-north alignment, bowing slightly west in one segment. On average, the canal was 6 m wide in Trench 253 and 25 cm deep, although it was truncated by the modern plowzone. In Trench 286, Feature 148 was 2.1 m wide and 98 cm deep. The canal was more than 52 cm below the modern ground surface. The base of the canal had small lenses of orange gravel and sand, above which were layers of silty clays. Ostracode samples were collected from the southern wall of Trench 253. This canal probably appears on the 1862 field map.

Feature 150

Feature 150 (Figure 4.122) was found in Trenches 248, 253, 255, 258, 271, and 272; it was drawn in Trenches 253, 255, 258, 271, and 272. The basin-shaped canal ran south to north and was traced for 75 m. The canal was between 2.46 m and 2.55 m wide and between 41 cm and 55 cm deep, originating at about 40 cm below the modern ground surface. The upper fill of the canal was a compact, brown, silty sandy clay with the lower fill being a brown, clayey silty sand that was moderately compact. Small charcoal flecks were dispersed throughout the fill. The upper portion of the canal was truncated by plowing. Ostracode samples were collected from the southern wall of Trench 253.

Feature 153

Feature 153 (see Figure 4.109) was found in Trenches 258 and 271, and it was drawn in Trench 258. This canal was traced for only a short distance and ran north-south. On average, it was 1.1 m wide and about 25 cm deep. The top of the canal had been cut by the plowzone and was found at about 20 cm below the modern ground surface. The canal had dark brown, blocky clay at the base, above which was a thick layer of dark, grayish-brown, silty clay. The canal cut into Feature 154, another canal. Ostracode samples were collected from the Trench 258 cross section.

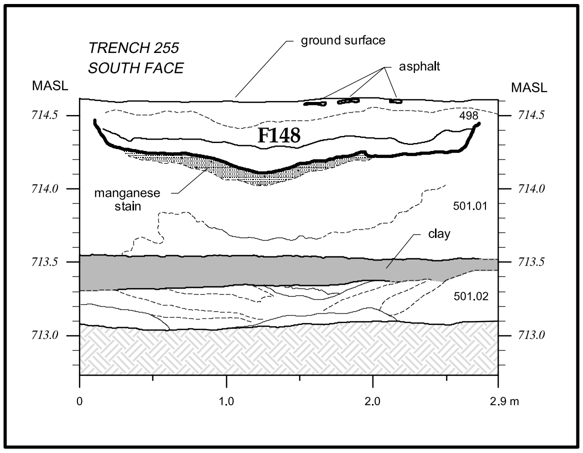

Figure 4.121. Cross section of canal Feature 148, AZ BB:13:481 (ASM), at the Congress Street and Brickyard loci, the Clearwater site, AZ BB:13:6 (ASM).

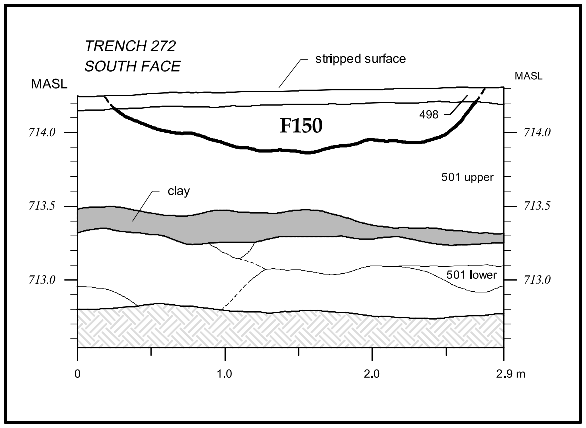

Figure 4.122. Cross section of canal Feature 150, AZ BB:13:481 (ASM), at the Congress Street and Brickyard loci, the Clearwater site, AZ BB:13:6 (ASM).

Feature 155

Feature 155 (see Figure 4.110) was a canal located in Trench 274, where it was drawn. The broad basin-shaped feature was 2.04 m wide and 50 cm deep. It was filled with a very compact, brown, sandy clay. Charcoal flecks were present in the fill. The base of the canal had manganese staining. The top of the feature was located at the modern ground surface, suggesting it may be one of the more recent historic-era canals. Feature 155 intruded a prehistoric canal, Feature 149.

SUMMARY

The first eyewitness accounts of Tucson, written by Father Eusebio Kino and his compatriots during the 1690s, as well as the map drafted in 1862, all indicate the importance of irrigated agriculture for the people who lived along the Santa Cruz River. The archaeological investigations of the Rio Nuevo project documented some of these Protohistoric period and Historic era canals, including the Acequia Madre Primera, the major canal used by Mexican farmers during the mid-nineteenth century. Also found were numerous large Hohokam canals. The entire surface flow of the Santa Cruz River was essentially being diverted through these canals to irrigate crops of maize, beans, squash, tobacco, and cotton. The Rio Nuevo Archaeology project has shown that irrigation has a long history in the Tucson Basin, extending back to at least 1500 B.C. The discovery of Early Agricultural period canals at the Mission and Congress Street loci provide additional evidence for water management by these early farmers.

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CHAPTER 4

FEATURE DESCRIPTIONS: PART 7. FEATURES SOUTHEAST OF INTERSTATE 10 AND CONGRESS STREET

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Archaeological work conducted during the Rio Nuevo Archaeology project resulted in the discovery of hundreds of features—areas in which human activities took place. Descriptions of excavated features and summarized data on unexcavated features are presented in this chapter. Descriptions of human burials found during the project are provided in Chapter 18 (this volume).

Work during this project was conducted at four different archaeological sites. The San Agustín Mission, Mission Gardens, Brickyard, and Congress Street loci were located at the Clearwater site, AZ BB:13:6 (ASM), on the western side of the Santa Cruz River. AZ BB:13:481 (ASM) were the Prehistoric, Protohistoric, and Historic era canals, ditches, and a spillway, also located on the western side of the Santa Cruz River. The Tucson Presidio has been designated AZ BB:13:13 (ASM), and the site includes both prehistoric- and historic-era features. Finally, a portion of a historic-era residential block on the northern side of Clark Street and east of the Interstate 10 (I-10) frontage road was designated AZ BB:13:735 (ASM).

The feature descriptions in this chapter are grouped by locus, except for canals, which are described in Part 6 and which are grouped by time period. All site numbers in this chapter are Arizona State Museum (ASM) numbers. Radiocarbon dates are reported in both uncalibrated radiocarbon years before present (b.p.), and in calibrated calendar years at the 1-sigma range of probability. Excavated and unexcavated features are listed, by site/locus and time period, in Table 4.1 (see Part 1 of this chapter).

INTRODUCTION

In November of 2000 and May of 2001, archaeological testing was conducted at a parcel of property adjacent to the westbound frontage road of Interstate 10 (I-10) (Figure 4.123). The property was bounded by Congress Street on the north and Clark Street on the south. Testing consisted of the mechanical excavation of 27 trenches both within the property and along its boundaries. Eight cultural features were discovered during testing; all features were recorded and drawn, and diagnostic artifacts were collected.

AZ BB:13:NW (ASM)

Two areas of trash were found on the former Pioneer Paint parcel, located immediately south of Congress Street and west of the El Paso and Southwestern Railroad tracks. These features were not assigned to a site.

Feature 1, Trash-filled Depression

This feature was a depression filled with historic trash in both walls of Trench 8. The depression was drawn in the southern wall of the trench, and over 100 artifacts were visible in the drawn face. The depression measured 9.3 m in width on the southern face and 9.7 m in length on the northern face. Fill of the depression began 74 cm below the modern ground surface and was overlain by a 50-cm-thick stratum of modern fill above a 24-cm-thick layer of mottled gray-brown silty clay.

The upper 16 cm of fill contained broken dishes, glass, ash, and charcoal. All the dishes appeared to be from Southern Pacific Railroad dining cars. The glass included pieces of tumblers, alcohol bottles, and food bottles. Below this layer of trash was a 14-cm-thick stratum of light gray silty clay with rusty metal, brick fragments, and charcoal. Pieces of historic ceramics and glass were collected from the fill. The feature probably represents a natural depression that was filled with trash after 1924, the year in which

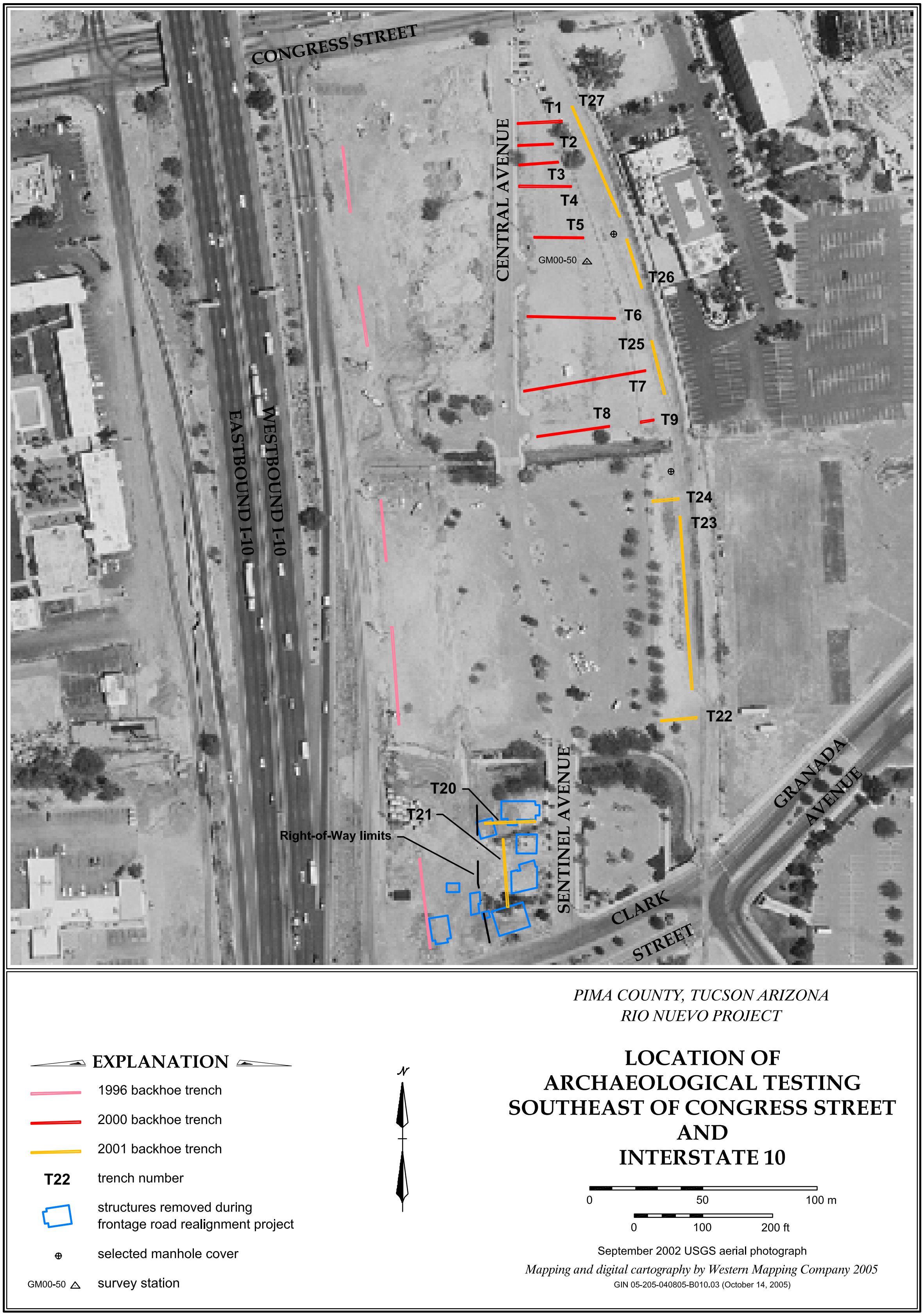

Figure 4.123. Locations of trenches excavated southeast of Congress Street and Interstate 10 at AZ BB:13:NW (ASM) and AZ BB:13:735 (ASM).

the Southern Pacific Railroad acquired the El Paso and Southwestern Railroad.

Feature 2, Trash Midden

Feature 2 was a historic trash midden deposited in a large shallow depression. The midden was discovered in backhoe Trench 8 and was visible in both walls of the trench. The exposed feature measured 17.25 m in length in the northern wall and 18.20 m in length in the southern wall of Trench 8. Fill of the depression began approximately 42 cm below the modern ground surface. The pit fill consisted of layers of ash, charcoal, burned coal, and pieces of architectural stone. Over 100 artifacts were visible within one exposed cross section of the feature. Artifacts noted in the fill included buttons, historic ceramics, and numerous glass bottles, including a Coca-Cola® bottle dated to 1929. The feature extended roughly 95 cm below the modern ground surface. Due to soil contamination from petroleum-based chemicals, this feature could not be drawn.

AZ BB:13:735 (ASM)

Features discovered during archaeological testing on the northern side of Clarke Street were assigned a new Arizona State Museum (ASM) site number AZ BB:13:735 (ASM) (see Figure 4.123). All the features are associated with residences constructed on the block in the 1940s to 1950s .

Feature 3, Roasting Pit

This historic roasting pit was discovered in the eastern wall of Trench 21 approximately 26 cm below the modern ground surface. The pit measured 64 cm in length and 71 cm in depth. The upper 57 cm of pit fill consisted of mottled lumps of sand, silt, and clay. The lower 14 cm of fill was a lens of almost pure ash and charcoal. The margins of the pit appeared reddish-brown from oxidization, suggesting this feature was used as a cooking pit or firepit. The similarity of the upper pit fill to the matrix into which this feature was constructed implied the feature was filled with the soil originally excavated from it soon after the pit was used. No artifacts were visible in the exposed profile of the pit.

Feature 4, Trash Pit

This historic trash pit was visible in both walls of the northern end of backhoe Trench 21. The northern end of the pit extended out of the trench to the north. The visible portion of the feature measured 3.2 m in length in the drawn (western) wall of the trench, and 2.3 m in the opposite wall. Fill of the feature began about 20 cm below the modern ground surface and extended below the excavated base of the trench (1.2 m in depth) at the northern end of the trench. The depth of the fill suggested this pit may also have been used as an outhouse pit.

The fill was heavily disturbed by a modern sewer pipe trench and a modern pit sometime before the overlying parking lot was constructed. The sewer pipe was visible in both walls of the backhoe trench, while the modern pit was visible only in the western wall. The modern pit had a plastic bag visible within its fill.

The uppermost layer of fill in the historic pit was composed of several lenses of white ash and charcoal. Filling the remainder of the pit was trash, including numerous glass bottles, pieces of rusted metal, and cooked animal bones. This undisturbed trash appeared historic in age. This fill continued down below the base of trench.

While the northern end of the feature continued below the base of the trench, a small, shallower lobe of the pit was present at the southern end of the feature. Although the fill in both the shallower and deeper areas of the pit was identical, the margins of the shallower lobe were slightly oxidized from burning. This area may represent a dump of burning materials, or use of this end of the pit as a cooking or firepit.

Feature 5, Water Trough

This historic water trough was discovered approximately 12 cm below the modern ground surface in the western face of Trench 21. The feature consisted of a basin of poured concrete whose edges were topped with a single course of brick. A few additional bricks were visible extending slightly south of the feature, and may have represented a constructed surface. Including the bricks, the feature was 1.2 m wide at the top. The concrete basin itself had sloping walls, and measured 42 cm in width at the top and 28 cm in width at the base. Total feature depth was 0.32 m; a 9-cm-thick orange brick topped a concrete basin 23 cm deep.

The fill of the basin consisted of concrete rubble and debris from the demolition of nearby structures. No artifacts were visible in the fill. A small metal drainpipe was visible at the base of the concrete basin; the pipe is the only portion of the feature visible in the opposite (eastern) wall of the trench. The exact function of this feature is unknown, but it seems likely it was designed to hold water. It may have been used as a trough, a fountain, or possibly a drain for a small outbuilding.

Feature 6, Posthole

This historic posthole was discovered about 34 cm below the modern ground surface in the western wall of Trench 21. The posthole was not visible in the eastern wall of the trench. The posthole pit was difficult to define, although a large piece of termite-eaten post was visible within it. The post was standing vertically in the hole, and measured 13 cm in width and 52 cm in length. Roughly 6 cm of fill was present between the base of the post and the base of the hole. The function of the post was unknown.

Feature 7, House Foundation

Portions of this historic rock and mortar house foundation were visible in the compacted dirt and gravel surface of the parking lot. The remaining portions of the foundation were hand-excavated and cleared of soil. In some places, the modern parking lot fill was as much as 5 cm deep above the foundation. The foundation formed a rough square 8.5 m in long and 7.8 m wide. A portion of the foundation split the large square into two smaller rectangles along its long (north-south) axis.

The foundation was composed of large (10-30 cm in diameter) rocks within a white mortar matrix. The foundation measured 30 cm in width and stood as much as 10 cm in height in some places. A 40-cm-wide opening in the western wall of the foundation near the northwestern corner may have represented an entrance to the structure. A small pipe embedded in the wall some 1.7 m south of this opening was the only possible evidence for any kind of utilities in the structure.

A poured concrete surface measuring 3.5 m in length and 3.0 m in width was discovered in the southwestern corner of the structure. The foundation walls were best preserved in this area. No other evidence for floors except a hard-packed earthen surface was found within the foundation.

The fill within the foundation was primarily compacted sandy silt and red gravels, representing modern fill added during construction of the parking lot. Some areas had a thin layer of loose gravel beneath the more compacted modern layer. These gravels lay atop a very compact brown clay surface that may have functioned as the floor of the structure. Some artifacts were noted in the loose gravel fill, but were not collected. These included six multicolored glass marbles, a small metal chain, several fragments of possible window glass, a butter knife blade, a pocket knife blade, and a few fragments of saw-cut cow bone. A small pile of bricks was also found in the southeastern corner of the foundation. This foundation was thought to be pre-1950 in age.

Feature 8, House Foundation

This concrete house foundation was revealed during excavation of Trench 21. The southern end of the trench clipped the northwestern corner of the foundation. Mechanical stripping then exposed a 6.5-m-long section of the western wall, as well as the northeastern corner of the foundation. The foundation was composed of whitish concrete with angular gravel inclusions. Intact portions were approximately 20 cm high and 55 cm wide. In some areas, fragments of crushed brick were visible at the top of the foundation. The walls of this structure may have been brick, but except for these fragments, nothing had been preserved.

A modern utility trench damaged a small portion of the foundation about 6 m along the western wall from the northwestern corner. Although a good amount of fill covered the foundation in some areas, most of it appeared modern. No diagnostic artifacts were discovered or collected. The foundation appeared to have been constructed more recently than Feature 7, another foundation to the northeast.

SUMMARY

Archaeological testing at two locations between Congress Street and Clark Street east of the westbound I-10 frontage road resulted in the discovery of eight cultural features. Six features were associated with homes located immediately north of Clark Street and dated to the 1940s on. Two other features represented depressions filled with trash, some of which may have been related to the nearby El Paso & Southwestern (later South Pacific) Railroad depot. Unfortunately, the more interesting of these features was contaminated by hydrocarbons and could not be examined.

The presence of paved parking lots in the area prevented more extensive archaeological testing. The area will be further studied prior to the planned construction of museums and a civic plaza in the area.

CHAPTER 5

ARTIFACT INVENTORIES AND RESEARCH QUESTIONS

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A large number of artifacts were discovered over the course of the Rio Nuevo archaeological fieldwork, ranging in age from about 4,100 years old, up to the 1950s. Unfortunately, many of the artifacts were discovered in poor contexts—features altered by rodents or later human activities, or truncated by the historic-era plowzone. A decision was made to focus analyses on samples from the best-preserved features that would provide data to address the research questions raised in the proposal submitted to the City of Tucson.

The numbers of artifacts recovered from excavated features are provided in this chapter, including overall counts by site locus and time period. The sample sizes are summarized in Table 5.1. The artifact totals in this chapter represent the initial inventories during laboratory processing. These are somewhat different from the final artifact totals presented in other chapters reporting the results of the analyses. Contexts and research issues are identified for the analyzed samples from each temporal component at each site locus. Chapters 6-18 (this volume) provide additional information about the artifacts, plant remains, faunal bone, shell, and human remains recovered during the Rio Nuevo Archaeology project.

CLEARWATER SITE, AZ BB:13:6 (ASM), MISSION LOCUS

Beneath the Spanish and Mexican period remains at the San Agustín Mission, a Cienega phase (circa 800 B.C.-A.D. 50) village was found. Portions of 22 pithouses were excavated, as well as 23 pits of various types, five inhumations, a hearth, and a portion of a canal. Superpositioning of pithouses and two distinctive flood deposits filling the features indicate two intervals of occupation. A large Hohokam canal was also found.

Samples Selected for Analyses

The focus of analyses was on the pithouse assemblages, although the botanical and faunal remains and whole ground stone artifacts in several extramural features were also examined (Table 5.2). The most important artifact contexts were floors, near floor fills, and intramural features. The ceramics recovered were primarily intrusive Hohokam sherds in the upper fills of houses, but all sherds from the Mission locus were scanned to look for incipient plain ware sherds.

Research Questions

What is the range of diversity of crops, wild plants, and animals used as food resources? What do the floral and faunal remains tell about the floodplain environment? Based on the residual utilities of floor and near floor artifacts, which pithouses had de facto assemblages? What types of activities occurred in the houses? Where did the inhabitants get their materials for making stone tools? What types of objects were manufactured of fired clay? What types of bone tools were used? What types of shell ornaments were made, and where did the shells come from?

SAN AGUSTÍN MISSION

Excavations at the San Agustín Mission resulted in the discovery of three trash middens (Features 64, 161, and 166), three trash-filled pits (Features 177, 178, and 203), and a roasting pit (Feature 193) that contained mission-occupation (1771-1821) artifacts and food remains discarded by the O'odham residents of the mission (Table 5.3). There were no datable artifacts and only a handful of nonlocal items (Table 5.3 includes some glass and metal items that were intrusive in the upper levels of each feature). The most likely dates for the features would be between the 1790s, when the first mission church was refurbished (wall plaster fragments from mission-occupation structures came from several features), and the 1820s, when the mission was largely abandoned.

Samples Selected for Analyses

Selected subsets of all artifacts, faunal bone, shell, and plant remains from the features were analyzed.

Table 5.1. Analyzed samples of artifacts and subsistence remains from the Rio Nuevo Archaeology project, by loci, contexts, and time intervals.

	Ceramics	Flaked Stone	Ground Stone	Shell	Faunal Bone	Rare/ Unusual	Flotation Samples	Historic Ceramics	Historic Miscellaneous
San Agustín Mission Locus									
Cienega phase pithouses									
Select context 10 (3 houses)	140	481	16	1	200	–	–	–	–
Contexts 11, 20, 30	44	768	70	5	316	8	43	–	–
Hohokam pithouses									
Contexts 11, 20, 30	77	29	2	1	2	–	1	–	–
Pima features									
All contexts	3,916	20	25	2	6,496	–	13	7	264
Chinese feature									
All contexts	743	77	15	645	11,436	1	21	630	12,343
Congress Street/Brickyard Loci									
Block 5 Early Agricultural occupations									
Stratum 504 features	79	571	17	–	52	–	68	–	–
Stratum 504 nonfeature	1	1,456	21	–	92	10	95	–	–
Stratum 503 features	–	42	1	–	62	–	12	–	–
Stratum 503 nonfeature	1	202	–	–	6	1	52	–	–
Cienega phase pithouses									
Select context 10 (3 houses)	51	889	60	4	2,081	11	–	–	–
Contexts 11, 20, 30	75	2,283	66	14	1,144	25	67	–	–
Early Ceramic period pithouses									
Contexts 11, 20, 30	96	64	3	–	12	1	6	–	–
Early Ceramic/Hohokam pithouses									
Select context 10 (1 house)	2,214	489	3	40	228	1	4	–	–
Contexts 11, 20, 30	166	217	5	11	56	–	4	–	–
Mission Gardens Locus									
Early Ceramic period pithouse									
Contexts 11, 20, 30	786	118	9	2	15	23	5	–	–
Hohokam pithouses									
Contexts 11, 20, 30	128	112	8	–	25	9	5	–	–
Tucson Presidio									
Spanish-Mexican									
All contexts	1,430	278	28	17	3,436	–	21	136	202
American Territorial									
All contexts	1,358	322	13	34	6,505	5	11	943	6,883
Hohokam pithouses									
All contexts	174	219	12	1	66	1	15	–	–
BB:13:481, prehistoric canals	111	–	–	–	–	–	–	–	–
BB:13:481, protohistoric canals	38	–	–	–	–	–	–	–	–
BB:13:481, historic canals	793	–	–	–	–	–	–	–	–
Totals	12,391	8,637	374	777	32,230	96	443	1,716	19,692

Table 5.2. Inventories of artifacts recovered from prehistoric pithouses at the Mission locus of the Clearwater site, AZ BB:13:6 (ASM).

Feature Number	Ceramic	Flaked Stone	Ground Stone	Shell	Faunal Bone	Rare/ Unusual	Flotation Samples	Other
Cienega phase								
7	5	90	10	–	33	2	7	1 charcoal, 3 pollen
15	14	250	26	2	46	2	5	2 pollen, 1 daub
17	–	5	–	–	4	–	2	–
28	4	82	1	–	19	–	2	–
29	50	30	6	–	86	–	3	2 pollen, 1 daub
32	14	26	3	–	11	–	2	1 pollen
57	116	195	1	–	150	–	2	1 macrobotanical, 2 pollen
62	1	1	–	–	–	–	1	–
65	9	64	6	–	44	5	6	2 pollen
88	8	3	–	–	2	–	1	1 piece glass
97	21	165	11	–	30	–	3	1 piece glass, 1 piece historic ceramics, 2 pollen
100	9	7	2	1	61	–	2	1 charcoal, 1 pollen
112	1	77	7	2	90	4	5	2 charcoal, 2 pollen, 2 daub
121	–	46	11	1	54	–	3	2 pollen, 3 daub
122	–	2	1	–	1	–	2	1 pollen
126	3	30	4	–	15	–	4	5 pollen
128	3	189	4	1	36	–	3	–
151	2	93	4	1	20	–	1	1 macrobotanical, 1 pollen, 1 soil
182	–	–	–	–	–	–	–	–
191	–	2	–	–	4	–	1	–
211	–	–	–	–	–	–	–	–
218	16	25	–	–	25	–	1	–
Cienega phase totals	276	1,382	97	8	731	13	56	43
Hohokam								
2	77	29	2	1	2	–	1	1 daub sample, 1 piece metal
Total, all	353	1,411	99	9	733	13	57	45

Table 5.3. Inventories of artifacts recovered from historic-era Native American features from the Mission locus of the Clearwater site, AZ BB:13:6 (ASM).

Feature Number	Native American Ceramics	Flaked Stone	Ground Stone	Shell	Faunal Bone	Flotation Samples	Historic Other	Glass	Metal	Historic Ceramics	Samples
64	856	50	7	1	2,000	1	1	114	26	2	–
161	164	3	–	–	119	2	–	–	–	–	–
166	1,471	65	14	1	2,480	4	44	3	17	3	–
177	184	9	2	–	400	2	1	7	–	–	Pollen
178	337	31	1	–	460	2	24	2	1	2	Pollen, macrobotanical
203	538	40	2	–	950	1	20	1	–	–	Charcoal, pollen, other
193	69	6	1	–	60	1	3	–	–	–	Charcoal, pollen
Total	3,619	204	27	2	6,496	13	93	127	44	7	8

Research Questions

What was life like for the Native Americans living at the mission? No comparable samples associated with this timespan have previously been examined from the Tucson Basin. Basic questions to be addressed include what foods were eaten, the origin and use of ceramics, and if characteristic flaked stone and ground stone implements were used.

CLEARWATER SITE, AZ BB:13:6 (ASM), CONGRESS STREET AND BRICKYARD LOCI

A large number of artifacts and samples were recovered from the Clearwater site south of Congress Street and north of the A-Mountain storm drain (Tables 5.4-5.6). After trenching, eight different excavation blocks were opened. Block 5 had the most excavated features and the oldest occupations (in strata 503 and 504), and was investigated during two phases of fieldwork. Across the site were three main strata containing features from five periods of prehistoric occupation and some historic-era features (Chapter 20, this volume). Stratum 502, the uppermost, contained a few Cienega phase pithouses, extramural features, inhumations, and canals; a few Early Ceramic and Hohokam pithouses, extramural features, and canals; and a few historic-era pits and canals. Stratum 503 contained Early Agricultural period features dating to 3,300-3,200 b.p. (uncalibrated radiocarbon years before present); excavated features included 7 small pits, 3 roasting pits, and 1 bell pit. Below Stratum 503, Stratum 504 contained a number of Early Agricultural period features dating to circa 3,600 b.p. to 3,800 b.p.; excavated features included 8 pithouses, 31 small pits, 1 roasting pit, 1 bell pit, and 1 extramural surface. In addition to features, extramural deposits were also sampled in strata 503 and 504.

A Cienega phase village and a few Early Ceramic period features were found below the historic-era brickyard. Superpositioning and distinct fills indicate at least two intervals of occupation during the Cienega phase (Chapter 4, this volume). The Cienega phase features include 21 pithouses, about half of them possibly arranged in a ring, and most of the rest located in a cluster to the northeast. A "bighouse," Feature 9357, was located between these two sets of houses. The 40 Cienega phase extramural features include large and small pits, roasting pits, bell pits, four inhumations, and an extramural surface. Two pithouses and a roasting pit appear to date to the Early Ceramic period. There was also a large Hohokam canal.

Samples Selected for Analyses

The most important occupations in Block 5 were those in strata 503 and 504; a selection of artifacts and samples from features and extramural deposits in these strata were analyzed. In Stratum 502 outside of Block 5, the most important contexts were pithouse floors, near floor fills, and intramural features

Table 5.4. Inventories of artifacts recovered from Block 5, Stratum 504, Congress Street locus of the Clearwater site, AZ BB:13:6 (ASM).

Feature No.	Ceramic	Flaked Stone	Ground Stone	Shell	Faunal Bone	Rare/ Unusual	Flotation Samples	Other
Pithouses								
506	40	67	1	–	1	–	9	–
516	–	179	3	–	–	–	6	–
580	–	15	–	–	2	–	4	–
581	3	23	2	–	17	–	4	–
608	–	2	–	–	–	–	2	–
629	–	6	–	–	–	–	1	–
3359	23	43	1	–	3	–	4	–
3364	10	75	–	–	13	–	2	–
3371	–	21	2	–	4	–	2	–
Total	76	431	9	–	40	–	34	–
Bell Pit								
631	1	–	–	–	–	1	–	–
Roasting Pit								
632	1	–	–	–	–	–	1	–
Small Pits								
584	–	2	–	–	–	–	1	–
592	–	6	1	–	–	–	1	–
593	–	55	–	–	1	–	1	–
594	–	6	–	–	–	–	1	–
595	–	8	–	–	–	–	1	–
596	–	1	–	–	–	–	1	–
597	–	3	–	–	–	–	1	–
598	–	–	1	–	–	–	1	–
599	–	–	4	–	–	–	1	–
600	–	–	–	–	–	–	1	–
601	–	24	–	–	–	–	1	–
609	–	–	–	–	–	–	1	–
610	–	–	–	–	–	–	1	–
611	–	–	–	–	–	–	1	–
612	–	–	–	–	–	–	1	–
613	–	–	–	–	–	–	2	–
615	–	–	–	–	–	–	1	–
616	–	–	–	–	–	–	1	–
619	–	9	–	–	2	–	1	–
622	–	15	–	–	6	–	1	–
623	–	2	–	–	–	–	1	–
624	–	1	–	–	–	–	2	–
625	–	–	–	–	–	–	1	–
626	–	1	–	–	–	–	1	–
628	1	–	–	–	–	–	1	–
630	–	–	–	–	2	–	1	–
3360	–	6	–	–	1	–	1	–
3362	–	–	1	–	–	–	1	–
3370	–	–	1	–	–	–	1	–
3375	–	1	–	–	–	–	1	–
3381	–	–	–	–	–	–	1	–
Total	1	140	8	–	12	–	33	–

Table 5.4. Continued.

Feature No.	Ceramic	Flaked Stone	Ground Stone	Shell	Faunal Bone	Rare/ Unusual	Flotation Samples	Other
Extramural Surface								
3414	–	–	2	–	–	–	–	–
Total, all	79	571	17	–	52	1	68	–

Table 5.5. Inventories of artifacts recovered from Block 5, Stratum 503, Congress Street locus of the Clearwater site, AZ BB:13:6 (ASM).

Feature Number	Ceramic	Flaked Stone	Ground Stone	Shell	Faunal Bone	Rare/ Unusual	Flotation Samples	Other
Roasting Pits								
558	–	2	–	–	1	–	1	–
572	–	19	–	–	57	–	2	–
9128	–	–	–	–	–	–	–	–
Total	–	21	–	–	58	–	3	–
Small Pits								
554	–	–	–	–	–	–	1	–
588	–	2	–	–	–	–	1	–
589	–	9	–	–	–	–	2	–
3360	–	6	–	–	1	–	1	–
3368	–	2	–	–	3	–	1	–
3369	–	1	–	–	–	–	1	–
3374	–	–	1	–	–	–	1	–
3384	–	–	–	–	–	–	–	–
Total	–	20	1	–	4	–	8	–
Bell Pit								
3373	–	1	–	–	–	–	1	–
Total, all	–	42	1	–	62	–	12	–

for the Cienega, Early Ceramic, and Hohokam intervals. Artifacts associated with the Cienega phase inhumations, many of which were recorded by analysts in the field and then repatriated, were also described and included in summaries of Cienega phase assemblages.

For the materials recovered from features beneath the historic-era brickyard, the focus of analyses was on the pithouse assemblages, although the botanical and faunal remains in the extramural features were sampled, and whole ground stone artifacts in extramural features were analyzed. The most important artifact contexts were floors, near floor fills, and intramural features. The ceramics were mostly intrusive Hohokam sherds in the upper fills of houses, although they were scanned for incipient plain ware sherds.

Research Questions

Are there differences in material culture and subsistence between the Stratum 503, Stratum 504, Cienega, Early Ceramic, and Hohokam occupations? During each interval, what is the range of diversity of crops, wild plants, and animals used as food resources? What do the floral and faunal remains tell about the floodplain environment? Based on the residual utilities of floor and near floor artifacts, which pithouses had de facto assemblages? What types of activities occurred in the houses? Where did the inhabitants obtain their materials for making stone tools? What types of objects were produced from fired clay? What types of bone tools were used? What types of shell ornaments were manufactured, and where did the shells come from?

Table 5.6. Inventories of artifacts recovered from Cienega phase and Early Ceramic period pithouses at the Brickyard locus of the Clearwater site, AZ BB:13:6 (ASM).

Feature Number	Ceramic	Flaked Stone	Ground Stone	Shell	Faunal Bone	Rare/ Unusual	Flotation Samples	Other
Cienega								
3220	10	97	16	1	32	1	2	–
3245	1	43	–	–	8	–	2	–
3260	1	42	1	2	31	–	4	2 pollen, 1 daub
3262	12	100	11	1	76	–	4	2 pollen
3264	4	289	6	1	195	7	4	1 pollen
3270	2	347	14	2	90	6	5	4 pollen, 1 daub
3273	–	93	5	2	37	2	4	1 macrobotanical, 2 species identified, 4 pollen
3274	10	134	1	–	19	2	3	1 pollen
3290	9	25	–	–	–	–	1	–
3294	9	476	4	4	147	8	2	–
3296	15	106	8	–	24	–	2	1 pollen
3300	1	44	–	–	3	–	–	–
3306	3	16	–	–	–	–	1	–
3308	28	27	–	–	6	–	2	–
3312	1	15	2	–	7	–	2	–
3323	41	173	3	1	11	3	1	1 species identified, 1 pollen
3325	2	62	–	–	31	–	1	1 species identified
3327	19	271	13	1	107	1	4	4 pollen, 1 temper sample, 2 daub
3332	9	119	–	1	33	–	1	–
9168	2	145	–	3	142	–	4	2 pollen
9357	61	938	58	1	2,196	1	15	2 macrobotanical, 5 pollen, 2 daub
9372	–	77	2	–	44	2	5	3 pollen
Total	240	3,639	144	20	3,239	33	69	44
Early Ceramic								
3293	118	43	–	–	14	–	4	2 macrobotanical, 3 pollen
9376	2	27	3	–	3	1	1	–
Total	120	70	3	–	17	1	5	5
Total, all	360	3,709	147	20	3,256	34	74	49

TUCSON PRESIDIO, AZ BB:13:13 (ASM), SPANISH AND MEXICAN PERIODS

Excavations at the Tucson Presidio, AZ BB:13:13 (ASM), took place in three areas. The first, in front of the Pima County courthouse, yielded a small set of artifacts of very little research value. The second, at the Tucson Museum of Art, yielded more artifacts from stratified deposits, but these items had been smashed into small pieces by foot traffic and were of limited usefulness. Work at the northeastern corner resulted in the discovery of six presidio-occupation

Table 5.7. Inventories of artifacts recovered from presidio-occupation (1775-1856) features, Tucson Presidio, AZ BB:13:13 (ASM).

Feature Number	Native American Ceramics	Flaked Stone	Ground Stone	Shell	Faunal Bone	Flotation Samples	Historic Other	Glass	Metal	Historic Ceramics	Samples
373	121	46	1	11	557	5	6	2	6	30	3 rare
409	1,095	162	19	4	1,910	9	13	38	130	82	4 rare, 1 temper
420	48	15	–	–	520	2	1	1	1	10	–
422	17	8	1	–	60	1	–	–	–	3	1 macro-botanical
423	6	3	–	–	37	1	–	–	–	2	–
441	143	44	7	2	352	3	1	1	2	9	–
Total	1,430	278	28	17	3,436	21	21	42	139	136	9

(1775-1856) borrow pits containing trash (Features 373, 409, 420, 422, 423, and 441). English ceramics from several of these pits indicate they were filled between circa 1820-1840. This may coincide with repairs to the presidio wall, documented to have occurred in both the late 1820s and in the early 1850s. The numbers of recovered artifacts dating to the Spanish and Mexican periods from the excavated pit features in the northeastern corner of the presidio are summarized in Table 5.7.

Samples Selected for Analyses

All artifacts from the presidio-occupation features were analyzed. Flotation samples and faunal bone from these features were also identified.

Research Questions

What was life like for the residents of the Tucson Presidio? Previous excavations have typically yielded sheet-trash deposits that are mixed or heavily trampled. One ash-filled trash pit from the City Hall lawn has been studied, but no other comparable trash-filled contexts have been found. The artifacts and plant remains should provide baseline information about the material culture and diet of the presidio residents.

TUCSON PRESIDIO, AZ BB:13:13 (ASM), AMERICAN TERRITORIAL PERIOD

Many American Territorial period artifacts were recovered from the northeastern corner of the Tucson Presidio. Particularly impressive were artifacts recovered from Feature 376, a very deep borrow pit. This pit was probably filled between 1870 and 1890, and yielded artifacts suggesting both Mexican-Americans and Euro-Americans contributed refuse to the feature. Other borrow pits, two outhouses, and numerous pits and postholes contained artifacts dating from the 1890s to the 1910s. Trash collection began in Tucson in the 1910s, and little trash appears to have been discarded on the block after that time.

Samples Selected for Analyses

The Native American ceramics from Feature 376 were analyzed; all historic-era artifacts from American Territorial period features were analyzed. Selected flotation samples from other historic-era features were also examined.

TUCSON PRESIDIO, AZ BB:13:13 (ASM), PREHISTORIC ERA

Portions of five Hohokam pithouses were discovered beneath the corner of the Tucson Presidio, including two pithouses that probably date to the Pioneer period, Feature 380 and Feature 430. Two Hohokam pits were also excavated, and the numbers of artifacts recovered from these features are presented in Table 5.8.

Samples Selected for Analyses

The pottery, arrow points and retouched tools, whole ground stone, and subsistence remains from all of these contexts were analyzed.

Table 5.8. Inventories of artifacts recovered from prehistoric Hohokam features found at the Tucson Presidio, AZ BB:13:13 (ASM), during the RNA 12 phase.

Feature Number	Ceramic	Flaked Stone	Ground Stone	Shell	Faunal Bone	Rare/ Unusual	Flotation Samples	Other
350	–	–	–	–	–	–	–	–
380	60	32	4	–	1	1	6	1 pollen, 1 historic ceramic
406	24	67	–	–	50	–	2	–
417	88	117	8	1	15	–	6	–
430	2	3	–	–	–	–	1	1 pollen
Total	174	219	12	1	66	1	15	3

CHINESE GARDENERS

Feature 4, an approximately 9-ft-deep well, contained a large sample of artifacts discarded by the Chinese farmers renting Leopoldo Carrillo's property (Table 5.9). There are relatively few artifacts with manufacturing dates, and these date to between 1880 and 1900. The well was likely abandoned after the water table dropped in the 1890s, due to the downcutting of the river. Therefore, a more likely scenario is that the well was filled between 1890 and 1900.

Samples Selected for Analyses

All artifacts and food remains from the well were analyzed.

Research Questions

What was life like for the Chinese gardeners at this time? A previous Desert Archaeology, Inc., excavation uncovered a Chinese gardener's household from the same time frame. The recovered artifacts and food remains suggested that farmers were attempting to maintain their traditional ways of life—eating foods prepared in traditional ways with imported seasonings, eating from vessels in traditional forms, and so forth (Thiel 1997). The initial impression of the artifacts from the well suggested that these farmers may have tried even harder to retain their Chinese lifestyle.

Table 5.9. Inventories of artifacts recovered from the Chinese well, Feature 4, at the San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

Artifact Type	Count
Native American ceramics	743
Flaked stone	77
Ground stone	15
Shell	645
Faunal bone	11,436
Flotation	21
Historic other	94
Glass	855
Metal	11,394
Historic ceramic	630
Other, pollen	25
Rare/Unusual	1

MISSION GARDENS, PREHISTORIC ERA

Prehistoric features excavated at the Mission Gardens locus included three Early Agricultural period inhumations, two Early Ceramic period pithouses, and numerous extramural features. Seven inhumations may date to the Early Ceramic, Hohokam, or Protohistoric intervals. The numbers of artifacts recovered from prehistoric pithouses in this locus are presented in Table 5.10.

Samples Selected for Analyses

The contexts for analysis included the pithouse floors, near floor fills, and intramural pits; the whole ground stone artifacts in extramural features were also analyzed.

Research Questions

Research goals for the prehistoric features at the Mission Gardens were limited to dating and description.

Table 5.10. Inventories of artifacts recovered from prehistoric pithouses at the Mission Gardens locus, the Clearwater site, AZ BB:13:6 (ASM).

Feature Number	Ceramic	Flaked Stone	Ground Stone	Shell	Faunal Bone	Rare/ Unusual	Flotation Samples	Other
3005	84	63	7	–	13	2	3	1 species identified, 1 pollen
3014	212	183	10	–	28	9	5	2 species identified, 1 pollen
3038	817	124	9	2	14	23	4	1 historic ceramic
Total	1,113	370	26	2	55	34	12	6

AZ BB:13:481 (ASM) CANALS

Irrigation canals were found at the Mission San Agustín, Mission Gardens, and Congress Street/ Brickyard loci. These included 6 Early Agricultural period canals, 13 Hohokam canals, 4 Protohistoric canals, and 13 Historic canals and 1 mill spillway. These linear water-control features were assigned site number AZ BB:13:481 (ASM). Table 5.11 summarizes the inventories of artifacts collected from all of the exposed canal cross sections.

Samples Selected for Analyses

The nature of canals, which were filled with sediments that could have originated from nearby or from a distance, makes the artifacts inside those canals somewhat problematic. Ceramics found in a canal could date to the time of filling, or they could represent sherds that eroded from other, older sites instead. Despite these problems, Native American sherds were scanned for decorated ceramics that could be dated. All historic-era artifacts were also examined.

Research Questions

Research questions studied for the canals included their date of construction and filling. Ostracode samples were examined to provide more detailed information about the local environment of selected canals (see Chapter 16).

Table 5.11. Inventories of artifacts recovered from irrigation canals and a mill spillway, AZ BB:13:481 (ASM), on the western side of the Santa Cruz River.

Feature Number	Ceramic	Flaked Stone	Ground Stone	Shell	Faunal Bone	Rare/ Unusual	Flotation Samples	Other
San Agustín Mission Locus								
Historic Era								
3	97	66	–	–	74	–	2	5 historic other, 355 glass, 268 metal, 24 historic ceramics
9	584	16	1	60	466	–	3	2 historic other, 21 glass, 23 metal, 61 historic ceramics
Subtotal	681	82	1	60	540	–	5	759
Early Agricultural Period								
53	36	15	2	1	27	–	4	–
127	–	–	–	–	–	–	–	–
Subtotal	36	15	2	1	27	–	4	–
Hohokam Periods								
137	–	–	–	–	–	–	–	–
Total	717	97	3	61	567	–	9	759

Table 5.11. Continued.

Feature Number	Ceramic	Flaked Stone	Ground Stone	Shell	Faunal Bone	Rare/ Unusual	Flotation Samples	Other
Congress Street/Brickyard Loci								
Early Agricultural Period								
139	4	33	7	1	3	–	1	–
140	–	–	–	–	2	–	–	1 pollen
141	1	–	–	–	–	–	1	–
152	–	–	–	–	–	–	–	–
Subtotal	5	33	7	1	5	–	2	1
Hohokam Periods								
142	2	6	1	–	–	–	–	–
143	1	1	–	–	–	–	2	–
144	42	65	–	1	–	2	–	–
146	3	–	–	–	–	–	–	–
149	21	–	1	–	–	–	–	–
151	1	–	–	–	–	–	–	–
154	–	–	–	–	–	–	–	–
Subtotal	70	72	2	1	–	2	2	–
Historic Era								
138	112	7	9	90	202	–	1	1 macrobotanical, 12 historic other, 245 glass, 99 metal, 67 historic ceramics
145	–	–	–	–	–	–	–	–
147	–	–	–	–	–	–	–	1 historic ceramics
148	–	1	–	–	–	–	–	–
150	–	–	–	–	–	–	–	–
153	–	–	–	–	–	–	–	–
155	–	–	–	–	–	–	–	–
Subtotal	112	8	9	90	202	–	1	425
Total	187	113	18	92	207	2	37	426
Mission Gardens Locus								
Hohokam Periods								
200	–	–	–	–	–	–	–	–
202	–	–	–	–	–	–	–	–
203	–	–	–	–	–	–	–	–
210	–	–	–	–	–	–	–	–
212	–	–	–	–	–	–	–	–
Subtotal	–	–	–	–	–	–	–	–
Protohistoric Period								
201	38	5	–	2	–	–	1	–
204	–	–	–	–	–	–	–	–
205	–	–	–	–	–	–	–	–
207	–	–	–	–	–	–	–	–
Subtotal	38	5	–	2	–	–	1	–
Historic Era								
206	–	–	–	–	–	–	–	–
208	–	–	–	–	–	–	–	–
209	–	–	–	–	–	–	–	–
211	–	–	–	–	–	–	–	–
Subtotal	–	–	–	–	–	–	–	–
Total	38	5	–	2	–	–	1	–

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1997 *Archaeological Investigations of a Chinese Gardener's Household, Tucson, Arizona (Revised)*. Technical Report No. 96-22. Center for Desert Archaeology, Tucson.

CHAPTER 6

PETROGRAPHIC ANALYSIS OF POTTERY FOR THE RIO NUEVO PROJECT, WITH A CASE STUDY OF TEMPORAL TRENDS IN HISTORIC ERA NATIVE AMERICAN POTTERY PRODUCTION

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INTRODUCTION

Petrographic modal analysis, or point counting, is a detailed microscopic analytical technique used to establish the mineralogical composition of a rock or sediment. It has been used extensively to establish composition and provenance of archaeological ceramics, especially in the Greater Southwest. For the Rio Nuevo Archaeology project, 56 sherds from the Clearwater site, AZ BB:13:6 (ASM), and the Tucson Presidio, AZ BB:13:13 (ASM), were selected for petrographic analysis to establish their provenance and to verify the temper characterizations provided by ceramicist James M. Heidke. The sherds are a subset of the 2,373 sherds chosen for detailed ceramic analysis (Chapter 7, this report). They comprise plain and red wares from prehistoric and historic contexts (Table 6.1).

The provenance analysis was conducted using the Tucson Basin petrofacies model. The Tucson Basin and Avra Valley have been a focus of petrographic sand temper studies for over 20 years. More than 500 sand samples have been collected and point counted, and statistical models have been developed to define petrofacies, or distinct sand composition zones, within the basin (Figure 6.1) (Lombard 1987; Miksa 2003, 2006). Many of these petrofacies are very limited in geographic extent, so that compositional changes are detailed on scales of kilometers to tens of kilometers. Excavation and subsurface sampling have shown that the sand composition at the surface has remained essentially unchanged for the last several thousand years. Therefore, the petrofacies model provides a way to compare the sand temper in sherds to the actual locations from which sand of various compositions could be procured. Ethnographic data from around the world indicate that potters who use sand for temper tend to procure it within 3 km—most often from within 1 km—of their pottery production location (Arnold 1985; Heidke 2006). These data are based on people who use only human labor to carry their materials—boats, beasts of burden, or vehicles of any sort are not included. Thus, we feel comfortable in asserting that the provenance of the sand temper in pottery indicates the provenance of the pottery itself.

METHODS

Temper characterization was conducted under a Unitron ZSM stereozoom microscope with magnifications of 6x to 30x. A three-part temper identification code was used: (1) temper type (TT) records what type of material was used (sand, grog, and so forth); (2) generic temper source (TSG) records the general temper composition and the likely group of petrofacies to which the temper belongs; and (3) specific temper source (TSS) records the specific petrofacies to which the ceramicist thinks the temper should be assigned.

Unfortunately, the temper characterization for Rio Nuevo was conducted prior to completion of the formal Tucson Basin petrofacies model. Consequently, while Heidke knew the major petrofacies in the Tucson Basin from extensive previous experience, less well-characterized, rarely encountered petrofacies were not fully included in his analysis. The full statistical model and descriptions are available as of this writing, and the petrographic verification was conducted with the completed mode. However, any errors or omissions must be evaluated in the light of the incomplete information available to Heidke at the time of temper characterization.

The most notable additions to the model are better characterization of the granitic and mixed lithic petrofacies. These include the basin fill and the bajada petrofacies that have volcanic input. In particu-

Table 6.1. Inventory of sherd samples from the Rio Nuevo Archaeology project submitted for petrographic analysis.

Sample Number	AZ (ASM) Site Number	Feature Number	Field Number	Obs	Ceramic Type
RNA2-01	BB:13:6	166	6692	154	Indeterminate red
RNA2-02	BB:13:6	166	6703	13	Indeterminate red
RNA2-03	BB:13:6	203	6600	18	Indeterminate red
RNA2-04	BB:13:6	64	6249	121	Unspecified plain ware
RNA2-05	BB:13:6	166	6692	25	Indeterminate red
RNA2-06	BB:13:6	166	6692	46	Indeterminate red
RNA2-07	BB:13:6	166	6703	38	Unspecified plain ware
RNA2-08	BB:13:6	178	6500	8	Indeterminate red
RNA2-09	BB:13:6	178	6500	9	Indeterminate red
RNA2-10	BB:13:6	178	6500	16	Indeterminate red
RNA2-11	BB:13:6	203	6600	8	Indeterminate red
RNA2-12	BB:13:6	203	6600	20	Indeterminate red
RNA2-13	BB:13:6	161	6531	2	Indeterminate red
RNA2-14	BB:13:6	166	6692	41	Indeterminate red
RNA2-15	BB:13:6	203	6600	19	Indeterminate red
RNA2-16	BB:13:6	203	6601	2	Indeterminate red
RNA2-17	BB:13:6	64	6249	91	Sobaipuri Plain (folded rim)
RNA2-18	BB:13:6	64	6249	100	Unspecified plain ware
RNA2-19	BB:13:6	178	6500	32	Unspecified plain ware
RNA2-20	BB:13:6	203	6601	1	Unspecified plain ware
RNA2-21	BB:13:6	4	5127	4	Papago Plain
RNA2-22	BB:13:6	61	5981	1	Papago Red
RNA2-23	BB:13:6	61	6224	2	Papago Red
RNA2-24	BB:13:6	1	5435	1	Indeterminate red
RNA-39	BB:13:13	373	2460	2	Sobaipuri Plain (folded rim)
RNA-40	BB:13:13	409	4260	2	Unspecified plain ware
RNA-41	BB:13:13	373	2460	12	Sobaipuri Plain (folded rim)
RNA-42	BB:13:6	3014	8168	2	Unspecified plain ware
RNA-43	BB:13:6	3038	8188	1	Unspecified plain ware
RNA-44	BB:13:13	441	4286	2	Papago Red
RNA-45	BB:13:13	422	4049	1	Papago Plain
RNA-46	BB:13:13	373	2372	1	Unspecified plain ware
RNA-47	BB:13:13	409	4260	7	Indeterminate red
RNA-48	BB:13:13	441	4269	3	Unspecified plain ware
RNA-49	BB:13:13	373	2456	2	Sobaipuri Plain (folded rim)
RNA-50	BB:13:13	409	4192	2	Unspecified plain ware
RNA-51	BB:13:13	441	4286	1	Sobaipuri Plain (folded rim)
RNA-52	BB:13:13	373	2372	10	Sobaipuri Plain (folded rim)
RNA-53	BB:13:13	376	2606	10	Unspecified plain ware
RNA-54	BB:13:13	373	2456	4	Indeterminate red
RNA-55	BB:13:13	409	4192	3	Sobaipuri Plain (folded rim)
RNA-56	BB:13:13	441	4269	1	Unspecified plain ware
RNA-57	BB:13:13	409	4153	12	Indeterminate red

Table 6.1. Continued.

Sample Number	AZ (ASM) Site Number	Feature Number	Field Number	Obs	Ceramic Type
RNA-58	BB:13:13	376	3722	2	Papago Plain
RNA-59	BB:13:13	376	3748	4	Papago Red
RNA-60	BB:13:13	409	4153	14	Papago Red
RNA-61	BB:13:13	409	4160	1	Papago Plain
RNA-62	BB:13:13	376	2577	2	Papago Plain
RNA-63	BB:13:13	376	2577	19	Papago Red
RNA-64	BB:13:13	376	2606	2	Papago Plain
RNA-65	BB:13:13	376	2606	24	Papago Red
RNA-66	BB:13:13	376	2644	1	Papago Plain
RNA-67	BB:13:13	376	2644	2	Papago Plain
RNA-68	BB:13:13	376	2644	24	Papago Red
RNA-69	BB:13:13	376	2646	2	Papago Plain
RNA-70	BB:13:13	376	3768	1	Papago Plain

lar, the petrofacies model of the floor of the Tucson Basin proper—bounded by the Santa Cruz River on the west, the Rillito River on the north, the Pantano Wash on the east, and approximately the town of Sahuarita on the south—has undergone major changes. The floor of the Tucson Basin is an agglomeration of alluvial sediments that have accumulated over thousands of years. Gradational composition changes occur from south to north and from east to west. Determining where to draw petrofacies boundaries in this very gradational sedimentary environment has been challenging.

In 2003 and 2004, additional samples were collected from the southern end of the basin, near Sahuarita, and at the southeastern corner, near Pantano Wash and Cienega Creek. Additionally, samples from the Rincon Petrofacies were reanalyzed. In some cases, new thin sections were made, because the original thin sections were uncovered and unstained, hampering detailed mineralogical analysis. Finally, we tested our ability to distinguish sands from provisionally assigned petrofacies on the basin floor from one another in hand-sample. With this new information available, we concluded that we could not reliably distinguish the provisional petrofacies in hand-sample. The gradational compositions of the basin floor make boundary definitions difficult.

The new samples, the reanalysis, and the hand-sample testing led to several changes. The new petrofacies map is provided in Figure 6.1. The most notable changes are among the petrofacies on the floor of the Tucson Basin and in the Black Mountain area. The Black Mountain Petrofacies was previously characterized based on only three samples. Collection of additional samples has significantly improved the definition of the Black Mountain Petrofacies. This improved definition was not available to Heidke when he characterized temper in Rio Nuevo project sherds, so he could not easily identify this area as a potential source. A full description of the changes is provided in Miksa (2006).

Petrographic Analysis

The 56 sherds selected for petrographic analysis were sent to Quality Thin Sections of Tucson, Arizona, for standard thin-section preparation, including staining for calcium and potassium to allow feldspars to be easily recognized. Detailed petrographic analysis was done for each thin section using the methods outlined in Miksa and Heidke (2001). The Gazzi-Dickinson method was used to point count all samples for provenance analysis (Dickinson 1970; Miksa and Heidke 2001). This method treats each sand-sized grain as an individual mineral. It provides detailed mineralogical composition of the sample, and allows for comparisons of sands and sand tempers that may be more mature or less mature—that is, more or less broken down into their constituent grains. A standard set of point-count parameters, developed for the Tucson Basin, was used for the analysis (Table 6.2) (Miksa 2003, 2006). The point-count data collected for each sherd are provided in Table 6.3, while the qualitative petrographic data collected for each sherd are provided in Table 6.4.

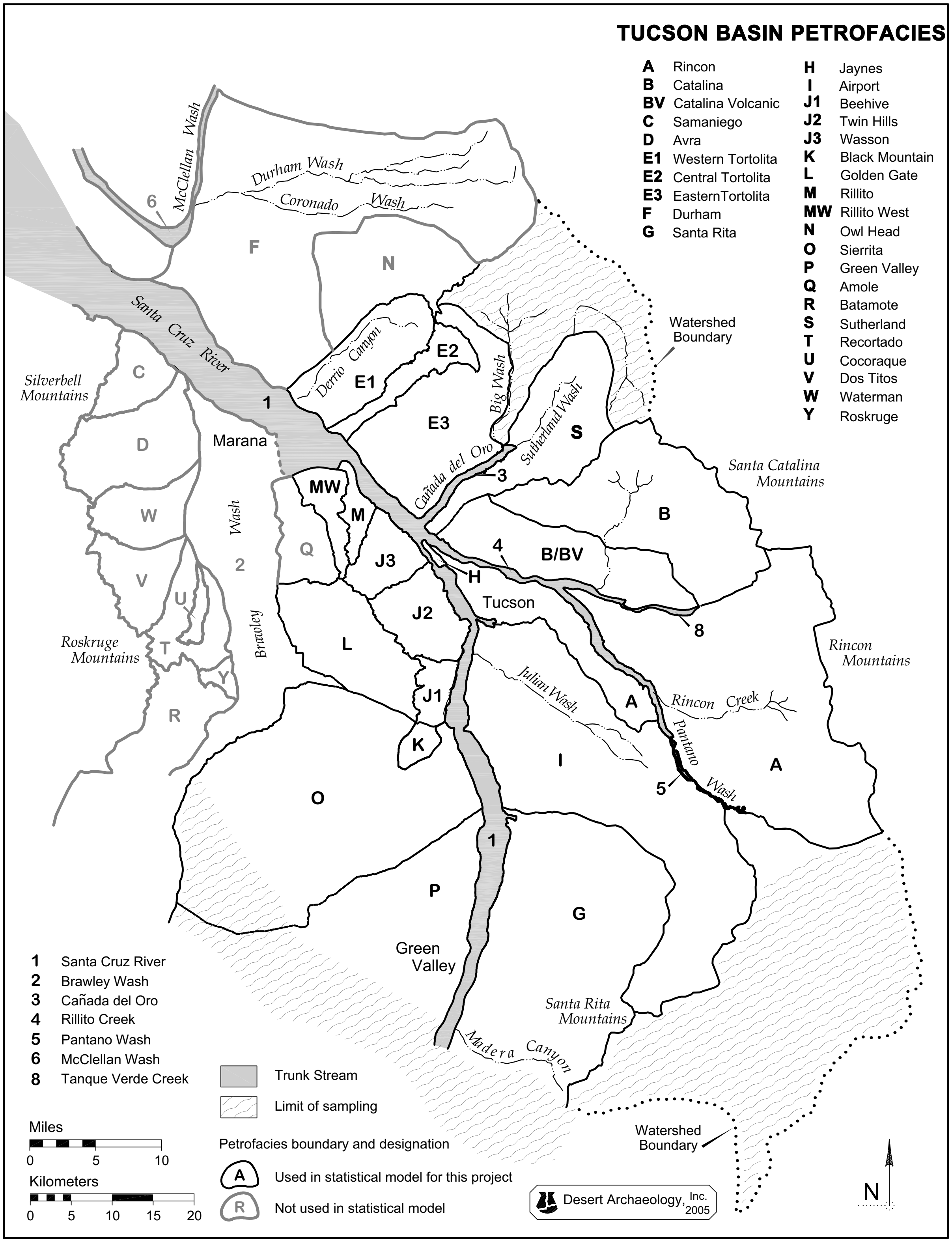

Figure 6.1. Current petrofacies map of the Tucson Basin.

Table 6.2. Point-count parameters and calculated parameters used for the petrographic analysis of Tucson Basin sands and sherds.

Parameter	Description
Totals and Calculated Parameters	
Total temper	The total number of point-counted sand-sized grains, including crushed rock, clay lumps, fiber temper, or grog.
Voids	The total number of open voids encountered in the paste.
Paste	The total number of points counted in the silt- to clay-sized fraction of the paste.
Paste percent	The proportion of points in the silt- to clay-sized fraction of the paste (Paste/[Paste + Total Temper]) x 100.
Grog	Sherd temper: dark, semiopaque angular-to-subround grains, with discrete margins, including silt- to sand-sized temper grains in a clay matrix, with or without iron oxides and/or micas. The grains differ in color and/or texture from the surrounding matrix of the "host" ceramic. This parameter is counted only in sherd samples.
Clay lump	Discrete "lumps," or grains, of untempered clay. These are generally in the sand-sized range. They comprise clay that lacks silt- to sand-sized grains. These grains are often similar in color to the surrounding paste, but they have well-defined, abrupt boundaries. Their internal texture is finer than the paste and has a different orientation. They are assumed to be clay that was insufficiently mixed with the surrounding clay body.
Sand total	The total number of point-counted *sand* grains; i.e., total temper *minus* clay lumps and grog.
Monomineralic Grains	
Qtz	All sand-sized quartz grains, except those derived from, or contained within, coarse-foliated rocks; unstained.
Kspar	Alkali feldspars, except those derived from, or contained within, coarse-foliated rocks; potassium feldspar stained yellow, unstained plagioclase feldspar, perthite, antiperthite.
Micr	Microcline/Anorthoclase: alkali feldspar, with polysynthetic (cross-hatch) twinning; stained yellow or unstained.
Sanid	Sanidine; volcanic alkali feldspar.
Plag	Plagioclase feldspar, stained pink, except grains derived from, or contained within, coarse-foliated rocks. Grains commonly have albite twinning and/or carlsbad twinning. Alteration, sericitization affect less than 10 percent of the grain.
Plagal	Altered plagioclase, except grains derived from, or contained within, coarse-foliated rocks. Alteration affects 10 percent to 90 percent of the grain; alteration products include sericite, clay minerals, carbonate, epidote.
Plaggn	Considerably altered plagioclase, except grains derived from, or contained within, coarse-foliated rocks; alteration affects more than 90 percent of the grain.
Musc	Muscovite mica.
Biot	Biotite mica.
Chlor	Chlorite group minerals.
Px	Undifferentiated members of the pyroxene group.
Amph	Undifferentiated members of the amphibole group.
Oliv	Olivine.
Opaq	Undifferentiated opaque minerals, such as magnetite/ilmenite, rutile, and iron oxides.
Epid	Undifferentiated members of the epidote family (epidote, zoisite, clinozoisite).
Sphene	Sphene.
Gar	Undifferentiated members of the garnet group.

Table 6.2. Continued.

Parameter	Description
Monomineralic Grains in Coarse-foliated Rocks	
Sqtz	All quartz derived from, or contained within, coarse-foliated rocks.
Skspar	Potassium feldspar derived from, or contained within, coarse-foliated rocks.
Splag	Plagioclase feldspar derived from, or contained within, coarse-foliated rocks.
Smusc	Muscovite mica derived from, or contained within, coarse-foliated rocks.
Sbiot	Biotite mica derived from, or contained within, coarse-foliated rocks.
Schlor	Undifferentiated chlorite group minerals derived from, or contained within, coarse-foliated rocks.
Sopaq	Undifferentiated opaque minerals derived from, or contained within, coarse-foliated rocks.
Metamorphic Lithic Fragments	
Lmvf	Metamorphosed volcanic rock such as rhyolite. Massive-to-foliated aggregates of quartz and feldspar grains with relict phenocrysts of feldspar.
Lmss	Metamorphosed sedimentary rock, such as a meta-siltstone. Massive fine-grained aggregates of quartz and feldspar, with or without relict sedimentary texture.
Lmamph	Amphibolite: a high-grade metamorphic rock, composed largely of amphibole.
Lma	Quartz-feldspar (mica) aggregate: quartz, feldspars, mica, and opaque oxides in aggregates with highly sutured grain boundaries but no planar-oriented fabric; some are schists or gneisses viewed on edge; some are metasediments or metavolcanics.
Lmt	Quartz-feldspar-mica tectonite (schists or gneisses): quartz, feldspars, micas, and opaque oxides, with strong planar oriented fabric; often display mineral segregation with alternating quartz-felsic and mica ribbons. Grains are often extremely sutured and/or elongated.
Lmtp	Phyllite: like Lmt, but the grains are silt-sized or smaller, with little or no mineral segregation. Also argillaceous grains, which exhibit growth of planar-oriented micas, silt-sized or smaller.
Lmm	Microgranular quartz aggregate: non-oriented polygonal aggregates of newly grown, strain-free quartz crystallites, with sutured, planar, or curved grain boundaries.
Lmf	Foliated quartz aggregate: planar-oriented fabric developed in mostly strained quartz crystals with sutured crystallite boundaries; quartzite.
Volcanic Lithic Fragments	
Lvf	Felsic volcanic such as rhyolite: microgranular nonfelted mosaics of submicroscopic quartz and feldspars, often with microphenocrysts of feldspar, quartz, or rarely, ferromagnesian minerals. Groundmass is fine to glassy, always has well-developed potassium feldspar (yellow) stain, may also have plagioclase (pink) stain.
Lvfb	Biotite-bearing felsic volcanic: microgranular nonfelted mosaics of submicroscopic quartz and feldspars, often with microphenocrysts of feldspar, quartz, always with phenocrysts of biotite. Groundmass is fine to glassy, always has well-developed potassium feldspar (yellow) stain.
Lvi	Intermediate volcanic rock such as rhyodacite, dacite, latite, and andesite.
Lvm	Basic volcanic: visible microlites or laths of feldspar crystals in random-to-parallel fabric, usually with glassy or devitrified or otherwise altered dark groundmass; often with phenocrysts of opaque oxides, occasional quartz, olivine, or pyroxene. Rarely yellow stained, often very well-developed pink stain, representing intermediate-to-basic lavas, such as latite, andesite, quartz-andesite, basalt, or trachyte.
Lvv	Glassy volcanics: vitrophyric grains, showing relict shards, pumiceous fabric, welding, or perlitic structures; sometimes with microphenocrysts, representing pyroclastic or glassy volcanic rocks.
Lvh	Hypabyssal volcanics (shallow igneous intrusive rocks): equigranular anhedral-to-subhedral feldspar-rich rocks, with no glassy or devitrified groundmass, coarser-grained than Lvf, most have yellow and pink stain.

Table 6.2. Continued.

Parameter	Description
Sedimentary Lithic Fragments	
Lss	Siltstones: granular aggregates of equant subangular-to-rounded silt-sized grains, with or without interstitial cement. May be well-to-poorly sorted, with or without sand-sized grains. Composition varies from quartzose to lithic-arkosic, with some mafic-rich varieties.
Lsa	Argillaceous: dark, semiopaque, extremely fine grained without visible foliation, may have mass extinction, variable amounts of silt-sized inclusions, representing shales, slates, and mudstones.
Lsch	Chert: microcrystalline aggregates of pure silica.
Lsca	Carbonate: mosaics of very fine calcite crystals, with or without interstitial clay- to sand-sized grains. Most appear to be fragments of soil carbonate (caliche) and are subround to very round.
Caco	Sand-sized calcium carbonate minerals. Technically, these should be listed with the monocrystalline grains, but they most often co-occur with caliche or other sedimentary rocks.
Unknown and Indeterminate Grains	
Unkn	Grains that cannot be identified, grains that are indeterminate, and grains such as zircon and tourmaline that occur in extremely low percentages.
Calculated Parameters Used in the Statistical Analyses	
TQtz	Qtz + Sqtz
TKspar	Kspar + Skspar
K	Kspar + Skspar + Micr + Sanid
TPlag	Plag + Plagal + Plaggn + Splag
F	Kspar + Skspar + Micr + Sanid + Plag + Plagal + Plaggn + Splag
TMusc	Musc + Smusc
TBiotchlor	Biot + Sbiot + Chlor + Schlor
Mica	Musc + Smusc + Biot + Sbiot + Chlor + Schlor
Pyr	Px + Amph
Plagpyr	Tplag + Pyr
TOpaq	Opaq + Sopaq
Pyrepid	Pyr + Epid
PyrOpaq	Pyr + Topaq
Hmin	Pyr + Topaq + Tbiotchlor
Lma2	Lma + Lmamph + Lmss + Lmvf + Lmepid
Lmatp	Lma2 + Lmt + Lmtp
Lmmftp	Lmm + Lmf + Lmt + Lmtp
Lmmf	Lmm + Lmf
Lm	Lmm + Lmf + Lma + Lmamph + Lmss + Lmvf + Lmepid + Lmt + Lmtp
Lm_Musc	Lm + Tmusc
Lvf2	Lvfb + Lvf
Lvm2	Lvi + Lvm
Lvmf2	Lvfb + Lvf + Lvi + Lvm
Lv	Lvfb + Lvf + Lvi + Lvm + Lvh + Lvv
Ls	Lss + Lsa + Lsch + Lsca + Caco
Lsclas	Lss + Lsa + Lsch
Lscaco	Lsca + Caco

Table 6.3. Point-count data for the thin-sectioned sherds.

A. Inventory, total points counted and paste characterization

Sample No.	Sample Type	Petro-facies	Obs[a]	Petrologists' Temper Type	Total Grains Counted	Paste	Voids	Fiber Voids	Grog	Clay Lumps
RNA2-01	Sherd	H2	1	Sandy clay (may have crushing features)	152	806	43	2	1	7
RNA2-02	Sherd	J1	1	Sand	268	551	65	1	5	1
RNA2-03	Sherd	J1	2	Sand and crushed rock, where crushed rock >25%	152	0	0	0	0	1
RNA2-04	Sherd	J1	1	Sand	288	347	21	3	1	0
RNA2-05	Sherd	K	1	Sand	248	582	105	3	6	0
RNA2-06	Sherd	J1	1	Sand	269	603	50	0	2	1
RNA2-07	Sherd	J1	1	Sand	309	611	55	1	7	1
RNA2-08	Sherd	J1	1	Sand	312	450	64	0	4	1
RNA2-09	Sherd	J1	1	Sand	263	395	27	2	7	1
RNA2-10	Sherd	K	1	Sand	299	392	35	1	1	2
RNA2-11	Sherd	J1	1	Sand	201	612	116	2	1	0
RNA2-12	Sherd	J1	1	Sandy clay (may have crushing features)	202	481	40	3	3	1
RNA2-13	Sherd	J1	1	Sand plus grog	240	479	48	0	21	7
RNA2-14	Sherd	J1	1	Sand plus grog	207	446	13	0	26	1
RNA2-15	Sherd	J1	1	Sandy clay plus grog	298	624	14	0	55	8
RNA2-16	Sherd	J1	1	Sand plus grog	252	500	93	0	29	1
RNA2-17	Sherd	J1	1	Sand plus grog	212	430	74	0	28	1
RNA2-18	Sherd	J1	1	Sand plus fiber temper	217	312	238	0	5	0
RNA2-19	Sherd	J1	1	Sand plus fiber temper	265	336	85	2	2	1
RNA2-20	Sherd	J1	1	Sandy clay plus grog	321	482	28	1	57	7
RNA2-21	Sherd	?G	1	Sand plus fiber temper	242	482	27	18	2	0
RNA2-22	Sherd	K	1	Sand plus fiber temper	276	349	42	31	3	3
RNA2-23	Sherd	J2	1	Sand plus fiber temper	277	405	40	46	4	2
RNA2-24	Sherd	J1	1	Sand	251	391	219	1	3	2
RNA-39	Sherd	K	1	Sand	264	477	141	2	0	0
RNA-40	Sherd	J1	1	Sand	263	538	138	3	1	0
RNA-41	Sherd	K	1	Sand	254	300	152	3	2	0
RNA-42	Sherd	J2	1	Sand	281	287	117	0	2	0
RNA-43	Sherd	J2	2	Sand plus grog	302	598	42	0	9	0

Table 6.3. A. Continued.

Sample No.	Sample Type	Petro-facies	Obs[a]	Petrologists' Temper Type	Total Grains Counted	Paste	Voids	Fiber Voids	Grog	Clay Lumps
RNA-44	Sherd	K	1	Sand plus fiber temper	329	550	120	85	0	0
RNA-45	Sherd	K	1	Sand	201	510	35	28	0	1
RNA-46	Sherd	K	1	Sandy clay (may have crushing features)	290	453	55	7	0	0
RNA-47	Sherd	K	1	Sand	283	478	58	3	2	1
RNA-48	Sherd	K	1	Sandy clay (may have crushing features)	261	513	87	4	2	0
RNA-49	Sherd	O	1	Sandy clay (may have crushing features)	234	540	246	0	1	0
RNA-50	Sherd	G	1	Sandy clay (may have crushing features)	281	465	170	6	0	0
RNA-51	Sherd	K	1	Sand + grog + 1-7% crushed rock	252	560	142	0	52	0
RNA-52	Sherd	J1	1	Sandy clay plus grog	248	345	98	0	101	0
RNA-53	Sherd	J1	1	Sand + grog + 1-7% crushed rock	274	484	202	0	51	0
RNA-54	Sherd	J1	1	Sandy clay plus grog	272	526	101	0	74	0
RNA-55	Sherd	J1	1	Sand + grog + 1-7% crushed rock	300	449	146	0	33	0
RNA-56	Sherd	J1	1	Sand plus grog	307	537	113	0	51	0
RNA-57	Sherd	K	1	Sand plus grog	323	511	161	0	44	0
RNA-58	Sherd	O	1	Sand plus fiber temper	311	596	86	84	0	12
RNA-59	Sherd	O	1	Sand plus fiber temper	319	514	165	78	0	0
RNA-60	Sherd	O	2	Sand plus fiber temper	229	696	119	13	0	3
RNA-61	Sherd	O	1	Sand plus fiber temper	321	605	58	91	0	0
RNA-62	Sherd	O	1	Sand plus fiber temper	367	448	91	70	0	2
RNA-63	Sherd	O	1	Sand plus fiber temper	379	435	87	114	0	2
RNA-64	Sherd	O	1	Sand plus fiber temper	368	618	38	151	0	10
RNA-65	Sherd	O	1	Sand plus fiber temper	397	586	63	181	0	1
RNA-66	Sherd	O	1	Sand plus fiber temper	302	495	122	90	1	1
RNA-67	Sherd	O	1	Sand plus fiber temper	293	460	147	75	1	1
RNA-68	Sherd	O	1	Sand plus fiber temper	293	460	230	73	0	1
RNA-69	Sherd	O	1	Sand plus fiber temper	289	495	185	64	1	2
RNA-70	Sherd	O	1	Sand plus fiber temper	309	436	235	50	0	6
RNA-3575	Ethnographic clay	O	1	Sand plus fiber temper	346	470	135	118	0	0
RNA-3642	Ethnographic clay	O	1	Not tempered	293	530	78	19	0	0
RNA-6100	Ethnographic clay	O	1	Sand plus fiber temper	335	520	90	93	0	1

[a] The "obs" number is used to distinguish among different point counts of the same thin section. Only one point count per thin section is used for statistical purposes.

Table 6.3. Point-count data for the thin-sectioned sherds.

B. Monocrystalline grains and unknown grains

	Monocrystalline Grains																			
Sample No.	Qtz	Kspar	Micr	Sanid	P	Plag	Plagal	Plaggn	Musc	Biot	Chlor	Pyr	Px	Amph	Opaq	Oliv	Epid	Sphene	Gar	Unkn
RNA2-01	48	10	4	0	37	7	14	1	1	8	2	4	0	4	9	0	0	0	0	0
RNA2-02	45	2	7	0	53	21	24	0	12	1	18	5	0	5	3	0	3	0	0	0
RNA2-03	48	7	7	0	42	21	21	0	0	1	3	2	0	2	4	0	3	0	0	1
RNA2-04	32	10	1	0	51	18	31	1	0	10	11	0	0	0	8	0	0	0	0	0
RNA2-05	81	19	17	0	57	22	20	0	2	4	2	4	0	4	6	0	2	0	0	0
RNA2-06	100	14	7	0	76	31	28	1	1	5	6	1	0	1	4	0	2	0	0	0
RNA2-07	96	6	11	0	105	60	37	1	2	5	4	3	0	3	1	0	3	1	0	0
RNA2-08	78	23	23	0	81	45	35	0	1	9	7	7	0	7	7	0	2	0	1	0
RNA2-09	59	11	14	0	90	43	45	0	0	3	4	4	0	4	6	0	0	0	0	0
RNA2-10	78	4	8	0	107	57	48	1	1	1	3	4	0	4	8	0	3	0	0	0
RNA2-11	54	21	6	0	54	34	16	1	0	6	7	0	0	0	1	0	1	1	0	0
RNA2-12	69	10	6	0	48	14	31	0	0	3	9	1	0	1	5	0	1	0	0	0
RNA2-13	45	1	0	0	48	15	31	1	6	2	3	3	1	2	19	0	0	1	0	1
RNA2-14	50	4	1	0	25	8	16	1	1	0	2	0	0	0	9	0	0	0	0	0
RNA2-15	66	2	0	0	45	12	33	0	2	3	4	0	0	0	13	0	1	0	0	1
RNA2-16	61	1	0	0	51	11	38	2	7	2	7	0	0	0	12	0	0	0	0	0
RNA2-17	43	2	2	0	40	28	10	2	0	4	3	0	0	0	5	0	0	0	0	0
RNA2-18	63	0	0	0	28	14	10	2	0	3	4	1	0	1	13	0	0	0	0	1
RNA2-19	49	6	1	0	71	28	31	2	1	2	1	0	0	0	17	0	0	0	0	0
RNA2-20	51	1	0	0	48	11	33	3	3	2	7	0	0	0	22	0	0	0	0	0
RNA2-21	64	3	3	0	69	33	33	0	0	5	7	5	2	3	5	0	1	2	0	0
RNA2-22	53	2	48	0	98	53	41	0	1	0	1	2	1	1	5	0	0	0	0	0
RNA2-23	47	13	5	0	54	14	37	1	0	1	1	2	1	1	5	0	0	0	0	0
RNA2-24	82	14	14	0	69	12	41	1	1	1	2	1	0	1	2	0	2	0	0	0
RNA-39	70	29	7	0	106	70	35	1	1	2	4	5	0	5	15	0	3	1	0	0
RNA-40	58	21	16	0	93	68	25	0	1	3	7	2	0	2	8	0	0	0	0	0
RNA-41	60	20	21	0	104	82	22	0	0	0	4	0	0	0	4	0	0	0	0	0
RNA-42	75	17	1	0	90	38	51	1	1	1	3	0	0	0	13	0	0	0	0	0
RNA-43	29	3	2	0	62	38	23	1	4	0	3	0	0	0	10	0	0	0	0	0

Table 6.3. B. Continued.

	Monocrystalline Grains																			
Sample No.	Qtz	Kspar	Micr	Sanid	P	Plag	Plagal	Plaggn	Musc	Biot	Chlor	Pyr	Px	Amph	Opaq	Oliv	Epid	Sphene	Gar	Unkn
RNA-44	72	1	15	0	101	50	48	3	1	1	2	3	0	3	10	0	2	0	0	0
RNA-45	48	13	15	0	56	32	23	1	0	3	2	4	0	4	4	0	0	0	0	0
RNA-46	86	1	15	0	105	78	27	0	0	2	6	8	0	8	7	0	2	0	0	0
RNA-47	90	23	12	0	94	43	50	1	0	3	3	8	0	8	14	0	1	0	0	0
RNA-48	49	3	13	0	123	107	16	0	0	1	2	8	0	8	16	0	1	0	0	1
RNA-49	68	7	9	0	87	48	38	1	1	1	0	2	0	2	6	0	1	0	0	0
RNA-50	85	20	8	0	101	67	34	0	0	6	5	2	0	2	2	0	3	2	0	1
RNA-51	36	3	7	0	100	92	8	0	0	0	1	0	0	0	15	0	2	0	0	0
RNA-52	24	7	8	0	36	29	7	0	2	0	1	1	1	0	13	0	1	0	0	1
RNA-53	39	11	0	5	23	11	10	0	2	2	0	0	0	0	3	0	0	0	0	2
RNA-54	40	8	2	1	23	17	5	1	2	0	3	0	0	0	17	0	3	0	0	0
RNA-55	34	16	0	1	84	65	17	2	4	0	6	0	0	0	8	0	0	0	0	1
RNA-56	35	6	8	12	67	44	22	1	0	0	6	1	1	0	21	0	0	0	0	0
RNA-57	56	15	12	3	102	84	18	0	0	0	9	1	0	1	8	0	0	0	0	0
RNA-58	53	3	39	0	66	53	13	0	0	0	2	1	0	1	7	0	0	0	0	2
RNA-59	63	10	38	0	114	93	21	0	0	1	1	0	0	0	6	0	0	1	0	2
RNA-60	54	14	11	0	73	51	22	0	0	0	6	5	2	3	3	0	1	0	0	0
RNA-61	71	17	45	0	87	70	17	0	0	0	0	0	0	0	2	0	0	0	0	2
RNA-62	64	58	28	0	114	104	10	0	0	0	1	6	6	0	14	0	2	0	0	1
RNA-63	54	29	27	0	106	93	13	0	1	0	0	3	2	1	26	0	0	3	0	1
RNA-64	61	10	35	0	83	61	22	0	0	0	0	0	0	0	11	0	0	0	0	2
RNA-65	64	5	36	0	93	77	16	0	0	0	1	1	0	1	4	0	0	0	0	3
RNA-66	63	2	45	0	76	45	30	1	1	0	1	3	2	1	7	0	0	0	0	0
RNA-67	52	5	51	0	82	57	25	0	1	0	1	0	0	0	9	0	0	1	0	0
RNA-68	52	3	48	0	99	84	15	0	0	0	1	1	1	0	10	0	0	0	0	0
RNA-69	58	2	41	0	99	75	23	1	0	1	1	1	0	1	9	0	0	0	0	0
RNA-70	64	8	51	0	109	73	36	0	2	1	1	1	1	0	6	0	0	1	0	0
RNA-3575	71	1	4	0	129	114	15	0	0	0	0	4	0	4	14	0	3	2	0	0
RNA-3642	85	5	47	0	121	43	78	0	0	0	1	1	0	1	12	0	0	0	0	0
RNA-6100	76	2	28	0	99	88	11	0	0	2	2	4	1	3	7	0	2	0	0	0

Table 6.3. Point-count data for the thin-sectioned sherds.

C. Metamorphic lithic fragments and monocrystalline grains from gneiss or schist

	Metamorphic Lithic Fragments								Monocrystalline Grains from Gneiss or Schist						
Sample No.	Lma	Lmvf	Lmss	Lmamph	Lmt	Lmtp	Lmm	Lmf	Sqtz	Splag	Skspar	Smusc	Sbiot	Schlor	Sopaq
RNA2-01	0	4	0	0	2	0	0	1	35	15	7	1	0	0	0
RNA2-02	0	3	0	0	4	0	1	0	39	8	0	0	1	0	0
RNA2-03	0	1	0	0	3	0	0	0	0	0	0	0	0	0	0
RNA2-04	0	7	0	0	7	0	0	0	8	1	2	0	0	0	0
RNA2-05	0	1	1	0	2	0	0	0	50	15	4	0	0	0	1
RNA2-06	0	6	0	0	6	0	1	0	68	16	1	0	1	0	0
RNA2-07	1	4	0	0	13	0	0	0	44	7	0	0	0	0	0
RNA2-08	1	6	0	0	6	0	1	0	32	1	0	0	1	2	0
RNA2-09	1	2	0	0	6	0	0	0	21	2	0	0	0	0	0
RNA2-10	0	7	0	0	5	0	0	0	20	1	0	0	0	0	0
RNA2-11	1	1	1	0	7	0	1	0	14	3	0	0	1	0	0
RNA2-12	1	1	0	0	3	0	0	0	30	3	0	0	0	0	0
RNA2-13	2	7	1	0	4	0	0	0	2	1	0	0	0	0	1
RNA2-14	1	3	0	0	5	0	0	0	3	0	0	0	0	0	0
RNA2-15	1	6	0	0	11	0	0	0	3	0	0	0	1	0	0
RNA2-16	0	11	1	0	16	1	0	0	4	0	0	0	0	2	0
RNA2-17	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
RNA2-18	0	5	0	0	8	0	0	0	9	2	0	0	0	0	0
RNA2-19	1	7	1	0	5	0	1	0	7	10	0	0	0	0	0
RNA2-20	0	16	1	0	12	0	0	0	6	1	0	0	0	0	0
RNA2-21	0	1	0	0	2	0	0	0	9	3	0	0	0	0	0
RNA2-22	0	0	0	0	0	0	0	0	11	4	0	0	0	0	0
RNA2-23	0	2	0	0	5	0	0	0	7	2	0	0	0	0	0
RNA2-24	1	6	0	0	2	0	0	1	53	15	1	0	0	0	0
RNA-39	1	0	0	0	3	0	0	0	0	0	0	0	0	1	0
RNA-40	0	3	1	0	2	0	0	0	1	0	0	0	0	0	0
RNA-41	1	3	0	0	10	0	0	0	0	0	0	0	0	0	0
RNA-42	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0
RNA-43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6.3. C. Continued.

	Metamorphic Lithic Fragments								Monocrystalline Grains from Gneiss or Schist						
Sample No.	Lma	Lmvf	Lmss	Lmamph	Lmt	Lmtp	Lmm	Lmf	Sqtz	Splag	Skspar	Smusc	Sbiot	Schlor	Sopaq
RNA-44	0	1	0	0	2	0	0	2	0	0	0	1	0	0	0
RNA-45	1	0	0	0	3	0	0	1	0	0	0	0	0	0	0
RNA-46	0	5	0	0	5	0	0	0	0	0	0	0	0	0	0
RNA-47	0	1	0	0	2	1	0	0	0	0	0	0	0	0	0
RNA-48	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0
RNA-49	0	7	0	0	4	0	0	0	0	0	0	0	0	0	0
RNA-50	0	4	0	0	7	0	0	0	0	0	0	0	1	1	0
RNA-51	4	0	0	0	3	0	0	0	0	0	0	0	0	0	0
RNA-52	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0
RNA-53	1	0	0	0	4	0	0	0	1	2	0	1	0	0	0
RNA-54	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
RNA-55	0	0	0	0	2	0	0	0	3	0	0	1	0	0	1
RNA-56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RNA-57	0	0	0	0	0	0	0	0	4	0	1	0	0	0	0
RNA-58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RNA-59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RNA-60	0	1	0	0	5	0	0	1	0	0	0	0	0	0	0
RNA-61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RNA-62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RNA-63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RNA-64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RNA-65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RNA-66	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
RNA-67	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
RNA-68	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
RNA-69	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
RNA-70	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
RNA-3575	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RNA-3642	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RNA-6100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6.3. Point-count data for the thin-sectioned sherds.

D. Volcanic and sedimentary lithic fragments

	Volcanic Lithic Fragments						Sedimentary Lithic Fragments							
Sample No.	Lvf	Lvfb	Lvi	Lvm	Lvv	Lvh	Lss	Lsa	Lsch	Lsca	Lsca1	Lsca2	Lsca3	Caco
RNA2-01	6	1	1	1	1	0	0	0	0	2	2	0	0	0
RNA2-02	28	6	9	3	5	1	0	1	4	47	1	1	45	0
RNA2-03	3	1	14	0	3	2	0	0	2	2	2	0	0	2
RNA2-04	86	52	0	1	6	0	0	0	2	0	0	0	0	0
RNA2-05	12	2	4	2	7	1	2	0	2	8	7	1	0	1
RNA2-06	12	1	7	2	4	1	3	0	3	4	3	1	0	0
RNA2-07	16	6	6	3	7	0	1	0	1	5	1	4	0	0
RNA2-08	12	8	5	2	8	1	1	0	2	15	10	5	0	0
RNA2-09	22	7	8	1	3	1	1	0	1	9	5	4	0	0
RNA2-10	18	11	6	5	6	0	2	0	3	15	7	8	0	0
RNA2-11	12	7	3	1	4	1	1	0	3	4	3	1	0	0
RNA2-12	11	7	4	2	3	2	0	0	3	6	3	3	0	0
RNA2-13	48	9	1	1	2	0	1	0	5	2	2	0	0	0
RNA2-14	61	4	1	1	4	0	0	0	4	4	4	0	0	0
RNA2-15	61	3	2	0	4	0	0	0	1	9	5	4	0	0
RNA2-16	36	9	1	0	2	1	0	0	2	1	1	0	0	0
RNA2-17	26	44	0	0	9	2	0	0	1	1	1	0	0	0
RNA2-18	44	16	1	2	9	1	0	0	2	11	2	9	0	0
RNA2-19	73	18	1	1	3	0	0	0	1	0	0	0	0	0
RNA2-20	55	20	3	0	7	0	0	0	6	2	1	1	0	0
RNA2-21	10	2	1	0	3	0	0	0	2	4	2	2	0	1
RNA2-22	0	0	1	0	0	3	0	0	0	9	7	2	0	0
RNA2-23	29	20	4	2	6	6	0	0	2	3	2	1	0	0
RNA2-24	24	13	3	0	4	2	0	0	0	1	1	0	0	0
RNA-39	4	1	2	0	0	0	0	0	4	0	2	2	0	0
RNA-40	15	11	5	1	2	5	0	0	2	2	3	0	0	0
RNA-41	4	3	1	0	0	2	0	0	7	4	2	0	0	3
RNA-42	18	2	5	0	3	38	1	0	1	3	2	4	0	1
RNA-43	173	4	0	0	1	0	0	0	0	2	2	0	0	0

Table 6.3. D. Continued.

	Volcanic Lithic Fragments						Sedimentary Lithic Fragments							
Sample No.	Lvf	Lvfb	Lvi	Lvm	Lvv	Lvh	Lss	Lsa	Lsch	Lsca	Lsca1	Lsca2	Lsca3	Caco
RNA-44	11	5	4	0	3	0	0	0	4	6	4	0	0	0
RNA-45	5	2	2	0	1	0	1	0	2	2	6	3	0	0
RNA-46	11	3	17	1	4	0	1	0	3	4	1	0	0	0
RNA-47	6	1	3	1	3	0	1	0	4	9	2	2	0	2
RNA-48	5	1	7	4	0	12	0	0	2	1	0	3	0	0
RNA-49	14	0	10	3	5	2	1	0	3	4	2	0	0	0
RNA-50	9	4	7	1	3	0	0	0	2	3	0	3	0	0
RNA-51	18	2	0	0	0	3	0	0	0	2	6	0	0	0
RNA-52	44	2	0	0	0	0	0	0	0	3	4	0	0	0
RNA-53	118	6	0	0	2	2	0	0	0	6	3	0	0	0
RNA-54	91	0	1	0	0	0	0	0	0	4	5	0	0	0
RNA-55	81	23	0	0	0	0	0	0	0	3	7	0	0	0
RNA-56	72	20	0	0	2	1	0	0	0	5	5	0	0	0
RNA-57	34	17	0	0	1	2	0	0	0	7	19	0	0	0
RNA-58	1	0	0	0	1	4	0	0	0	5	36	0	0	0
RNA-59	3	0	0	0	0	1	0	0	0	19	1	0	0	0
RNA-60	19	1	2	0	5	3	0	0	2	36	7	0	0	0
RNA-61	2	0	0	0	0	1	0	0	0	1	3	0	0	0
RNA-62	4	0	0	0	0	2	0	0	0	7	1	0	0	0
RNA-63	2	0	0	0	0	1	0	0	0	3	10	0	0	0
RNA-64	0	0	0	0	0	0	0	0	0	14	5	0	0	0
RNA-65	2	1	0	0	0	2	0	0	0	1	3	0	0	0
RNA-66	2	0	0	0	0	5	0	0	1	10	2	0	0	0
RNA-67	1	0	1	0	0	4	0	0	0	5	3	0	0	0
RNA-68	0	0	0	0	0	2	0	0	1	3	1	0	0	1
RNA-69	0	0	1	0	0	3	0	0	2	2	1	0	0	0
RNA-70	0	0	0	0	0	4	0	0	0	3	3	0	0	0
RNA-3575	0	0	0	0	0	0	0	0	0	1	0	0	0	0
RNA-3642	0	0	0	0	0	0	0	0	0	1	2	0	0	0
RNA-6100	0	1	1	0	0	3	0	0	0	3	14	0	0	0

Table 6.4. Qualitative data for the thin-sectioned sherds from the Rio Nuevo Archaeology project.

A. Fine fraction characteristics

Sample No.	Matrix Opacity[a]	Silt Fraction 1	Silt Fraction 2	Silt Fraction 3	Clay Fraction 1	Clay Fraction 2	Lumps in Matrix?
RNA2-01	2	Quartz	Biotite	Plagioclase feldspar	Quartz and/or feldspars	Biotite	Several
RNA2-02	2	Quartz	Plagioclase feldspar	Opaque oxides	Quartz and/or feldspars	Biotite	Few
RNA2-03	3	Quartz	Feldspar	Micas	Quartz	Opaque oxides	Several
RNA2-04	2	Quartz	Biotite	Opaque oxides	Quartz and/or feldspars	Biotite	None
RNA2-05	3	Quartz	Plagioclase feldspar	Biotite	Quartz and/or feldspars	Micas	Few
RNA2-06	3	Quartz	Plagioclase feldspar	Potassium feldspar	Quartz and/or feldspars	Feldspar	None
RNA2-07	3	Quartz	Plagioclase feldspar	Opaque oxides	Quartz and/or feldspars	Biotite	None
RNA2-08	3	Quartz	Plagioclase feldspar	Opaque oxides	Quartz and/or feldspars	Biotite	Few
RNA2-09	2	Quartz	Plagioclase feldspar	Opaque oxides	Quartz and/or feldspars	Biotite	Few
RNA2-10	3	Quartz	Plagioclase feldspar	Opaque oxides	Quartz	Feldspar	Few
RNA2-11	3	Quartz	Plagioclase feldspar	Potassium feldspar	Quartz and/or feldspars	Biotite	None
RNA2-12	3	Quartz	Plagioclase feldspar	Chlorite	Quartz and/or feldspars	Micas	Few
RNA2-13	3	Quartz	Plagioclase feldspar	Opaque oxides	Quartz and/or feldspars	Micas	Several
RNA2-14	3	Quartz	Plagioclase feldspar	Opaque oxides	Quartz and/or feldspars	Micas	Several
RNA2-15	1	Quartz	Micas	Quartz and/or feldspars	Quartz and/or feldspars	Micas	Zoned and mottled
RNA2-16	3	Quartz	Plagioclase feldspar	Opaque oxides	Quartz and/or feldspars	Micas	Few
RNA2-18	3	Quartz	Plagioclase feldspar	Biotite	Quartz and/or feldspars	Micas	Few

Table 6.4. A. Continued.

Sample No.	Matrix Opacity[a]	Silt Fraction 1	Silt Fraction 2	Silt Fraction 3	Clay Fraction 1	Clay Fraction 2	Lumps in Matrix?
RNA2-19	2	Quartz	Plagioclase feldspar	Opaque oxides	Quartz and/or feldspars	Micas	None
RNA2-20	2	Quartz	Biotite	Plagioclase feldspar	Quartz and/or feldspars	Micas	Zoned, mottled, lumpy, and otherwise highly heterogeneous
RNA2-21	3	Quartz	Biotite	Plagioclase feldspar	Quartz and/or feldspars	Micas	Few
RNA2-22	3	Quartz	Microcline	Opaque oxides	Quartz	Feldspar	Few
RNA2-23	1	Quartz	Feldspar	Opaque oxides	Quartz and/or feldspars	Opaque oxides	Several
RNA2-24	3	Quartz	Feldspar	Opaque oxides	Feldspar	Micas	Few
RNA-39	3	Quartz and/or feldspars	Biotite	Opaque oxides	Quartz and/or feldspars	Micas	Few
RNA-40	3	Quartz	Plagioclase feldspar	Potassium feldspar	Quartz	Quartz and/or feldspars	None
RNA-41	3	Quartz	Plagioclase feldspar	Potassium feldspar	Quartz	Quartz and/or feldspars	Few
RNA-42	3	Quartz	Plagioclase feldspar	Opaque oxides	Quartz	Feldspar	Few
RNA-43	2	Quartz	Plagioclase feldspar	Opaque oxides	Quartz and/or feldspars	Micas	None
RNA-44	2	Quartz	Biotite	Opaque oxides	Quartz and/or feldspars	Micas	Few
RNA-45	3	Quartz	Plagioclase feldspar	Opaque oxides	Quartz and/or feldspars	Opaque oxides	Few
RNA-46	3	Plagioclase feldspar	Quartz	Opaque oxides	Quartz	Quartz and/or feldspars	Few
RNA-47	3	Quartz	Plagioclase feldspar	Potassium feldspar	Quartz and/or feldspars	Micas	Few
RNA-48	3	Quartz	Plagioclase feldspar	Opaque oxides	Quartz and/or feldspars	Opaque oxides	Few
RNA-49	2	Quartz	Plagioclase feldspar	Opaque oxides	Micas	Quartz and/or feldspars	None
RNA-50	3	Plagioclase feldspar	Quartz	Biotite	Quartz and/or feldspars	Biotite	None
RNA-51	2	Quartz	Plagioclase feldspar	Opaque oxides	Quartz and/or feldspars	Micas	None

Table 6.4. A. Continued.

Sample No.	Matrix Opacity[a]	Silt Fraction 1	Silt Fraction 2	Silt Fraction 3	Clay Fraction 1	Clay Fraction 2	Lumps in Matrix?
RNA-52	2	Quartz	Plagioclase feldspar	Opaque oxides	Quartz and/or feldspars	Micas	None
RNA-53	1	Quartz	Plagioclase feldspar	Opaque oxides	Quartz and/or feldspars	Micas	Few
RNA-54	2	Quartz	Plagioclase feldspar	Potassium feldspar	Quartz and/or feldspars	Micas	None
RNA-55	2	Plagioclase feldspar	Quartz	Chlorite	Quartz	Plagioclase feldspar	Few
RNA-56	2	Quartz	Plagioclase feldspar	Opaque oxides	Quartz and/or feldspars	Micas	None
RNA-57	2	Quartz	Plagioclase feldspar	Opaque oxides	Quartz and/or feldspars	Micas	None
RNA-58	1	Plagioclase feldspar	Quartz	Potassium feldspar	Quartz	Feldspar	Few
RNA-59	1	Plagioclase feldspar	Quartz	Opaque oxides	Quartz and/or feldspars	Opaque oxides	None
RNA-60	2	Quartz	Plagioclase feldspar	Micas	Quartz and/or feldspars	Opaque oxides	None
RNA-61	1	Plagioclase feldspar	Quartz	Pyroxene or amphibole	Quartz and/or feldspars	Opaque oxides	None
RNA-62	1	Plagioclase feldspar	Quartz	Potassium feldspar	Quartz and/or feldspars	Opaque oxides	None
RNA-63	1	Plagioclase feldspar	Quartz	Potassium feldspar	Quartz	Feldspar	Few
RNA-64	1	Quartz	Plagioclase feldspar	Feldspar	Quartz and/or feldspars	Opaque oxides	Several
RNA-65	1	Quartz	Plagioclase feldspar	Opaque oxides	Quartz	Feldspar	None
RNA-66	1	Quartz	Plagioclase feldspar	Potassium feldspar	Feldspar	Micas	Few
RNA-67	1	Quartz	Plagioclase feldspar	Micas	Feldspar	Micas	Few
RNA-68	1	Quartz	Plagioclase feldspar	Potassium feldspar	Quartz and/or feldspars	Micas	Few
RNA-69	2	Quartz	Plagioclase feldspar	Potassium feldspar	Feldspar	Opaque oxides	Few
RNA-70	1	Quartz	Plagioclase feldspar	Potassium feldspar	Feldspar	Micas	Few

[a] Matrix opacity is expressed as an integer from 0 = opaque to 9 = transparent.

Table 6.4. Qualitative data for the thin-sectioned sherds from the Rio Nuevo Archaeology project.

B. Sand fraction characteristics

Sample No.	Finest (mm)	Coarsest (mm)	Mode (mm)	Sorting	Dominant Coarse Grain	Accessory Mineral 1	Accessory Mineral 2	Accessory Mineral 3
RNA2-01	Silt (<0.0625)	Very coarse sand (1.0-2.0)	Bimodal	Bimodal	Quartz	Opaque oxides	Plagioclase feldspar	Biotite
RNA2-02	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Quartz	Opaque oxides	Biotite and chlorite	Plagioclase feldspar
RNA2-03	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Quartz	Opaque oxides	Plagioclase feldspar	Biotite and chlorite
RNA2-04	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Tuff of Beehive Peak	Tuff of Beehive Peak	Quartz	Plagioclase feldspar
RNA2-05	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Quartz	Microcline	Opaque oxides	Plagioclase feldspar
RNA2-06	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Quartz	Plagioclase feldspar	Feldspar	Tuff of Beehive Peak
RNA2-07	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Quartz	Plagioclase feldspar	Opaque oxides	Potassium feldspar
RNA2-08	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Quartz	Plagioclase feldspar	Biotite	Microcline
RNA2-09	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Quartz	Plagioclase feldspar	Opaque oxides	Potassium feldspar
RNA2-10	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Quartz	Plagioclase feldspar	Opaque oxides	Altered/Chloritized mafics
RNA2-11	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Plagioclase feldspar	Quartz	Biotite and chlorite	—
RNA2-12	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Quartz	Plagioclase feldspar	Biotite and chlorite	Potassium feldspar
RNA2-13	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Quartz	Tuff of Beehive Peak	Hypabyssal volcanic, "dirty snowballs"	Plagioclase feldspar
RNA2-14	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Quartz	Plagioclase feldspar	Tuff of Beehive Peak	Opaque oxides
RNA2-15	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Quartz	Grog	Opaque oxides	Plagioclase feldspar
RNA2-16	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Quartz	Tuff of Beehive Peak	Opaque oxides	Sherd temper of various sorts
RNA2-18	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Quartz	Tuff of Beehive Peak	Plagioclase feldspar	Biotite and chlorite

Table 6.4. B. Continued.

Sample No.	Finest (mm)	Coarsest (mm)	Mode (mm)	Sorting	Dominant Coarse Grain	Accessory Mineral 1	Accessory Mineral 2	Accessory Mineral 3
RNA2-19	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Quartz	Tuff of Beehive Peak	Plagioclase feldspar	Opaque oxides
RNA2-20	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Quartz	Plagioclase feldspar	Opaque oxides	Micas
RNA2-21	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Quartz	Fiber, non-specific	Biotite	Plagioclase feldspar
RNA2-22	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Quartz	Microcline	Fiber, non-specific	Plagioclase feldspar
RNA2-23	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Quartz	Fiber, non-specific	Plagioclase feldspar	Opaque oxides
RNA2-24	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Quartz	Plagioclase feldspar	Opaque oxides	Microcline
RNA-39	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Quartz	Plagioclase feldspar	Potassium feldspar	Opaque oxides
RNA-40	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Quartz	Plagioclase feldspar	–	–
RNA-41	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Plagioclase feldspar	Quartz	–	–
RNA-42	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Hypabyssal volcanic, "dirty snowballs"	Quartz	Plagioclase feldspar	Opaque oxides
RNA-43	Silt (<0.0625)	Very coarse sand (1.0-2.0)	Coarse sand (0.50-1.00)	Moderately well	Hypabyssal volcanic, "dirty snowballs"	Quartz	Plagioclase feldspar	Opaque oxides
RNA-44	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Quartz	Plagioclase feldspar	–	–
RNA-45	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Quartz	Plagioclase feldspar	Potassium feldspar	Opaque oxides
RNA-46	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Plagioclase feldspar	Quartz	Opaque oxides	Amphibole
RNA-47	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Quartz	Plagioclase feldspar	Potassium feldspar	Biotite and chlorite
RNA-48	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Plagioclase feldspar	Quartz	Opaque oxides	Potassium feldspar
RNA-49	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Quartz	Plagioclase feldspar	Schist	Potassium feldspar
RNA-50	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Plagioclase feldspar	Quartz	Biotite	Potassium feldspar
RNA-51	Silt (<0.0625)	Very coarse sand (1.0-2.0)	Coarse sand (0.50-1.00)	Moderately poor	Quartz	Plagioclase feldspar	Microcline	Opaque oxides

Table 6.4. B. Continued.

Sample No.	Finest (mm)	Coarsest (mm)	Mode (mm)	Sorting	Dominant Coarse Grain	Accessory Mineral 1	Accessory Mineral 2	Accessory Mineral 3
RNA-52	Silt (<0.0625)	Very coarse sand (1.0-2.0)	Coarse sand (0.50-1.00)	Moderately sorted	Quartz	Plagioclase feldspar	Undifferentiated felsic volcanic	Opaque oxides
RNA-53	Silt (<0.0625)	Granule (>2.0)	Very coarse sand (1.00-2.00)	Moderately sorted	Undifferentiated felsic volcanic	Quartz	Grog	Opaque oxides
RNA-54	Silt (<0.0625)	Granule (>2.0)	Very coarse sand (1.00-2.00)	Moderately poor	Quartz	Plagioclase feldspar	Undifferentiated felsic volcanic	Opaque oxides
RNA-55	Silt (<0.0625)	Very coarse sand (1.0-2.0)	Bimodal	Bimodal	Plagioclase feldspar	Potassium feldspar	Undifferentiated felsic volcanic	Biotite and chlorite
RNA-56	Silt (<0.0625)	Very coarse sand (1.0-2.0)	Very coarse sand (1.00-2.00)	Moderately sorted	Quartz	Plagioclase feldspar	Undifferentiated felsic volcanic	Opaque oxides
RNA-57	Silt (<0.0625)	Granule (>2.0)	Very coarse sand (1.00-2.00)	Moderately well	Plagioclase feldspar	Quartz	Microcline	Biotite and chlorite
RNA-58	Silt (<0.0625)	Granule (>2.0)	Very coarse sand (1.00-2.00)	Moderately sorted	Microcline	Quartz	Plagioclase feldspar	Caliche; granular carbonate grains
RNA-59	Silt (<0.0625)	Granule (>2.0)	Coarse sand (0.50-1.00)	Moderately sorted	Plagioclase feldspar	Microcline	Quartz	Granite
RNA-60	Silt (<0.0625)	Granule (>2.0)	Coarse sand (0.50-1.00)	Moderately poor	Potassium feldspar	Plagioclase feldspar	Quartz	Undifferentiated felsic volcanic
RNA-61	Silt (<0.0625)	Granule (>2.0)	Coarse sand (0.50-1.00)	Moderately poor	Plagioclase feldspar	Microcline	Quartz	Granite
RNA-62	Silt (<0.0625)	Granule (>2.0)	Coarse sand (0.50-1.00)	Poorly sorted	Plagioclase feldspar	Microcline	Quartz	Unknown
RNA-63	Silt (<0.0625)	Granule (>2.0)	Very coarse sand (1.00-2.00)	Moderately poor	Microcline	Plagioclase feldspar	Quartz	Granite
RNA-64	Silt (<0.0625)	Granule (>2.0)	Very coarse sand (1.00-2.00)	Moderately poor	Microcline	Plagioclase feldspar	Quartz	Clay lumps
RNA-65	Silt (<0.0625)	Very coarse sand (1.0-2.0)	Medium sand (0.25-0.50)	Moderately poor	Microcline	Plagioclase feldspar	Quartz	Granite
RNA-66	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Plagioclase feldspar	Fiber, non-specific	Quartz	Microcline
RNA-67	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Quartz	Fiber, non-specific	Micas	Plagioclase feldspar
RNA-68	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Quartz	Fiber, non-specific	Microcline	Plagioclase feldspar
RNA-69	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Plagioclase feldspar	Fiber, non-specific	Quartz	Microcline
RNA-70	Silt (<0.0625)	Granule (>2.0)	Bimodal	Bimodal	Plagioclase feldspar	Fiber, non-specific	Quartz	Microcline

Temper Type Analysis

The diverse assortment of temper types in this set of sherds requires additional explanation (see Table 6.4). In addition to sand temper, sherds with sand plus grog and sand plus fiber temper were encountered. In all but one of the 56 thin sections, the ceramicist's assessment of temper type concurs with that seen under the petrographic microscope (Table 6.5). The single exception is RNA-44, a very fine-grained sherd with a dark paste. In this sherd, fiber temper is clearly visible in the thin section, but the fibers are small and the paste is very dark, making it impossible to see the fiber voids under the low-powered binocular stereomicroscope. Additionally, the petrographers characterized some tempers as "sandy clay" or "sandy clay plus fiber" instead of the ceramicist's characterization of "sand" and "sand plus fiber." These more detailed characterizations under the petrographic microscope reflect the presence of crushing features on the sand grains—features that are only visible in thin section. Thus, the ceramicist's "sand" is equivalent to the petrographers' "sandy clay." A more complete discussion of the anthropological and statistical implications of the use of sand versus sandy clay is found later in this chapter.

Statistical Implications of Temper Type Variations

With sand-tempered sherds, the sand temper data are simply submitted for analysis. With more complex mixtures—for example, sand plus grog—the non-sand phase must be excluded from consideration during the statistical analysis process. For the Rio Nuevo sherds, the following statistical adaptations were used.

The sand-tempered sherds in the Tucson Basin are straightforward; therefore, all sand-sized grains are counted. A record of the number of matrix and voids encountered while counting is kept, making a full volumetric composition of the paste available. Figure 6.2 is a photomicrograph of a Beehive Petrofacies sand-tempered sherd, illustrating common grain sizes and shapes for sand-tempered sherds.

The sand plus grog-tempered sherds in the Tucson Basin commonly have sand temper in the grog (Figure 6.3). Thus, anything that may be encountered within the grog grain was counted as "grog," although a separate list of grog composition was collected. The grog is not included in the compositional analysis of the sand temper for provenance analysis.

The fiber-tempered sherds in the Tucson Basin commonly have large, elongated voids, frequently with charred remains of plant material (Figures 6.4-6.6). The plant structure is sometimes retained, and the voids may also have dark, carbonized margins. When counting, the characteristic fiber voids are tallied separately from the "bubble" voids commonly seen in ceramics. Voids are not included in the statistical provenance analyses of sand. Ethnographic evidence indicates the source of the fiber in these ceramics is manure, presumably horse manure (Fontana et al. 1962).

In addition to the fiber, all the fiber-tempered pottery also contains sand. This sand could be added intentionally, although it is more likely a component of the clay selected for pottery production. Ethnographic research conducted in the mid-twentieth century indicates pedologically derived clays forming on alluvial parent material were a common source for local historic Native American potters (Fontana et al. 1962:Figure 41). These materials are rich in sand-sized grains. The clays were ground up (Fontana et al. 1963:Figure 42), then horse manure was added to make the clay paste. We have noted crushing features on the sand grains in the fiber-tempered pottery, which supports the ethnographic reports. Compositionally, the sands naturally included in these clays are directly related to their provenance. However, their composition may differ slightly from our reference sands, which have experienced less chemical weathering than sediments subjected to soil formation. Behaviorally, the sand is not "temper;" that is, it was not added to the clay to change the properties of the material (Shepard 1995).

Finally, Whittlesey (1997) has suggested that some amount of sand may be introduced into the clay body from the horse manure. Although we have collected horse manure to test this hypothesis, we are still debating a suitable method for extracting and quantifying sand fraction that may be included in the manure. Visually, sparse grains of sand can be seen in the manure, but the quantity introduced into the clay body would be volumetrically very low.

For comparison, three ethnographic samples of raw and prepared clay were obtained from the Arizona State Museum (ASM). One of the samples is from the San Xavier area; the remaining samples are from farther west on the Tohono O'odham Reservation. All three samples were collected and prepared by O'odham potters (Fontana et al. 1962: 142-143). Test briquettes were made from the samples; these were subsequently thin sectioned and point counted (Figures 6.7-6.8). The raw clay sample contains 33 percent sand, while the prepared clay samples, which have added manure, have 35-36 percent sand. All three samples are at the high end of sand content compared with the fiber-tempered archaeological pottery, which ranges from 20-38 percent sand, with a mean of 27 percent (Figure 6.9). Visual examination of horse manure and the point-count data from ethnographic samples suggest a small amount of

Table 6.5. Comparison of temper type assessments made by the ceramicist (low magnification) and the petrographers (high magnification) for sherds from the Rio Nuevo Archaeology project.

Sample Number	Ceramic Type	Ceramicist's Temper Type	Petrographer's Temper Type	Results
RNA2-01	Indeterminate red	Sand	Sandy clay	Agree
RNA2-02	Indeterminate red	Sand	Sand	Agree
RNA2-03	Indeterminate red	Sand	Sand	Agree
RNA2-04	Unspecified plain ware	Sand	Sand	Agree
RNA2-05	Indeterminate red	Sand	Sand	Agree
RNA2-06	Indeterminate red	Sand	Sand	Agree
RNA2-07	Unspecified plain ware	Sand	Sand	Agree
RNA2-08	Indeterminate red	Sand	Sand	Agree
RNA2-09	Indeterminate red	Sand	Sand	Agree
RNA2-10	Indeterminate red	Sand	Sand	Agree
RNA2-11	Indeterminate red	Sand	Sand	Agree
RNA2-12	Indeterminate red	Sand	Sandy clay	Agree
RNA2-13	Indeterminate red	Sand plus grog	Sand plus grog	Agree
RNA2-14	Indeterminate red	Sand plus grog	Sand plus grog	Agree
RNA2-15	Indeterminate red	Sand plus grog	Sandy clay plus grog	Agree
RNA2-16	Indeterminate red	Sand plus grog	Sand plus grog	Agree
RNA2-17	Sobaipuri Plain (folded rim)	Sand plus grog	Sand plus grog	Agree
RNA2-18	Unspecified plain ware	Sand plus grog	Sand plus grog	Agree
RNA2-19	Unspecified plain ware	Sand plus grog	Sand	Agree
RNA2-20	Unspecified plain ware	Sand plus grog	Sandy clay plus grog	Agree
RNA2-21	Papago Plain	Sand plus manure/fiber	Sand plus manure/fiber	Agree
RNA2-22	Papago Red	Sand plus manure/fiber	Sand plus manure/fiber	Agree
RNA2-23	Papago Red	Sand plus manure/fiber	Sand plus manure/fiber	Agree
RNA2-24	Indeterminate red	Sand	Sand	Agree
RNA-39	Sobaipuri Plain (folded rim)	Sand	Sand	Agree
RNA-40	Unspecified plain ware	Sand	Sand	Agree
RNA-41	Sobaipuri Plain (folded rim)	Sand	Sand	Agree
RNA-42	Unspecified plain ware	Sand	Sand	Agree
RNA-43	Unspecified plain ware	Sand plus grog	Sand plus grog	Agree
RNA-44	Papago Red	Sand	Sand plus manure/fiber	Disagree
RNA-45	Papago Plain	Sand	Sand	Agree
RNA-46	Unspecified plain ware	Sand	Sandy clay	Agree
RNA-47	Indeterminate red	Sand	Sand	Agree
RNA-48	Unspecified plain ware	Sand	Sandy clay	Agree
RNA-49	Sobaipuri Plain (folded rim)	Sand	Sandy clay	Agree
RNA-50	Unspecified plain ware	Sand	Sandy clay	Agree
RNA-51	Sobaipuri Plain (folded rim)	Sand plus grog	Sand plus grog	Agree
RNA-52	Sobaipuri Plain (folded rim)	Sand plus grog	Sandy clay plus grog	Agree
RNA-53	Unspecified plain ware	Sand plus grog	Sand plus grog	Agree
RNA-54	Indeterminate red	Sand plus grog	Sandy clay plus grog	Agree
RNA-55	Sobaipuri Plain (folded rim)	Sand plus grog	Sand plus grog	Agree
RNA-56	Unspecified plain ware	Sand plus grog	Sand plus grog	Agree
RNA-57	Indeterminate red	Sand plus grog	Sand plus grog	Agree

Table 6.5. Continued.

Sample Number	Ceramic Type	Ceramicist's Temper Type	Petrographer's Temper Type	Results
RNA-58	Papago Plain	Sand plus manure/fiber	Sand plus manure/fiber	Agree
RNA-59	Papago Red	Sand plus manure/fiber	Sand plus manure/fiber	Agree
RNA-60	Papago Red	Sand plus manure/fiber	Sand plus manure/fiber	Agree
RNA-61	Papago Plain	Sand plus manure/fiber	Sand plus manure/fiber	Agree
RNA-62	Papago Plain	Sand plus manure/fiber	Sand plus manure/fiber	Agree
RNA-63	Papago Red	Sand plus manure/fiber	Sand plus manure/fiber	Agree
RNA-64	Papago Plain	Sand plus manure/fiber	Sand plus manure/fiber	Agree
RNA-65	Papago Red	Sand plus manure/fiber	Sand plus manure/fiber	Agree
RNA-66	Papago Plain	Sand plus manure/fiber	Sand plus manure/fiber	Agree
RNA-67	Papago Plain	Sand plus manure/fiber	Sand plus manure/fiber	Agree
RNA-68	Papago Red	Sand plus manure/fiber	Sand plus manure/fiber	Agree
RNA-69	Papago Plain	Sand plus manure/fiber	Sand plus manure/fiber	Agree
RNA-70	Papago Plain	Sand plus manure/fiber	Sand plus manure/fiber	Agree

sand could have been introduced into the paste from manure temper, although the bulk of the sand-sized grains in the temper were probably a natural component of the clay.

Behavioral Implications of the Material Types

After full consideration of the data, we included all sand-sized grains from fiber-tempered pottery in our statistical analysis, on the assumption that the sand is predominantly derived from the clay itself, and that it reflects the provenance of that material. We recognize that our sand samples may not be the perfect source material from which to match sandy clays derived from soils, but we assert that they are similar enough to compare statistically. Therefore, the sand in fiber-tempered pottery is treated as if it were sand temper for statistical purposes. However, the collection of sandy clays from soils is a different behavior than the collection of sand to temper clay.

Ethnographic examples collected from around the world show that potters sometimes collect clay resources from farther away than sand resources (Arnold 1985; Heidke 2006; Heidke et al. 2002; Heidke et al. 2006; Miksa and Heidke 1995). Most clays are collected within 4 km of the pottery production locations (Figure 6.10). An examination of a box-and-whiskers plot of 150 distance-to-clay resource measurements shows the median distance to clay as 2 km, with the upper hinge (75 percent) at 4 km. There are 16 outliers between 8 km and 50 km. Of these 16 outliers, only one is specified as foot transport of the material. The remaining distance-to-resource data do not list the specific mode of transport,

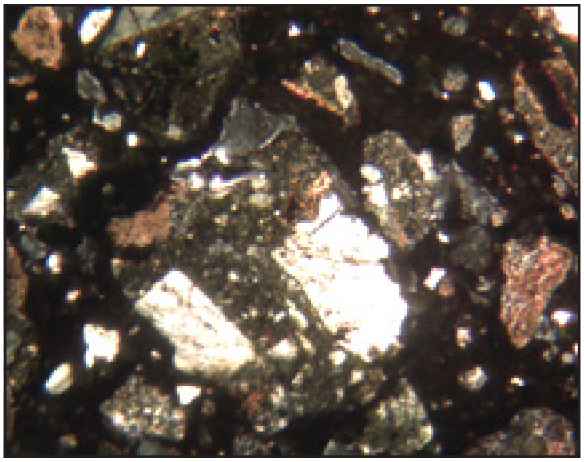

Figure 6.2. Photomicrograph of a Beehive Petrofacies sand-tempered sherd.

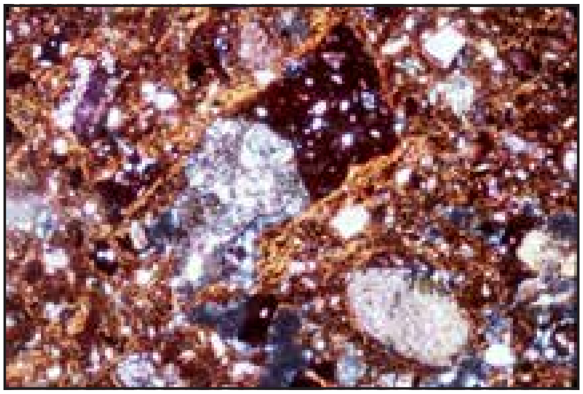

Figure 6.3. Photomicrograph of sherd RNA-52, tempered with Beehive Petrofacies sand plus grog. (Photograph was taken at 13.2x magnification under crossed nicols; note the sand temper in the dark grog fragment.)

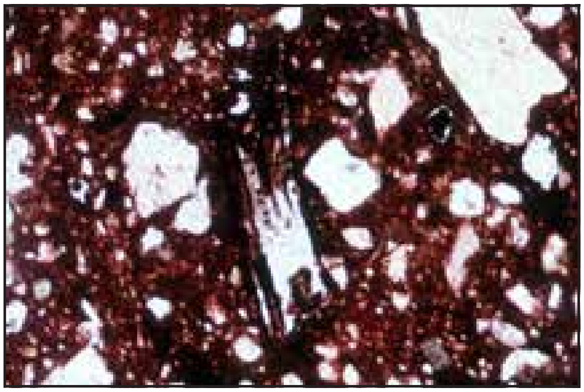

Figure 6.4. Photomicrograph of sherd RNA2-22, showing prismatic fiber voids, carbon rim, and some remnant fiber structure. (Photograph was taken at 13.2x magnification under plane polarized light.)

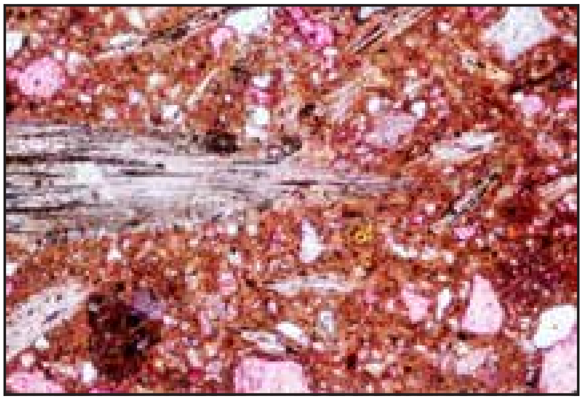

Figure 6.7. Photomicrograph of an unfired briquet made from an ethnographic collection of prepared clay (ASM number E6100) collected by Fontana et al. (1962). (Note the abundant fiber in the paste; photograph was taken at 13.2x magnification under plane polarized light.)

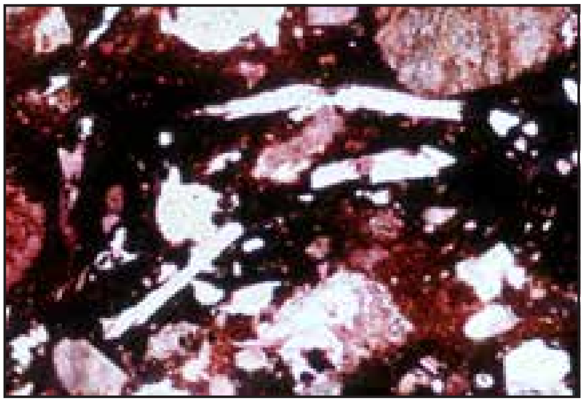

Figure 6.5. Photomicrograph of sherd RNA-44, showing elongated fiber voids, one of which is bent around a sand grain. (Photograph was taken at 13.2x magnification under plane polarized light.)

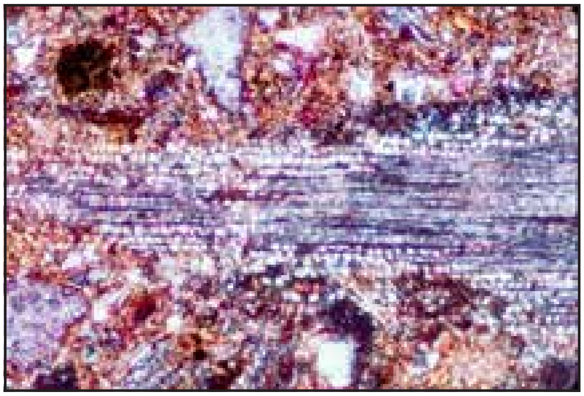

Figure 6.8. Photomicrograph of an unfired briquet made from an ethnographic collection of prepared clay (ASM number E6100) collected by Fontana et al. (1962). (Close-up of structural detail; photograph was taken at 33x magnification under cross polarized light.)

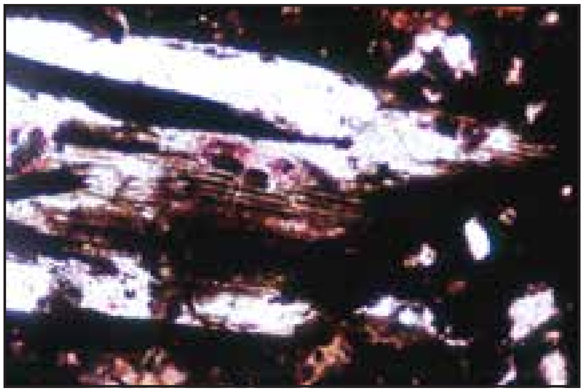

Figure 6.6. Photomicrograph of sherd RNA2-23, showing detail of a fiber void with remnant plant structure. (Photograph was taken at 33x magnification under crossed nicols.)

so some non-foot transport distances may be included (Heidke et al. 2006). Examination of the ethnographic and historic literature for O'odham and Sobaipuri potters of southern and western Arizona suggest their distance-to-clay resource measurements would have been within the 4 km estimate, at least while human labor was the primary mode of transportation. We use this distance in calculating clay procurement by historic Native American potters.

Temper Composition Analysis

Temper composition of the Rio Nuevo sherds was characterized by Heidke. Because only 56 of 2,373 characterized sherds were selected for thin-section analysis, the overall thin-section proportion for this data set is 2.4 percent (Table 6.6). This is approximately half the usual proportion of thin sections selected for verification purposes (Miksa and Heidke 2001). The low proportion is due to a number of circumstances. First, sherds assigned to the unspecified generic and specific temper composition group were not sampled due to their low information value. The high number of fine-grained or fiber-tempered historic sherds in this data set led to a high number of unspecified temper designations, because temper could not be distinguished at low, reflected light magnification. This group includes 666 of the 2,373 sherds, or 28 percent of the data set. This group was sampled at a deliberately low rate for this project, due to its low information value and the likelihood that the sherds belonged to multiple compositions.

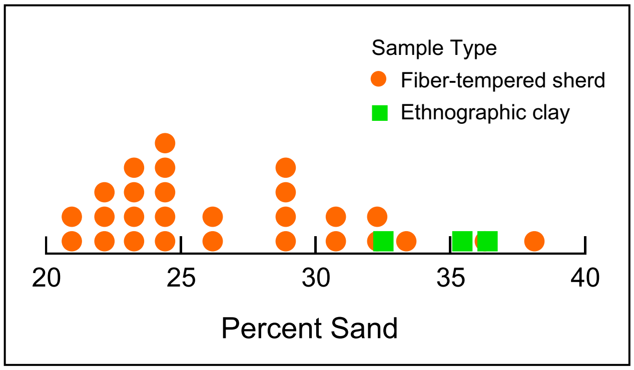

Figure 6.9. Dot density graph showing the proportion of sand in the sand plus fiber-tempered sherds versus the fiber-tempered ethnographically collected prepared clays.

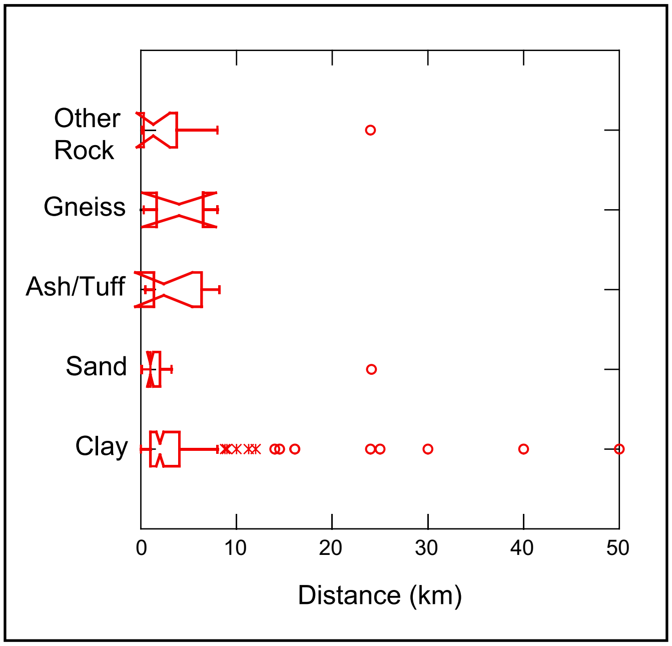

Figure 6.10. Ethnographic distance-to-resource measurements, by resource type.

Sherds belonging to the "Fine Paste" generic group were not thin sectioned due to their lack of sand-sized grains. Sherds assigned to the "Santan or Gila Butte Schist Plus Sand" and "Metamorphic Core Complex" generic groups, and the Catalina and Tortolita petrofacies, were not sampled because they represent a very low proportion of the complete data set.

The Twin Hills Petrofacies was sampled at a lower rate because Heidke has shown his ability to recognize these petrofacies on previous projects (Heidke 2000, 2003a, 2003b, 2006; Heidke et al. 1998). Although Heidke has demonstrated a similar success rate with the Beehive Petrofacies sand-tempered sherds, this group is still being sampled at a higher rate to explore the limits of this composition, especially at its southern edge where it meets the Black Mountain Petrofacies. Sherds assigned to the volcanic generic group with an unspecified petrofacies were sampled at a low rate, due to their lower information value and the likelihood that they would represent several petrofacies. In the remaining composition groups, sampling rates of approximately 4-10 percent were used to test the temper characterizations. This sampling rate is adequate to test the diversity of the sample and the accuracy of the ceramicist's temper characterizations within the sampled groups.

After the petrographic analysis was complete, sherds were submitted as unknowns for classification by the current Tucson Basin discriminant analysis model (Miksa 2006), following standard statistical analysis methods for point-counted sherds (Heidke and Miksa 2000; Miksa and Heidke 2001). The discriminant model used for this project considers only the 18 petrofacies in the Tucson Basin proper. It includes 243 sands, of which 214 are classified correctly by the model, for an accuracy of 88 percent. The model comprises nine nested discriminant analysis models. The output at each modeling level is used as the input for the next level, as detailed in Heidke and Miksa (2000). The point-count parameters and calculated parameters used in each level of the model are shown in Table 6.7, and a schematic view of how the nested models relate to each another is provided in Figure 6.11.

Table 6.6. Proportion of thin sections by concatenated generic temper source and specific temper source groups, Rio Nuevo Archaeology project.

		Number of Sherds (number of thin sections) in the Detailed Ceramic Analysis Set, by Site[b]					
Generic Temper Source[a]	Specific Temper Source[a]	BB:13:13	BB:13:481	BB:13:6	Total Sherds	Total Thin Sections	Thin Section Proportion
Unspecified	Unspecified	82 (2)	13 (0)	571 (4)	666	6	0.9
Fine paste	Unspecified	0 (0)	4 (0)	91 (0)	95	0	0.0
Santan or Gila Butte schist plus sand	Unspecified	0 (0)	0 (0)	5 (0)	5	0	0.0
Metamorphic core complex	Catalina	0 (0)	0 (0)	11 (0)	11	0	0.0
Metamorphic core complex	Unspecified	0 (0)	0 (0)	15 (0)	15	0	0.0
Granitic	Unspecified	171 (15)	0 (0)	117 (2)	288	17	5.9
Granitic	Tortolita	0 (0)	0 (0)	3 (0)	3	0	0.0
Mixed volcanic and granitic	Unspecified	39 (4)	0 (0)	3 (0)	42	4	9.5
Granitic and mixed lithic	Santa Cruz River	0 (0)	0 (0)	239 (9)	239	9	3.8
Granitic and mixed lithic	Unspecified	25 (2)	0 (0)	1 (0)	26	2	7.7
Volcanic	Unspecified	17 (2)	0 (0)	390 (4)	407	6	1.5
Volcanic	Beehive	50 (5)	0 (0)	218 (5)	268	10	3.7
Volcanic	Twin Hills	12 (0)	0 (0)	296 (2)	308	2	0.6
Column totals		396 (30)	17 (0)	1,960 (26)	2,373	56	2.4

[a]From ceramicist's temper characterization.
[b]All sites are AZ # (ASM).

Results

Discriminant analysis results for the compositional analysis are shown in Table 6.8. Fifty-three of the 56 thin-sectioned sherds were given final petrofacies assignments. It is informative to examine the sherds in terms of the generic and specific temper groups assigned during the detailed analysis. Discriminant analysis assigns all submitted samples to the closest group in multidimensional space, even though the samples may be far from the closest group. Thus, discriminant assignments are checked for accuracy before a final petrofacies assignment is made.

The six sherds with both generic and specific temper source unspecified were difficult to classify even with quantitative petrographic data. One was thought to belong to the Rincon Petrofacies by the petrographer. The discriminant analysis also classified the sherd as Rincon Petrofacies, so the final assignment is accepted as Rincon Petrofacies. Two of the sherds have a final classification as indeterminate. The petrographer's temper assignment did not match that of the discriminant analysis, and after much additional inspection and comparison of composition proportions, none of the assignments could be affirmed as correct. Consequently, these sherds have "Indeterminate" temper classifications. One of the sherds was thought to be extrabasinal by the petrographers. It was assigned to the Airport Petrofacies in the discriminant analysis, but does not have any volcanic grain types in common with that petrofacies. The temper in this sherd bears some similarity to rocks located west of Avra Valley and should be compared with source materials from the Altar Valley should they become available. Finally, two of the unspecified sherds were thought to belong to the Black Mountain Petrofacies by the petrographer. Both were assigned to Black Mountain Petrofacies by the discriminant analysis. Their final assignment is Black Mountain Petrofacies.

Seventeen of the thin-sectioned sherds were assigned to the "Granitic Sand, Unspecified Petrofacies" group. These sherds come from historic Native American pots with fiber temper. The petrographers characterized them as coming from either the Black

Table 6.7. Point–count parameters and calculated parameters used for each discriminant analysis model.

	Family Level	Granitic-Metamorphic Generic Level	Granitic, Rich in Microcline	Granitic, Rich in Heavy Minerals	Volcanic, Generic Level	Volcanic, Rich in Feldspars	Volcanics Only, Generic Level	Tucson Mountains, East	Tucson Mountains, North and West
Petrofacies			*A, G, K, O, P*	*B, E1, E2, E3, S*		*Bv, I*		*J1, J2, J3*	*L, M, Mw*
TQtz	X	X	X	X	X	X	X	X	X
Kspar	X	–	–	–	–	–	–	X	–
Micr	X	X	X	–	–	–	–	X	–
TKspar	–	–	X	–	–	–	–	–	–
K	–	–	–	X	–	X	–	–	X
TPlag	X	–	X	X	–	X	X	X	X
TMusc	–	–	X	X	–	–	–	–	–
TBiotchlor	–	–	X	–	X	–	X	–	–
Mica	–	–	–	–	–	X	–	X	–
PlagPyr	–	X	–	–	–	–	–	–	–
TOpaq	–	–	X	–	X	–	–	X	–
PyrOpaq	–	–	–	X	–	–	–	–	–
Epid	–	X	X	X	–	–	–	–	–
Pyrepid	–	–	–	–	–	–	–	X	–
Hmin	X	–	–	–	–	X	–	–	–
Lma2	–	–	–	–	–	X	–	–	–
Lmmf	–	–	–	X	–	–	X	–	–
Lmatp	–	–	–	X	–	–	–	–	–
Lmmftp	–	–	–	–	–	X	–	–	–
Lm_Musc	–	X	–	–	–	–	–	–	–
Lm	X	–	X	–	X	–	–	–	–
Lvf2	–	–	X	–	–	X	–	–	X
Lvm2	–	–	–	–	–	X	–	–	X
Lvmf2	–	–	–	–	–	–	–	X	–
Lvv	–	–	–	–	–	–	–	X	–
Lvh	–	–	–	–	–	–	X	X	–
Lv	X	X	–	–	X	–	–	–	–
Ls	–	–	–	–	X	X	–	–	X
Lsclas	–	–	–	–	–	–	X	X	–
Lscaco	–	–	–	–	–	–	X	–	–

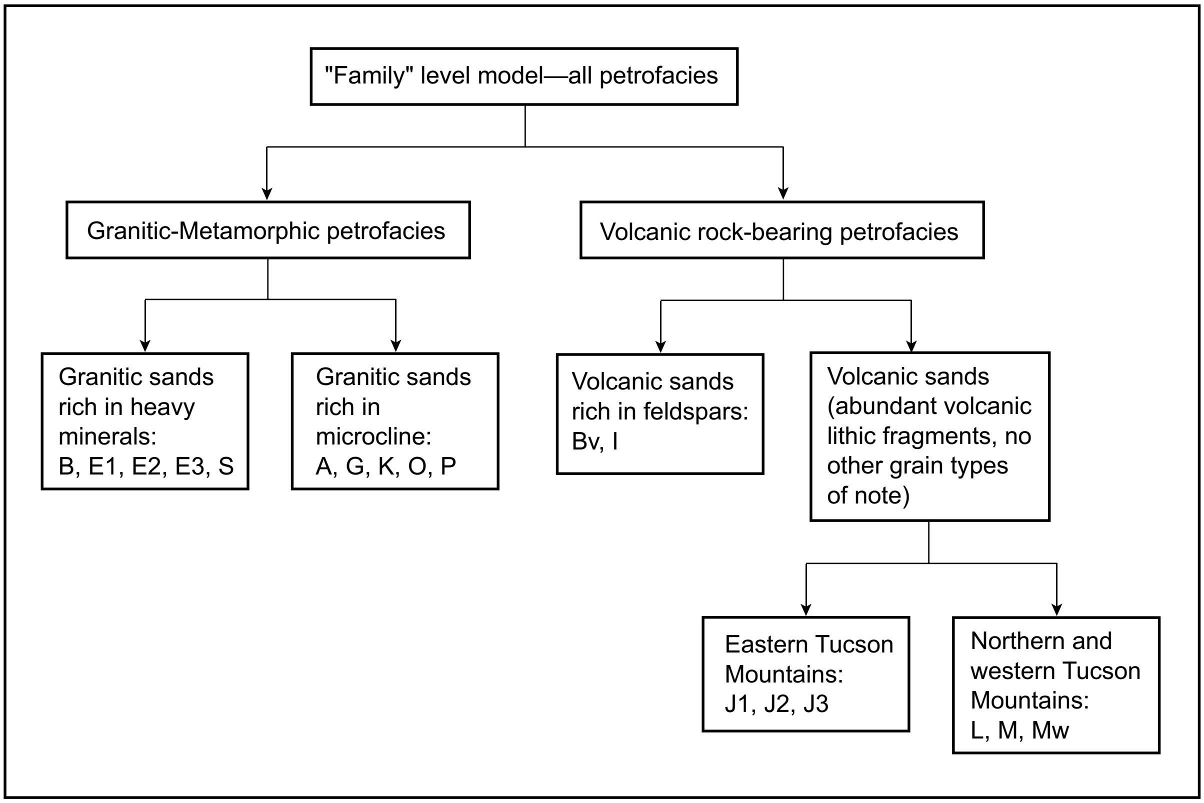

Figure 6.11. Schematic diagram illustrating the relationships among the nested discriminant models in the Tucson Basin Petrofacies model.

Mountain or Sierrita petrofacies. The discriminant analysis also assigned 16 of the sherds to one of these two petrofacies, although the petrographer's assignment does not necessarily match the discriminant analysis assignment in any given case. These sherds have been assigned to the final group "Black Mountain or Sierrita petrofacies." There is considerable compositional gradation in this group between the two petrofacies, and it is difficult to assign them to one petrofacies or another. This may be a case in which the application of sand point-count data to the provenance characterization of sandy pedogenic clay is less exact than preferred. It may also reflect use of the resources in a gradational boundary zone between the two petrofacies (see the case study discussion below). To further complicate the situation, the Black Mountain Petrofacies was not adequately sampled and described at the time of the sherd characterization, so Heidke was unable to identify the sherds to specific petrofacies. Since that time, Heidke has learned to recognize the specific grain combination that characterizes the Black Mountain Petrofacies and to distinguish it from the Sierrita Petrofacies (Heidke and Miksa 2006).

The sherd that was not assigned to either the Black Mountain or Sierrita petrofacies by the discriminant analysis model merits a specific note. Sample RNA-45 was assigned to the Twin Hills Petrofacies by the discriminant analysis model. This sample has a higher than usual proportion of a micrigranite that is generally found in the Black Mountain Petrofacies. The micrigranite is counted on the LVH parameter (see Table 6.2), but is not the same as the spherulitic hypabyssal volcanic found in the Twin Hills Petrofacies, which is also counted on the LVH parameter. Although this type of overlap rarely causes problems, in this case, it led to a faulty discriminant analysis characterization.

Four sherds characterized by the ceramicist as belonging to the "Mixed Volcanic and Granitic" generic group with an unspecified petrofacies were characterized as belonging to the Black Mountain Petrofacies by the petrographers. Three of the four were classified as Black Mountain Petrofacies by the discriminant analysis; the fourth was assigned to the Airport Petrofacies. The volcanic grains in the four samples are consistent with the mixture of volcanic lithic fragments seen on the western side of the Santa Cruz River near the Black Mountain Petrofacies, not with those seen on the eastern side of the Santa Cruz River in the Airport Petrofacies. The final assignment for the four sherds is the Black Mountain Petrofacies.

Table 6.8. Discriminant analysis results and petrofacies characterizations for the point-counted sherds.

Sample Number	Ceramic Type	Ceramicist's Generic Temper Source	Ceramicist's Petrofacies	Petrographer's Petrofacies	Discriminant Analysis Predicted Petrofacies	Final Petrofacies Assignment
RNA2-01	Indeterminate red	Unspecified	Unspecified	Rincon	Rincon	Rincon
RNA2-02	Indeterminate red	Unspecified	Unspecified	Beehive	Catalina Volcanic	Indeterminate
RNA2-03	Indeterminate red	Unspecified	Unspecified	Extrabasinal	Airport	Extrabasinal
RNA2-04	Unspecified plain ware	Volcanic	Beehive	Beehive	Golden Gate	Beehive
RNA2-05	Indeterminate red	Granitic and mixed lithic	Santa Cruz River	Black Hills	Santa Rita	Airport
RNA2-06	Indeterminate red	Granitic and mixed lithic	Santa Cruz River	Beehive	Airport	Airport
RNA2-07	Unspecified plain ware	Granitic and mixed lithic	Santa Cruz River	Beehive	Airport	Airport
RNA2-08	Indeterminate red	Granitic and mixed lithic	Santa Cruz River	Beehive	Santa Rita	Airport
RNA2-09	Indeterminate red	Granitic and mixed lithic	Santa Cruz River	Beehive	Airport	Airport
RNA2-10	Indeterminate red	Granitic and mixed lithic	Santa Cruz River	Black Hills	Airport	Airport
RNA2-11	Indeterminate red	Granitic and mixed lithic	Santa Cruz River	Beehive	Airport	Airport
RNA2-12	Indeterminate red	Granitic and mixed lithic	Santa Cruz River	Beehive	Airport	Airport
RNA2-13	Indeterminate red	Volcanic	Unspecified	Beehive	Golden Gate	Beehive
RNA2-14	Indeterminate red	Volcanic	Unspecified	Beehive	Beehive	Beehive
RNA2-15	Indeterminate red	Volcanic	Unspecified	Beehive	Beehive	Beehive
RNA2-16	Indeterminate red	Volcanic	Unspecified	Beehive	Beehive	Beehive
RNA2-17	Sobaipuri Plain (folded rim)	Volcanic	Beehive	Beehive	Beehive	Beehive
RNA2-18	Unspecified plain ware	Volcanic	Beehive	Beehive	Beehive	Beehive
RNA2-19	Unspecified plain ware	Volcanic	Beehive	Beehive	Golden Gate	Beehive
RNA2-20	Unspecified plain ware	Volcanic	Beehive	Beehive	Beehive	Beehive
RNA2-21	Papago Plain	Unspecified	Unspecified	Granitic	Airport	Indeterminate
RNA2-22	Papago Red	Granitic	Unspecified	Black Hills	Sierrita	Black Hills or Sierrita
RNA2-23	Papago Red	Granitic	Unspecified	Black Hills	Twin Hills	Black Hills or Sierrita
RNA2-24	Indeterminate red	Granitic and mixed lithic	Santa Cruz River	Beehive	Beehive	Airport
RNA-39	Sobaipuri Plain (folded rim)	Unspecified	Unspecified	Black Hills	Black Hills	Black Hills
RNA-40	Unspecified plain ware	Volcanic	Beehive	Beehive	Beehive	Beehive
RNA-41	Sobaipuri Plain (folded rim)	Volcanic	Beehive	Black Hills	Black Hills	Beehive
RNA-42	Unspecified plain ware	Volcanic	Twin Hills	Twin Hills	Twin Hills	Twin Hills

Table 6.8. Continued.

Sample Number	Ceramic Type	Ceramicist's Generic Temper Source	Ceramicist's Petrofacies	Petrographer's Petrofacies	Discriminant Analysis Predicted Petrofacies	Final Petrofacies Assignment
RNA-43	Unspecified plain ware	Volcanic	Twin Hills	Twin Hills	Twin Hills	Twin Hills
RNA-44	Papago Red	Granitic	Unspecified	Black Hills	Black Hills	Black Hills or Sierrita
RNA-45	Papago Plain	Granitic	Unspecified	Black Hills	Black Hills	Black Hills or Sierrita
RNA-46	Unspecified plain ware	Mixed volcanic and granitic	Unspecified	Black Hills	Airport	Black Hills
RNA-47	Indeterminate red	Mixed volcanic and granitic	Unspecified	Black Hills	Black Hills	Black Hills
RNA-48	Unspecified plain ware	Mixed volcanic and granitic	Unspecified	Black Hills	Black Hills	Black Hills
RNA-49	Sobaipuri Plain (folded rim)	Granitic and mixed lithic	Unspecified	Sierrita	Airport	Airport
RNA-50	Unspecified plain ware	Granitic and mixed lithic	Unspecified	Santa Rita	Santa Rita	Airport
RNA-51	Sobaipuri Plain (folded rim)	Unspecified	Unspecified	Black Hills	Black Hills	Black Hills
RNA-52	Sobaipuri Plain (folded rim)	Volcanic	Unspecified	Beehive	Beehive	Beehive
RNA-53	Unspecified plain ware	Volcanic	Unspecified	Beehive	Beehive	Beehive
RNA-54	Indeterminate red	Volcanic	Beehive	Beehive	Beehive	Beehive
RNA-55	Sobaipuri Plain (folded rim)	Volcanic	Beehive	Beehive	Beehive	Beehive
RNA-56	Unspecified plain ware	Volcanic	Beehive	Beehive	Beehive	Beehive
RNA-57	Indeterminate red	Mixed volcanic and granitic	Unspecified	Black Hills	Black Hills	Black Hills
RNA-58	Papago Plain	Granitic	Unspecified	Sierrita	Sierrita	Black Hills or Sierrita
RNA-59	Papago Red	Granitic	Unspecified	Sierrita	Black Hills	Black Hills or Sierrita
RNA-60	Papago Red	Granitic	Unspecified	Sierrita	Black Hills	Black Hills or Sierrita
RNA-61	Papago Plain	Granitic	Unspecified	Sierrita	Sierrita	Black Hills or Sierrita
RNA-62	Papago Plain	Granitic	Unspecified	Sierrita	Black Hills	Black Hills or Sierrita
RNA-63	Papago Red	Granitic	Unspecified	Sierrita	Black Hills	Black Hills or Sierrita
RNA-64	Papago Plain	Granitic	Unspecified	Sierrita	Sierrita	Black Hills or Sierrita
RNA-65	Papago Red	Granitic	Unspecified	Sierrita	Sierrita	Black Hills or Sierrita
RNA-66	Papago Plain	Granitic	Unspecified	Sierrita	Sierrita	Black Hills or Sierrita
RNA-67	Papago Plain	Granitic	Unspecified	Sierrita	Sierrita	Black Hills or Sierrita
RNA-68	Papago Red	Granitic	Unspecified	Sierrita	Sierrita	Black Hills or Sierrita
RNA-69	Papago Plain	Granitic	Unspecified	Sierrita	Sierrita	Black Hills or Sierrita
RNA-70	Papago Plain	Granitic	Unspecified	Sierrita	Sierrita	Black Hills or Sierrita

Two sherds were characterized by the ceramicist as belonging to the "Granitic Plus Mixed Lithic" generic group with an unspecified petrofacies. One was characterized as the Sierrita Petrofacies by the petrographers, while the other was characterized as belonging to the Santa Rita Petrofacies. In the discriminant analysis model, the first was characterized as belonging to the Airport Petrofacies, while the second was characterized as belonging to the Santa Rita Petrofacies. On petrographic review, both samples were assigned to the Airport Petrofacies; however, this is a provisional assignment. Additional information is necessary to assess the compositional range of both petrofacies, especially the distal ends near the Santa Cruz River.

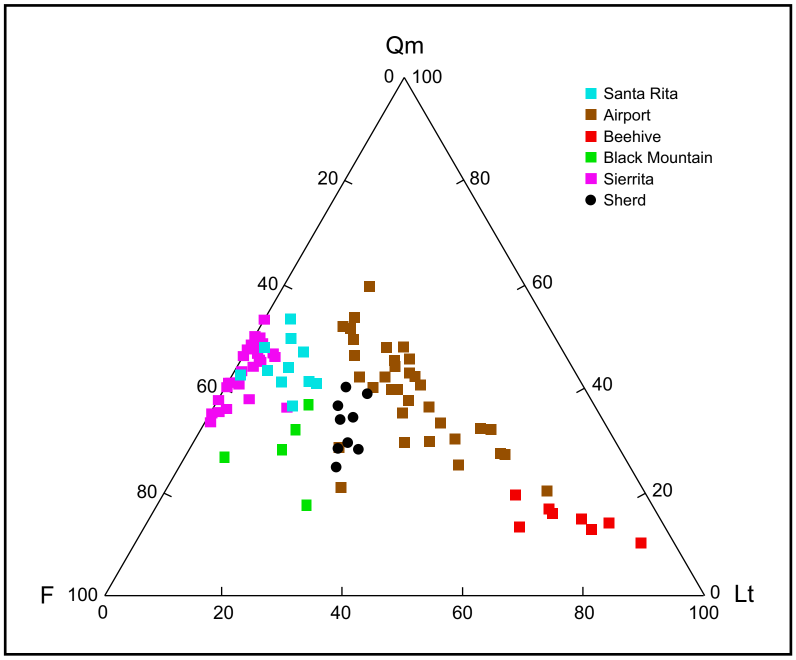

Figure 6.12. QmFLt ternary plot showing sherds assigned to the Airport Petrofacies, along with sand from the Airport, Beehive, Black Mountain, Santa Rita, and Sierrita petrofacies.

Nine samples were characterized by the ceramicist as belonging to the "Granitic Plus Mixed Lithic" generic group and the Santa Cruz River Petrofacies. These samples were characterized by the petrographers as belonging to the Beehive and Black Mountain petrofacies. The discriminant analysis classification for six of the samples is the Airport Petrofacies. Two samples are classified as members of the Santa Rita Petrofacies. One sample was classified as a member of the Beehive Petrofacies, although it lacks the distinctive volcanic grains of that petrofacies. Extensive petrographic review shows that the initial characterization by both the ceramicist and the petrographers was incorrect.[1] A QmFLt ternary plot of the composition shows that the temper composition of the sherds overlaps with the composition of Airport Petrofacies sands, but not with those of the Santa Rita Petrofacies (Figure 6.12). Volcanic lithic fragments in the sherds are consistent with those of Airport Petrofacies sands. Therefore, the final assignment of these sherds is to the Airport Petrofacies. With recent improvements in the description of the Airport Petrofacies, and improved characterizations to help distinguish between Airport and Santa Cruz River petrofacies sands in hand-sample, it should be possible to make this distinction more easily in the future.

Six samples were assigned by the ceramicist to the volcanic generic group, with petrofacies unspecified. These samples were characterized by the petrographers as Beehive Petrofacies. The discriminant analysis classification for five of the samples is the Beehive Petrofacies, while the sixth is to the Golden Gate Petrofacies. Petrographic review of the samples suggests all six belong to the Beehive Petrofacies.

Ten samples were assigned by the ceramicist to the volcanic generic group and the Beehive Petrofacies. Nine of the 10 sherds were characterized as Beehive Petrofacies by the petrographers and the discriminant analysis model; the tenth was characterized as Black Mountain Petrofacies by the petrographers and the discriminant analysis model. After petrographic review, all 10 samples were assigned to the Beehive Petrofacies.

Two samples were assigned by the ceramicist to the volcanic generic group and the Twin Hills Petrofacies. Both samples were also assigned to the Twin Hills Petrofacies by the petrographers and the discriminant analysis model. The final assignment of Twin Hills Petrofacies is accepted for these samples.

Discussion

The data presented above show that sands or sandy clays from four petrofacies were used to manufacture the Native American ceramics recovered from the sites investigated during the Rio Nuevo Archaeology project. These four petrofacies include the following.

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[1] The Airport Petrofacies composition had not been defined at the time Heidke characterized the temper provenance of these sherds.

- The Beehive Petrofacies, which is south-southwest of the Rio Nuevo sites. It is known as a pottery production area since at least A.D. 350. The Beehive Petrofacies is approximately 4 km from the project area sites, so it is not considered a local production source for the sites.
- The Airport Petrofacies, which covers much of the Tucson Basin floor. The Clearwater site is situated just across the Santa Cruz River from the northwestern tip of the Airport Petrofacies; therefore, it is a local source of sand for the site. The Tucson Presidio is located within the Airport Petrofacies.
- The Black Mountain Petrofacies is located approximately 11 km south of the project area sites; it is not a local production source.
- The Sierrita Petrofacies, located approximately 13 km south of the project area sites is not a local production source.

Combining the final characterization data given above and in Table 6.8 with the proportion of the ceramics represented by the thin-sectioned sherds, 49 percent of the sherds are in a petrographically verified group assigned to a petrofacies. Forty-five percent of the study set remains in petrographically verified groups not assigned to a petrofacies. Approximately 5 percent of the sherds in the detailed study set were not included in the petrographic verification study.

Examination of Table 6.9 shows that source areas are not distributed equally between the sites. For instance, the San Agustín Mission locus has a much larger proportion of sherds identified as originating in the Beehive or Twin Hills petrofacies than the Tucson Presidio, while the Tucson Presidio has a slight majority of the sherds originating in the Black Mountain or Sierrita petrofacies, although the difference is not as pronounced as that for the volcanic petrofacies. The time differences between these two sites may play a role in this difference: The San Agustín Mission locus dates to the Spanish period, A.D. 1694 to 1821, with most of the excavated features dating between 1771 and 1821. The Tucson Presidio dates slightly later, to both the Spanish and Mexican periods, circa A.D. 1775 to 1856. Without additional data and time periods, it is difficult to assess the nature of this pattern. Fortunately, several other sites in the downtown Tucson area have been excavated in recent years and petrographically verified data sets spanning the historic time periods from the Spanish to American Statehood periods are available. A small case study using selected, well-dated features from the Rio Nuevo project sites and other nearby sites has been used to evaluate the relationship among pottery production location, pottery technology, and time in the historic Tucson Basin.

CASE STUDY: THE EFFECTS OF HISTORIC EVENTS ON O'ODHAM POTTERY PRODUCTION IN HISTORIC TUCSON, ARIZONA

In the Historic era, Native Americans in the Tucson area produced ceramic vessels for their own use, as well as for sale or trade to the growing Euro-American community. As noted above, historic ceramics were commonly tempered with sand, sand plus grog, or manure. The pottery production locations and technology of manufacture changed through time. This study explores these changes.

Native American pottery from eight sites and site components in the Tucson area, excavated by Desert Archaeology, Inc., over the last 10 years (Figures 6.13-6.14; Table 6.10) was examined. The sites were occupied throughout the Historic era, from approximately A.D. 1771 to 1929; that is, from the time of Spanish occupation, through the Mexican period, and into the American Territorial and American Statehood periods. The sites are located along the eastern and southern flanks of the Tucson Mountains.

To explore changes in production technology and provenance over time, a collection of 1,097 decorated sherds and plain ware rim sherds from well-dated contexts spanning 12 distinct time intervals at the eight sites was selected for detailed ceramic analysis (Figure 6.15; Table 6.11). The contexts are dated by historic artifact content, and it is these dates that have been applied to the ceramics.

As noted above, information such as ceramic form, style, vessel size, and detailed notes on decorative elements was recorded for each sherd. Additionally, temper attributes were identified by the project ceramicist, so that the sherds could be compared with known sand temper sources available in Tucson. A random sample stratified by ware and temper characterization was used to select 67 of the sherds for thin sectioning so that detailed petrographic analyses could be completed. Overall, a 6.1 percent sample was thin sectioned, although this sample is not distributed evenly through all sampled time intervals (see Figure 6.15). The sherds were point counted and submitted for discriminant analysis, as detailed above.

Results

Results of the discriminant analysis were very strong. Most of the pottery can be assigned to petrofacies found near the central and southern Tucson Mountains. Much of it was produced in the Beehive Petrofacies, a known production area since prehistoric times. Limited numbers of sherds with Twin Hills Petrofacies sands were recovered. This is also a

Table 6.9. Number of sherds and proportion of thin sections in each final provenance group.

					Number of Sherds (proportion of sherds) in the Detailed Ceramic Analysis Set, by Site[b]		
Generic Temper Source[a]	Specific Temper Source[a]	Final Temper Characterization	Total Sherds Not Characterized to Petrofacies	Total Sherds Characterized to Petrofacies	BB:13:13	BB:13:481	BB:13:6
Unspecified	Unspecified	Unspecified	666		82 (0.03)	13 (0.01)	571 (0.024)
Granitic	Unspecified	Black Mountain or Sierrita petrofacies	–	288	171 (0.07)	0 (0.00)	117 (0.005)
Mixed volcanic and granitic	Unspecified	Black Mountain Petrofacies	–	42	39 (0.02)	0 (0.00)	3 (0.001)
Granitic and mixed lithic	Santa Cruz River	Airport Petrofacies	–	239	0 (0.00)	0 (0.00)	239 (0.001)
Granitic and mixed lithic	Unspecified	Airport Petrofacies	-	26	25 (0.01)	0 (0.00)	1 (0.000)
Volcanic	Unspecified	Unspecified	407	–	17 (0.01)	0 (0.00)	390 (0.016)
Volcanic	Beehive	Beehive Petrofacies	–	268	50 (0.02)	0 (0.00)	218 (0.009)
Volcanic	Twin Hills	Twin Hills Petrofacies	–	308	12 (0.01)	0 (0.00)	296 (0.012)
Column totals			1,073	1,171	396 (0.17)	13 (0.01)	1,835 (0.077)

Notes: Total sherds in the study set:	2,373
Total sherds in a petrographically verified group:	2,244
Percentage of total study set in a petrographically verified petrofacies:	*49.3*
Percentage of total study set not in a petrographically verified petrofacies:	*45.2*
Percentage of total study set not petrographically verified:	*5.4*

[a] From ceramicist's temper characterization.

[b] All site numbers are AZ # (ASM).

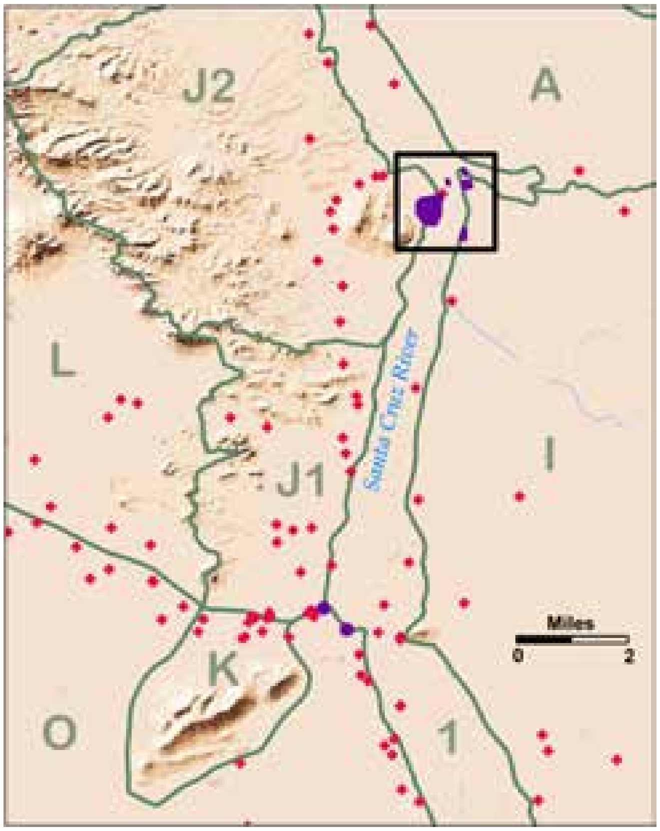

Figure 6.13. Overview of archaeological sites in the case study, showing nearby petrofacies.

known prehistoric production area. Interestingly, a large number of pots produced in the Airport Petrofacies were recovered. Finally, a majority of the pottery recovered from these sites was manufactured in the Black Mountain Petrofacies, or in either the Black Mountain or Sierrita petrofacies. This latter group is a set of ceramics that grades in composition from one petrofacies to the other. The two petrofacies are adjacent and closely related, and their boundary is a diffuse geomorphic transition zone on the bajada of the Sierrita Mountains, with alluvial tributaries moving freely back and forth across the landscape. Much of the pottery was likely produced along the boundary zone between the two petrofacies, near San Xavier del Bac Mission. Two historic villages are noted in a late nineteenth century map of the San Xavier area; they straddle this boundary zone (Chillson 1888). The potters may have lived in or near these villages.

The temper type analysis confirms long-held notions about the change from sand or sand plus grog temper to fiber temper over time (Figure 6.16). Almost all the ceramics recovered from the San Agustín Mission locus, from features dating between 1771 and 1821, are tempered with sand or sand plus grog, as are the ceramics recovered from features at the Tucson Presidio dating from 1810 to 1820. In the ceramics recovered from units dating to the 1820s and 1830s at the Tucson Presidio, fiber temper begins to appear, but other temper types are also used. In the next time interval, 1840-1869, fiber temper jumps to more than 50 percent of the total pottery recovered from the León farmstead, AZ BB:13:505 (ASM). By the 1870s, fiber-tempered pottery comprises the majority of that recovered from all of the sites. By 1890, it is the only temper being used in Native American pottery.

The trends in temper composition reflect those seen in temper type (Figure 6.17). In the earliest San Agustín Mission deposits, the pottery was being produced primarily in the Beehive and Airport petrofacies. The Airport Petrofacies source is local to those sites and to Tucson at the time. The Beehive Petrofacies source is 4 km to the south. There is a very small amount of pottery from the Twin Hills Petrofacies, which is local to the sites. Starting in the early 1820s, the Black Mountain and Sierrita petrofacies

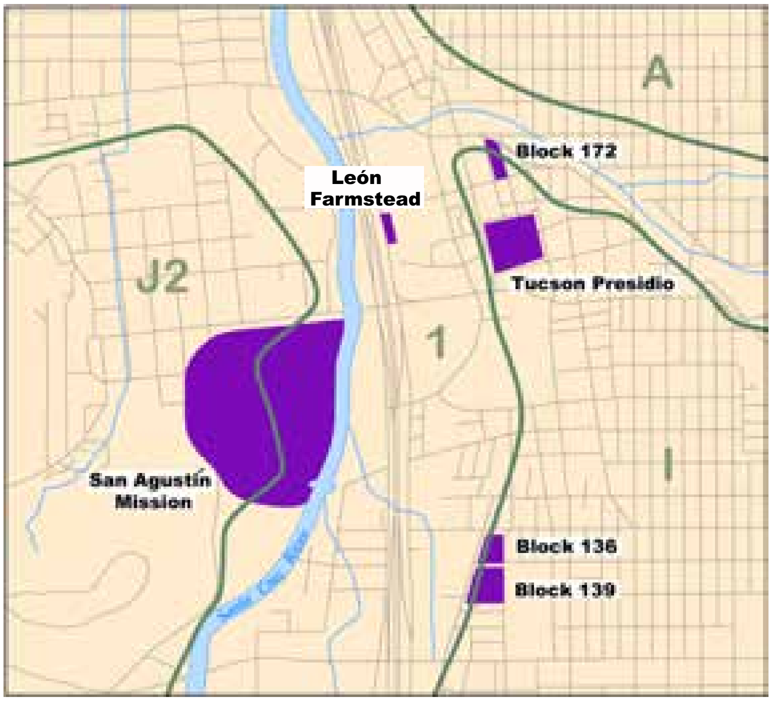

Figure 6.14. Close-up of archaeological sites in the case study, showing site names and locations in downtown Tucson.

Table 6.10. Sites and site components used in the case study.

Site Number	Site Name	Feature	Date Range	Historic Period
AZ BB:13:6 (ASM)	San Agustín Mission	64, 161, 166, 177, 178, 193, 203	1771-1821	Spanish
AZ BB:13:13 (ASM)	Tucson Presidio	373	1810s-1820s	Spanish to Mexican
AZ BB:13:13 (ASM)	Tucson Presidio	409, 441	1820s-1830s	Mexican
AZ BB:13:505 (ASM)	León Farmstead	4 (Stratum 50.03), 14, 25, 28	1840-1869	Mexican and American Territorial
AZ BB:13:6 (ASM)	Carrillo Household	61	1860-1880	American Territorial
AZ BB:13:505 (ASM)	León Farmstead	4 (Stratum 50.02)	1870-1880	American Territorial
AZ BB:13:13 (ASM)	Block 181	376	Late 1870s-early 1890s	American Territorial
AZ BB:13:505 (ASM)	León Farmstead	4 (Stratum 50.01)	1880-1890	American Territorial
AZ BB:13:644 (ASM)	Block 139	19	1890-1895	American Territorial
AZ BB:13:668 (ASM)	Block 172	46, 54	1891/1892-1900	American Territorial
AZ BB:13:513 (ASM)	Block 136	60	1898-1911	American Territorial and American Statehood
AZ BB:13:513 (ASM)	Block 136	7, 41	1916-1929	American Territorial and American Statehood

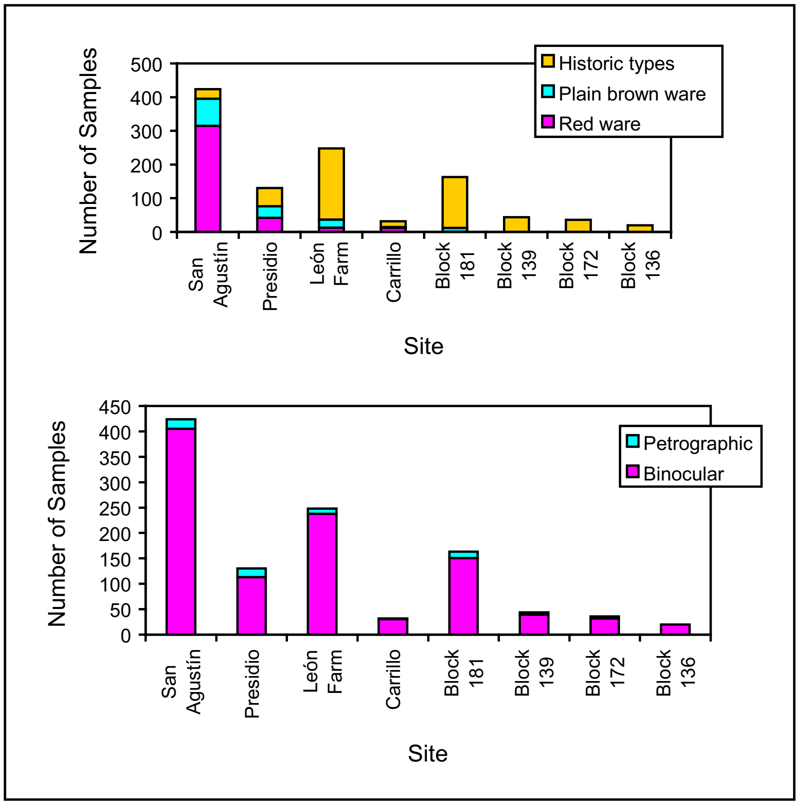

Figure 6.15. Distribution of ceramic sample, by ware, site, and analytical group.

begin to be used, and apparent production falls off at the Beehive Petrofacies. Clearly, the Native American population was still free to use materials located in a wide area around Tucson. This changed, however, as the century progressed. In the 1840 to 1869 time interval, there was a dramatic increase in pottery produced in the Black Mountain/Sierrita petrofacies, concomitant with the change to fiber temper. By the 1870s, the Black Mountain/Sierrita petrofacies composition dominates the assemblage, and its proportion increases through time.

These changes in ceramic technology and provenance coincide with the major political events of the Historic era. The Spanish claimed Arizona soon after their *entrada* into the "New World," although there was not a strong Spanish presence near Tucson until Father Kino founded missions at Guevavi (1692) and San Xavier del Bac (1699). The San Agustín Mission, a *visita* of San Xavier, was founded in 1757 at the Native American village of "*Schook-shon*," followed by the Tucson Presidio in 1776. Throughout this time, the Spanish exercised political control over the Tucson area, until Mexico established independence in 1821. Interestingly, although the San Xavier Mission was well established prior to 1800, it is not until the second decade of the nineteenth century that Black Mountain/Sierrita

Table 6.11. Number of sherds in the case study, by ware, site, time interval, and type of analysis.

	Time Interval												
Site[a]	1771-1821	1810s-1820s	1820s-1830s	1840-1869	1860-1880	1870-1880	Late 1870s-Early 1890s	1880-1890	1890-1895	1891/1892-1900	1898-1911	1916-1929	Row Total
Total Sherds Analyzed													
Red Ware													
BB:13:006	315	0	0	0	12	0	0	0	0	0	0	0	327
BB:13:013	0	18	24	0	0	0	1	0	0	0	0	0	43
BB:13:505	0	0	0	13	0	0	0	0	0	0	0	0	13
BB:13:513	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:644	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:668	0	0	0	0	0	0	0	0	0	0	0	0	0
Column total	315	18	24	13	12	0	1	0	0	0	0	0	383
Plain Brown Ware													
BB:13:006	80	0	0	0	3	0	0	0	0	0	0	0	83
BB:13:013	0	9	25	0	0	0	11	0	0	0	0	0	45
BB:13:505	0	0	0	16	0	1	0	7	0	0	0	0	24
BB:13:513	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:644	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:668	0	0	0	0	0	0	0	0	0	0	0	0	0
Column total	80	9	25	16	3	1	11	7	0	0	0	0	152
Historic Types													
BB:13:006	29	0	0	0	17	0	0	0	0	0	0	0	46
BB:13:013	0	10	44	0	0	0	151	0	0	0	0	0	205
BB:13:505	0	0	0	66	0	14	0	131	0	0	0	0	211
BB:13:513	0	0	0	0	0	0	0	0	0	0	15	5	20
BB:13:644	0	0	0	0	0	0	0	0	44	0	0	0	44
BB:13:668	0	0	0	0	0	0	0	0	0	36	0	0	36
Column total	29	10	44	66	17	14	151	131	44	36	15	5	562
Thin-sectioned Sherds													
Red Ware													
BB:13:006	14	0	0	0	0	0	0	0	0	0	0	0	14
BB:13:013	0	1	2	0	0	0	0	0	0	0	0	0	3
BB:13:505	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:644	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:668	0	0	0	0	0	0	0	0	0	0	0	0	0
Column total	14	1	2	0	0	0	0	0	0	0	0	0	17
Plain Brown Ware													
BB:13:006	4	0	0	0	0	0	0	0	0	0	0	0	4
BB:13:013	0	1	4	0	0	0	1	0	0	0	0	0	6
BB:13:505	0	0	0	3	0	0	0	0	0	0	0	0	3
BB:13:644	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:668	0	0	0	0	0	0	0	0	0	0	0	0	0
Column total	4	1	4	3	0	0	1	0	0	0	0	0	13
Historic Types													
BB:13:006	1	0	0	0	1	0	0	0	0	0	0	0	2
BB:13:013	0	4	5	0	0	0	11	0	0	0	0	0	20
BB:13:505	0	0	0	2	0	1	0	4	0	0	0	0	7
BB:13:644	0	0	0	0	0	0	0	0	5	0	0	0	5
BB:13:668	0	0	0	0	0	0	0	0	0	4	0	0	4
Column total	1	4	5	2	1	1	11	4	5	4	0	0	38

[a]All sites are AZ # (ASM).

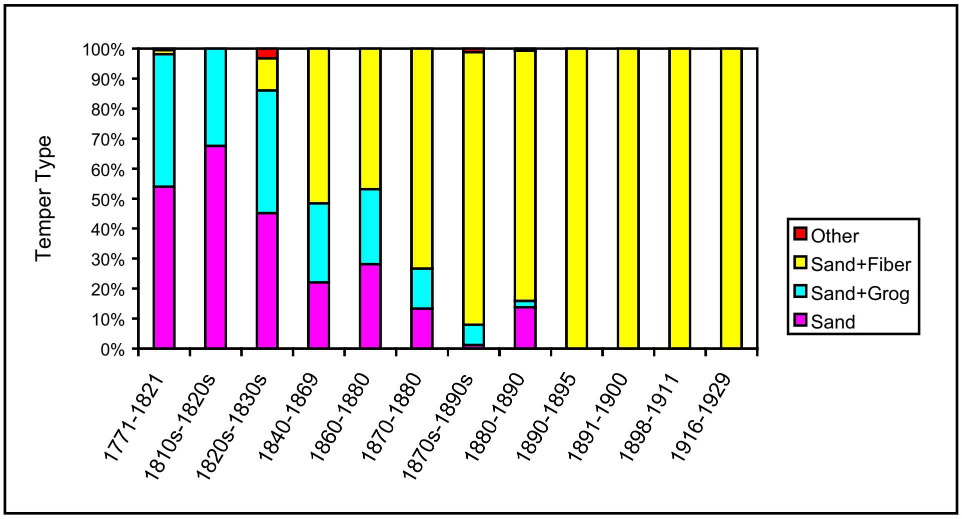

Figure 6.16. Bar chart showing results of the temper type analysis through time.

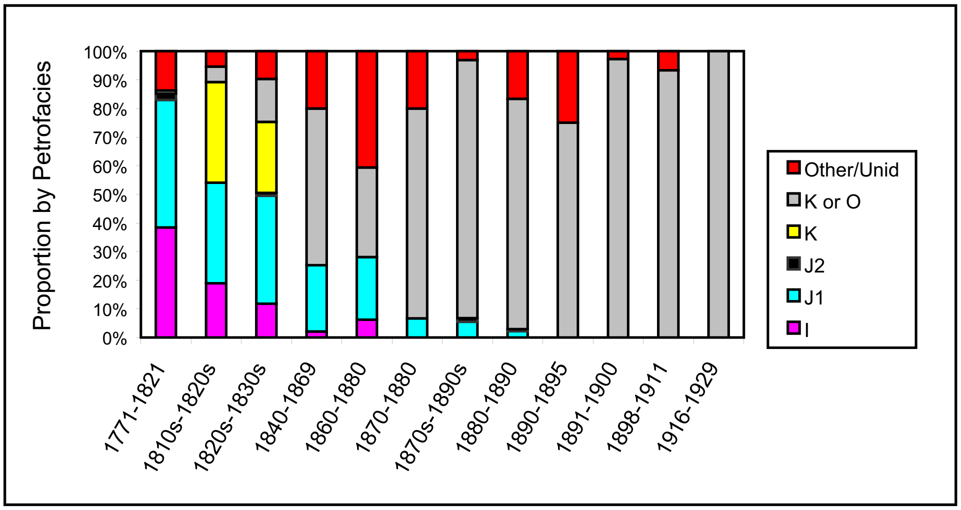

Figure 6.17. Bar chart showing results of the temper composition analysis through time.

petrofacies temper begins to appear in the archaeological record. Many factors contributed to this pattern: an influx of non-Native American peoples, Apache raiding, disease among the O'odham, and huge regional economic changes all occurred at the same time. Without evidence from contemporary sites located near the San Xavier Mission, it is difficult to know if pottery production had occurred in that area and was simply not traded to Tucson, or if pottery was not produced in the area prior to the mid-nineteenth century.

The most significant changes in pottery production occur in the decades following Mexican independence. In the period between 1840 and 1870, the shift to fiber-tempered pottery from the Black Mountain/Sierrita petrofacies occurs rapidly, as this pottery begins to represent 50 percent of the assemblage or more. The influx of Euro-Americans and Mexicans to the Tucson area may have limited the availability of source materials in central Tucson, while the O'odham were simultaneously being "encouraged" to live near the San Xavier Mission. This population shift was intensified after the Gadsden Purchase of 1853, making Tucson and southern Arizona a part of the United States and bringing American political control to the region. The United States government established the San Xavier Reservation for the Tohono O'odham in 1874. At that time, over 80 percent of the pottery recovered from the archaeological deposits discussed here came from the Black Mountain/Sierrita petrofacies, near the reservation boundary and San Xavier Mission.

While interpretation of the temper provenance record is straightforward with respect to the historic record in this case, interpretation of the temper type record is more difficult. What brought about the shift from sand or grog temper to fiber temper? The idea of using manure as temper may have been imported with the influx of people into the area in the nineteenth century. The O'odham potters probably lost political control of land in the Beehive Petrofacies, formerly a preferred pottery production area. The material properties of the pedologic clays in the Black Mountain/Sierrita petrofacies could have required a more plastic temper than sand or grog. Alternatively, it could be that the O'odham potters needed a temper that was less expensive in terms of labor. As horses and cattle increased in the region, so did a readily available, free, preprocessed temper source. Fontana (personal communication 2005) reports that it was just "easier" to make pots with manure temper rather than sand, and ease of production may have become an increasingly important factor as the O'odham supplied not only themselves, but a growing Euro-American population with water storage jars and everyday cookware (Naranjo 2002). The fiber-tempered pottery may have also been lighter and easier to transport.

In summary, the historic pattern of pottery production and distribution in the Tucson area is clear. In the approximately 200 or so years that saw the coming of the Spanish, Mexicans, and Americans to the region, pottery production shifted from a pattern much like the prehistoric, to one that was governed by the new political and economic realities of the times.

CONCLUSIONS

This technical study addresses two areas of interest. The first is the composition and provenance analysis of 56 thin sections for the Rio Nuevo Archaeology project, representing 2,373 sherds examined for the detailed ceramic analysis. Temper type assessments made by the ceramicist and the petrographers were found to be in agreement in all but one case. Temper composition and provenance assessments were in agreement on previously known and well-defined petrofacies. This project has helped refine current understanding of temper composition and provenance for two major sources that were previously inadequately defined. A group of sherds with granitic and mixed lithic sand was shown to have probably originated in the Airport Petrofacies, a large area occupying much of the floor of the Tucson Basin. A group of sherds with granitic sands, a distinctive altered granite or granodiorite, and distinctive Tucson Mountain volcanics was shown to have originated in the Black Mountain or Sierrita petrofacies, near the San Xavier Mission.

The second subject addressed in this study is that of placing the Rio Nuevo data in a wider regional and temporal context by combining data from Rio Nuevo sherds with that from several recently excavated nearby sites. The combined data set allowed us to study pottery production and distribution in the Tucson-San Xavier Mission area from circa A.D. 1771 to 1936. The data from the case study show a change in O'odham pottery production over time. In the earlier part of the study interval, pottery was sand tempered, or sand plus grog tempered, and was produced in the Beehive or Airport petrofacies. By the middle of the study interval, pottery production began shifting southward, near San Xavier Mission, and grog temper was replaced by fiber temper. By the end of the study interval, nearly all pottery was tempered with fiber and was produced in the Black Mountain or Sierrita petrofacies, probably near the San Xavier Mission. In this context, data gained from the Rio Nuevo excavations are integral in developing an understanding of the broad patterns of Tucson's history.

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CHAPTER 7

NATIVE AMERICAN POTTERY

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Desert Archaeology, Inc.

Prehistoric and Historic Native American pottery was recovered from three archaeological sites investigated as a part of the Rio Nuevo Archaeology project. A total of 17,073 sherds was recovered from the Clearwater site, AZ BB:13:6 (ASM), with 9,790 of those sherds recovered from features located at the San Agustín Mission locus of the site, 4,226 sherds from the Mission Gardens locus, and 3,057 sherds from the Congress Street and Brickyard loci. Another 950 sherds were recovered from canal features at AZ BB:13:481 (ASM). Finally, a total of 8,704 sherds was recovered from features located at the Tucson Presidio/Block 181, AZ BB:13:13 (ASM).

SAMPLING STRATEGY

The ceramic sampling strategy for the current project was designed by the author, in consultation with Project Directors Jonathan B. Mabry and J. Homer Thiel. It was structured to maximize information return by treating deposits recovered from the three sites somewhat differently. Emphasis was placed on identifying sherds of Early Agricultural period incipient plain ware pottery, regardless of recovery context, and temporally unmixed deposits of prehistoric, Spanish, Mexican, and American Territorial period O'odham pottery.

All potsherds recovered from deposits that were initially assigned to the Early Agricultural period (circa 2100 B.C.-A.D. 50) were inspected for the presence of incipient plain ware. Many of the Early Agricultural period features located in the San Agustín Mission locus were found to contain later, Hohokam ceramic types, and incipient plain ware sherds were also recovered from mission-occupation deposits at BB:13:6, indicating extensive temporal mixing had occurred in that part of the project area. When incipient plain ware sherds were found, they were analyzed following procedures developed previously (Heidke 2001).

All diagnostic sherds (that is, painted and/or slipped sherds and all rim sherds/reconstructible vessels) recovered from deposits initially assigned to the Early Ceramic (circa A.D. 50-450) and Hohokam (A.D. 500-1450) periods were analyzed, with the primary goal being to date the deposits. Few temporally unmixed deposits were identified; all that were are located at BB:13:6. They are: Features 3014 and 3038 (Agua Caliente phase, circa A.D. 50-500, described below), Feature 308 (Cañada del Oro phase, circa A.D. 750-850, described below), and Features 3001, 3005, and 3067 (definitely Classic period, circa A.D. 1150-1450, and probably Tanque Verde phase, circa A.D. 1150-1300). Due to the rarity of excavated Agua Caliente phase contexts in the Tucson area, all the plain ware body sherds recovered from Features 3014 and 3038 were analyzed.

All diagnostic and plain ware body sherds recovered from seven mission deposits at BB:13:6—Features 64, 161, 166, 177, 178, 193, and 203—were also analyzed; ceramicist Charla Hedberg analyzed the plain ware body sherds, while the author analyzed the remaining diagnostic sherds. Similarly, all diagnostic and plain ware body sherds recovered from seven Presidio-type deposits at BB:13:13—Features 373, 409, 420, 422, 423, 428, and 441—were analyzed; ceramicist Stacy Ryan analyzed the plain and red ware body sherds, while the author analyzed the diagnostic sherds. Finally, two features dating to the American Territorial period—BB:13:6 Feature 61 and BB:13:13 Feature 376—were analyzed. Charla Hedberg analyzed the plain ware body sherds recovered from Feature 61, Stacy Ryan analyzed the plain and red ware body sherds recovered from Feature 376, and the author analyzed all the diagnostic sherds recovered from both features. The format used to describe the Agua Caliente and Cañada del Oro phase prehistoric and historic ceramics recovered from Rio Nuevo Archaeology project sites is identical; thus, those sections may be somewhat repetitious. Identical conventions are used in all of those sections so that each section can stand alone, as well as to facilitate comparisons among sections.

ANALYSIS METHODS

Dating information was provided by the project directors for the Early Agricultural period, Agua Caliente phase, and Spanish, Mexican, and American Territorial period contexts, while the approximate age of contexts hypothesized by the project directors to be Hohokam was determined based on the types of pottery, especially the painted and/or red-slipped pottery, recovered from them. As mentioned above, all sherds other than unmodified, plain ware body sherds were closely examined by the author.

All painted and red-slipped pottery, as well as all plain ware rim sherds, reconstructible vessels, necks, and worked sherds from a feature were laid out at one time in the order of the strata and the levels excavated, in addition to any subfeatures present, such as hearths and postholes. In some cases, a number of sherds within a bag, or from different strata, levels, or bags within a feature, conjoined (that is, the pieces literally fit together); in other cases, aspects of the sherd's decoration or morphology and temper were similar enough to consider multiple sherds "matching" portions of a single vessel. When conjoins or matches were observed, the vessel was recorded in the provenience containing the largest portion of the pot.

Because all temporally diagnostic sherds recovered from a feature were laid out at one time, it was possible to quickly assess if the feature was mixed (that is, containing types of pottery inferred to have non-overlapping production date ranges), as well as if pieces of a pot were recovered from more than one vertical or horizontal excavation unit. Consequently, a more accurate estimate of the minimum number of vessels (MNV) present in each deposit could be obtained.

The coding index used to record provenience, typological, technological, morphological, and use-alteration data from the pottery recovered in BB:13:6 Features 61, 64, 161, 166, 177, 178, 193, and 203 (by Hedberg), and BB:13:13 Features 373, 376, 409, 420, 422, 423, 428, and 441 (by Ryan), is reproduced in Table 7.1. The index used by the author to record attributes of incipient plain ware pottery is reproduced in Table 7.2, while the index used to record attributes of later prehistoric and Historic era pottery is reproduced in Table 7.3. Three attributes of the pottery recovered from well-dated deposits are explained in detail here, because they are addressed repeatedly below for each point in time. These attributes are: temper type, temper provenance, and vessel function.

Temper Type and Provenance

Native American pottery produced in the Greater Southwest often contains abundant temper such as sand, disaggregated rock, and crushed sherd. For example, Tohono O'odham pottery is known to have been tempered with various types of material, including sand, crushed schist, ground potsherds, and dried and sifted horse manure (Fontana et al. 1962:57-58, 135). Both sand and crushed rock tempers can be used as indicators of provenance once their geological sources have been identified (Arnold 1985; Heidke et al. 2002; Shepard 1936, 1942).

In the current study, most of the sherds that were not manure-tempered were tempered with either sand or a mixture of sand and crushed potsherds (grog). Sherds of Historic era sand-tempered plain and red ware vessels are very difficult to separate from those made throughout prehistory (Haury 1975:343-344; Whittlesey 1997:453), which is why they are not referred to as "Papago" ceramic types in this chapter. Except the Agua Caliente phase, the practice of tempering a vessel's paste with a mixture of sand and crushed potsherds was never common among Tucson area prehistoric potters. However, recent archaeological studies indicate that practice was relatively common during the eighteenth and nineteenth centuries (Heidke et al. 2004:71-73; Thiel and Faught 1995:Table 7.7). This provides another confident means of identifying Historic era O'odham pottery (Whittlesey 1997:455).

Manure-tempered pots also contain sand. The presence of both sand and fiber casts (presumably from horse manure) in a sherd seems to contradict the assertion of Fontana et al. (1962:135) that Tohono O'odham potters added only one type of nonplastic temper to their clay. It is argued elsewhere that the likely reason why ceramicists see two types of temper is that the pedogenic clays used by Tohono O'odham potters usually contained a sand-sized component (Heidke and Wiley 1997a); accordingly, a potter may have added manure to a clay that already contained some sand-sized material. Petrographic analysis supports that conclusion (Chapter 6, this report).

During the last two decades an intensive program of wash sand sampling in the Tucson Basin has provided evidence that many spatially discrete sand temper compositions were available to Native American potters (Heidke and Wiley 1997b; Heidke et al. 1998a; Kamilli 1994; Lombard 1986, 1987a, 1987b, 1987c, 1987d, 1989, 1990; Miksa 2006). Therefore, analysis of the sand temper component of a sherd provides evidence about it if the pot was produced in the Tucson Basin, and, if it was, where it was likely to have been made.

Generic compositions are defined when the sands within a well-defined region are studied and it is determined that they can be broken into subsets based on similar compositions. Generic compositions are also visible in sand-tempered pottery, where they are characterized as "generic" temper resources. Further study of the sands within a well-defined region may determine that the generic sand compositions can be broken into subsets based on additional spatial and compositional information. When that is accomplished, petrofacies, or sand composition zones, are defined. Individual petrofacies compositions may also be visible in sand-tempered pottery, or pottery produced from a clay that naturally contains sand-sized

Table 7.1. Attribute index used to record provenience, typological, technological, morphological, and use-alteration data from pottery recovered at the Clearwater site, AZ BB:13:6 (ASM), and the Tucson Presidio, AZ BB:13:13 (ASM), and analyzed by Hedberg and Ryan. (Commonly used attributes are shown in italics.)

PROVENIENCE ATTRIBUTES

1. ASM Site Number [From bag-tag; use correct form] (ASMSITE)

2. Primary Feature Number [From bag-tag] (FEATNUM)

3. Field Number [From bag-tag] (FN)

MORPHOLOGICAL, TECHNOLOGICAL, AND USE-ALTERATION VARIABLES/ATTRIBUTES

4. Red Slip Location [Only recorded by Ryan] (LOCATION)

-9 = Indeterminate
0 = Slip absent (plain ware, red-on-brown, other decorated type, etc.)
1 = Interior only
2 = Interior and rim
3 = Interior, rim, and exterior band
4 = Full slip (for rims = all interior, rim, and exterior surfaces; for body = all interior and exterior surfaces)
5 = Exterior and rim
6 = Exterior only
7 = Other slip location (describe below in *COMMENTS* field)
8 = Exterior, rim, and interior band below rim

5. Painted Decoration Present? [Only recorded by Ryan] (DECTYPE)

-9 = Indeterminate
0 = Absent
1 = Present

6. Vessel Part (VESPART)

1 = Body (see also VESPART = 21, below)
2 = Rim
3.1 = Partial Reconstructible Vessel [RV] (25-50% complete)
3.2 = Partial Reconstructible Vessel [RV] (50-75% complete)
4.1 = Partial Reconstructible Vessel [RV] (75-99% complete)
4.2 = Reconstructible Vessel [RV] (100% complete)
5 = Gila shoulder
6 = Transitional Gila/Classic shoulder
7 = Classic shoulder
8.0 = Classic indented base (thickness/uniformity indeterminate or unspecified)
8.1 = Classic indented base (thickened)
8.2 = Classic indented base (uniform)
9 = Handle (unspecified type)
10 = Tabular handle/Spout
11 = Strap handle
12 = Tall, vertical jar neck
13 = Indeterminate shoulder type
14 = Miscellaneous appendage
15 = Base
16 = Knob handle
17 = Ladle handle
18.0 = Indeterminate coil handle
18.1 = Single coil handle

Table 7.1. Continued.

18.2 = Side-by-side coil handle
18.3 = Braided coil handle
19.0 = Indeterminate lug handle
19.1 = Solid lug handle
19.2 = Pierced lug handle
19.9 = Other lug handle
20 = Field identified RV; ceramic analysis indicates reworked/recycled sherd/vessel
21 = Body sherd with compound curvature, but no rim (in jars a "neck")

7. Sherd Size [Only recorded by Hedberg] (CERSIZE)
-9 = Indeterminate
99 = <5 cm^2
1 = 5-16 cm^2
2 = 16-49 cm^2
3 = 49-100 cm^2
4 = 100 cm^2-RV

8. Temper Type (TT)
-9 = Indeterminate
1 = High LMT (>25% gneiss/schist)
2 = High LMT/low sand (7-25% gneiss/schist)
3 = Low LMT/high sand (1-7% gneiss/schist)
4 = High sand (<1% gneiss/schist)
5 = High muscovite mica (>25% MUSC)
6 = Mixed sand and muscovite mica (1-25% MUSC)
7 = Gneiss/schist and muscovite mica (>25% LMT+MUSC)
8 = Mixed sand, gneiss/schist, and muscovite mica (1-25% LMT+MUSC)
9 = Sand and crushed sherd
10 = High phyllite (>25% LMTP)
11 = Sand and manure/fiber (Papago types)
12 = Sherd temper (no sand)
13 = Transitional (?) sand and manure/fiber (no black core and fewer casts than TT = 11)

9. Ceramic Type (CERTYPE)
251 = Unidentified/indeterminate red ware type
800 = Unspecified plain ware (just about any temper type other than manure)
1205 = Sobaipuri Plain (folded rim) (usually sand or sand+sherd tempered)
1250 = Papago Red (manure temper)
1251 = Possible Papago Red (unsure if it is slipped or manure-tempered)
1255 = Papago Red-on-brown
1256 = Possible Papago Red-on-brown
1257 = Papago Black-on-brown
1260 = Papago White-on-red
1265 = Papago Black-on-red
1267 = Papago Black-on-buff
1268 = Papago Red-on-buff
1270 = Papago Glaze
1275 = Papago Plain (manure temper)
1276 = Possible Papago Plain (unsure if it is manure temper)
1280 = (Indeterminate) Papago Red-on-buff or White-on-buff (only a buff surface is present)

Table 7.1. Continued.

10. Use-Alteration [List type in *COMMENTS*: soot, scratch marks, interior exfoliation] (USEALTER)

-9 = Indeterminate
0 = Absent
1 = Present

11. Quantity [A reconstructible vessel—VESPART = 3.1, 3.2, 4.1, 4.2—is counted as "1" with the total sherd count in *SHERDCNT* field] (QUANTITY)

12. Sherd Count. [During analysis, only used to tally the total count of sherds included in a reconstructible vessel; otherwise "0." Post-analysis SHERDCNT = 0 records will be replaced with QUANTITY.] (SHERDCNT)

13. Comments [Note, especially, if a Papago Red, Plain, or decorated type has a folded rim.] (COMMENTS)

grains, where they are characterized as "specific" temper resources. These specific temper resource zones are also referred to as petrofacies. Currently, 37 petrofacies are defined for the greater Tucson Basin (Figure 7.1).

The temper type and generic and specific sources of pottery recovered from Rio Nuevo project sites were characterized with respect to that petrofacies model. Temper attributes were recorded after examination of a sherd at 15x magnification, using a Unitron ZSM binocular microscope fitted with a Stocker and Yale Lite Mite Series 9 circular illuminator. Subsequently, 56 sherds were selected for petrographic analysis by Elizabeth Miksa and her colleagues (see Chapter 6). The results of her study are summarized in Table 6.8 and discussed below (see Tables 7.12-7.13, 7.17-7.18, 7.23-7.24, 7.29-7.30, 7.35-7.36, 7.41-7.42, 7.46-7.47, and 7.50-7.52).

Vessel Function

Two different approaches are utilized throughout this chapter to assess the likely uses that pottery played in the lives of the sites' residents at different points in time. The first approach is strictly typological, and entails the assignment of rim sherds and reconstructible vessels to vessel form categories originally created to classify the prehistoric pottery of the region (Kelly 1978). The second approach examines a subset of the rim sherds and, when present, reconstructible vessels—those with measurable orifice and/or aperture diameters—and places them into functional categories determined by their overall morphology and size. This approach is based on Braun's (1980) study of historic and modern Piman, Yuman, and Puebloan pottery. That study led Braun to formulate a model relating vessel form to use; the ethnographically based model that resulted from Braun's study provides an objective and replicable means to examine the function of prehistoric pottery, regardless of when or where a pot was made.

The approach begins with the assignment of large rim sherds and reconstructible vessels to one of 24 vessel form classes (Table 7.4). Vessel form classes are defined by the attributes of *containment security* and *frequency of access,* following procedures described in Braun (1980). Like Braun (1980), Henrickson and McDonald (1983) and Smith (1985), the current study assumes: (1) the function and morphology of ceramic vessels are related; (2) vessels within a functional class are designed and manufactured according to a specific set of morphological boundary conditions; and (3) generic morphological parameters are cross-cultural (Henrickson and McDonald 1983:630-631). These appear to be relatively safe assumptions. However, these attributes represent indirect evidence of use, and therefore, yield conclusions that must be phrased as "inferred uses" (Rice 1996:140).

Containment security is defined as the ability of a vessel to reduce spillage and to restrict the width of the angle at which its mouth can be entered (Braun 1980:172). Frequency of access is defined as the number of access events occurring per unit of time, and the volume of material flowing into and out of the vessel during that time (Braun 1980:172). These morphological attributes should reflect aspects of vessel function, although in the absence of additional ratio measures, these attributes cannot separate jars manufactured for cooking from those made for storage. It must also be noted that the data are unlikely to reflect the exact proportions of different vessel form classes when they were in use (Braun 1980:186). For example, small, frequently used pots probably broke far more often than large, infrequently used vessels, and cooking and serving pots probably broke far more often than storage vessels (David 1972; DeBoer 1974; Foster 1960; Longacre 1991; Mills 1989). Thus, the greater the number of trash-accumulation years represented by a deposit, the greater the amount of variation there will be between the original, systemic frequency of a vessel class and its frequency in the archaeological record.

Table 7.2. Attribute index used to record supplemental information from incipient plain ware sherds recovered at the Clearwater site, AZ BB:13:6 (ASM), and the Tucson Presidio, AZ BB:13:13 (ASM).

PROVENIENCE ATTRIBUTES

1. ASM Site Number (ASMSITE)

2. Primary Feature Number (FEATNUM)

3. Field Number (FN)

4. Clay Artifact Analyst [HARDNESS, TT, TSG, TSS, SIZEMODE, ORGANIC, CHARCOAL, WORKED recorded for all OBS] (ANALYST)

H = J. Heidke (all ceramic containers)
D = Deleted (lab PLAD indicated a ceramic container, but Heidke's analysis indicates otherwise)
X = Reassigned from Heidke to XCER analyst
A = Fired clay object recovered in ABONE (animal bone) bag

5. Observation Number [assigned 1-n for each FIELDNUM; written on object in pencil if >1 per FIELDNUM] (OBS)

6. Sherd Number (within bag conjoin/match) (SHERDNUM)

MORPHOLOGICAL, TECHNOLOGICAL, AND USE-WEAR/REUSE ATTRIBUTES

7. Sherd Size [NOTE: This variable has been used differently in other analyses] (CERSIZE)

-9 = Indeterminate
99 = <5 cm^2
1 = 5-16 cm^2
2 = 16-49 cm^2
3 = 49-100 cm^2
4 = 100 cm^2-RV

8. Ceramic Class (CERCLASS)

9. Ceramic Type (CERTYPE)

10. Incipient Plain Ware Variety (where ANALYST = ″H″) (IPWVAR)

-9 = Indeterminate
0 = Not an incipient plain ware
1.0 = Bumpy
2.0 = Coiled
2.1 = Coiled and incised
3.0 = Incised (no punctation or impression present)
3.1 = Incised and punctate
3.2 = Incised and impressed
4.0 = Interior impressed
5.0 = Punctate

11. Vessel Part (VESPART)

1 = Body (see also VESPART = 21, below)
2 = Rim
3.0 = Partial RV (25-75% complete)
3.1 = Partial RV (25-50% complete)
3.2 = Partial RV (50-75% complete)
4.0 = RV (75-100% complete)

Table 7.2. Continued.

4.1 = Partial RV (75-99% complete)
4.2 = RV (100% complete)
5 = Gila shoulder
6 = Transitional Gila/Classic shoulder
7 = Classic shoulder
8.0 = Classic indented base (thickess/uniformity indeterminate or unspecified)
8.1 = Classic indented base (thickened)
8.2 = Classic indented base (uniform)
9 = Handle (unspecified type)
10 = Tabular handle/Spout
11 = Strap handle
12 = Tall, vertical jar neck
13 = Indeterminate shoulder type
14 = Miscellaneous appendage
15 = Base
16 = Knob handle
17 = Ladle handle
18.0 = Indeterminate coil handle
18.1 = Single coil handle
18.2 = Side-by-side coil handle
18.3 = Braided coil handle
19.0 = Indeterminate lug handle
19.1 = Solid lug handle
19.2 = Pierced lug handle
19.9 = Other lug handle
20 = Field identified RV; ceramic analysis indicates reworked/recycled sherd/vessel
21 = Body sherd with compound curvature, but no rim (in jars a "neck")

12. Vessel Shape (SHAPE)
-9 = Indeterminate vessel form
0 = Indeterminate bowl or jar
1 = Bowl
2 = Jar
3 = Scoop
4 = Indeterminate "flare-rim"
5 = Pitcher
6 = Ladle
7 = Effigy vessel
8 = Legged vessel
9 = Cup
10 = Elongated vessel
11 = Ceramic censer
12 = Canteen
13 = Pinch pot
14 = Indeterminate bowl or seed jar
15 = Indeterminate bowl or scoop
16 = Cornucopia
17 = Ceramic pipe
90 = Other ceramic item

Table 7.2. Continued.

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13. Vessel Form (VESFORM)

-9 = Indeterminate vessel form
0 = Indeterminate bowl or jar
100 = Indeterminate bowl
101 = Flare-rim bowl
102 = Plate/Platter
103 = Outcurved bowl
104 = Hemispherical bowl
105 = Cauldron
106 = Incurved bowl
107 = Indeterminate semi-flare-rim bowl form
108 = Semi-flare-rim, outcurved bowl
120 = Semi-flare-rim, hemispherical bowl
121 = Semi-flare-rim, incurved bowl
122 = Straight-walled or vertical-sided bowl
123 = Double bowl
124 = Recurved bowl
127 = Low-shouldered bowl
190 = Other bowl (list type in COMMENTS)
200 = Indeterminate jar
209 = Flare-rim, height indeterminate
210 = Tall flare-rim jar
211 = Short flare-rim jar
212 = Returned rim jar
213 = Short straight-collared jar
214 = Tall straight-collared jar
215 = Seed jar
216 = Knobby "datura" pot
217 = Neckless, or rimless, jar
218 = Semi-flaring tall straight-collared jar
219 = Incurved short straight-collared jar
230 = Double jar form
231 = Jar-in-a-bowl form
242 = Semi-flaring angled long-collared jar
243 = Semi-flaring short straight-collared jar
244 = Angled, straight-collared jar
290 = Other jar (list type in COMMENTS)
300 = Indeterminate-shaped scoop
310 = Teardrop-shaped scoop
320 = Oval-shaped scoop
330 = Keyhole-shaped scoop
340 = Elongated scoop
390 = Other scoop (list type in COMMENTS)
400 = Indeterminate flare-rim bowl or jar, or semi-flare-rim bowl or short straight-collared jar
500 = Indeterminate pitcher
600 = Indeterminate ladle
610 = Oval bowl ladle
620 = Circular bowl ladle
690 = Other ladle (list type in COMMENTS)
710 = Bird effigy vessel

Table 7.2. Continued.

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720 = Anthropomorphic effigy vessel
730 = Shell effigy vessel
790 = Effigy vessel (describe in COMMENTS)
800 = Indeterminate legged vessel part
810 = Leg
890 = Other legged vessel part (describe part in COMMENTS)
900 = Indeterminate cup
1000 = Indeterminate elongated vessel
1100 = Indeterminate censer
1190 = Other censer (list type in COMMENTS)
1200 = Indeterminate canteen
1290 = Other canteen (list type in COMMENTS)
1400 = Indeterminate bowl or seed jar
1500 = Indeterminate bowl or scoop
1600 = Cornucopia
1700 = Indeterminate ceramic pipe
9000 = Other ceramic vessel/item (list type in COMMENTS)

14. Rim Length (RIMLENG)
-9 = Not a rim or indeterminate (i.e., unusual curvature of a scoop, etc.)
0 = 0-5%
1 = 5-10%
2 = 10-15%
3 = 15-20%
4 = 20-25%
5 = 25-30%
6 = 30-35%
7 = 35-40%
8 = 40-45%
9 = 45-50%
10 = >50%

15. Orifice Diameter [in cm] (ORIFDIA)
-9 = Not a rim, or indeterminate orifice diameter

16. Aperture Diameter [in cm] (APETDIA)
-9 = Not a jar rim, or indeterminate aperture diameter

17. Rim Shape (RIMSHAPE)
-9 = Not a rim
0 = Indeterminate rim shape
1.0 = Tapered (length unspecified)
1.1 = Long taper
1.2 = Short taper
2 = Rounded
3 = Squared
4.0 = Sharp bevel
4.1 = Sharp exterior bevel
4.2 = Sharp interior bevel

Table 7.2. Continued.

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5 = Other or miscellaneous
6.0 = Rounded bevel
6.1 = Rounded exterior bevel
6.2 = Rounded interior bevel
7 = Flattened exterior bulge
8 = Flattened interior and exterior bulge
9 = Rounded exterior bulge
10 = Rounded interior and exterior bulge
11 = Rounded interior bulge

18. Vessel Wall Thickness [in mm] (BODTHICK)

19. Minimum Vessel Wall Thickness [in mm] (MINTHICK)

20. Maximum Vessel Wall Thickness [in mm] (MAXTHICK)

21. Fire Cloud (FIRE)
-9 = Indeterminate
0 = Absent
1 = Interior only
2 = Exterior only
3 = Interior and Exterior
4 = Rim only (<1 cm on interior and exterior surfaces)

22. Carbon Core (CARBON)
-9 = Indeterminate
0 = Absent
1 = Middle, thin (<half)
2 = Middle, thick (>half)
3 = Exterior edge
4 = Interior edge
5 = Fully carbonized
6 = Interior and exterior edges carbonized, core clear
8 = Present, location unspecified

23. Interior Surface Treatment (INTSURF)
-9 = Indeterminate, or not a rim
1.1 = Uniform polish/burnish, scrape marks absent (in early plain wares = light tool polish, not burnish); lustrous feel
1.2 = Polished/burnished, scrape marks present (in early plain wares = light tool polish, not burnish); waxy feel
1.3 = Light polish; smooth, chalky feel
2 = Wiped
3 = Hand-smoothed
4 = Anvil impressed
5 = Scraped
6 = Massed plant fiber or animal fur or basketry
9 = Not polished/burnished; other marks not recorded
10 = Basket impressed

Table 7.2. Continued.

24. Exterior Surface Treatment (EXTSURF)
-9 = Indeterminate, or not a rim
1.1 = Uniform polish/burnish, scrape marks absent (in early plain wares = light tool polish, not burnish); lustrous feel
1.2 = Polished/burnished, scrape marks present (in early plain wares = light tool polish, not burnish); waxy feel
1.3 = Light polish; smooth, chalky feel
2 = Wiped
3 = Hand-smoothed
4 = Paddle impressed
5 = Scraped
6 = Basket impressed
7 = Corrugated
9 = Not polished/burnished; other marks not recorded

25. Hardness (HARDNESS)
-9 = Indeterminate
0 = Less than Mohs' hardness scale of 2 (softer than gypsum, easily scratched by a fingernail)
1 = Equal or greater than Mohs' hardness scale of 2 (harder than gypsum)

26. Temper Type (TT)
-9 = Indeterminate
1 = High LMT (>25% gneiss/schist)
2 = High LMT/low sand (7-25% gneiss/schist)
3 = Low LMT/high sand (1-7% gneiss/schist)
4 = High sand (<1% gneiss/schist)
5 = High muscovite mica (>25% MUSC)
6 = Mixed sand and muscovite mica (1-25% MUSC)
7 = Gneiss/schist and muscovite mica (>25% LMT+MUSC)
8 = Mixed sand, gneiss/schist, and muscovite mica (1-25% LMT+MUSC)
9 = Sand and crushed sherd
10 = High phyllite (>25% LMTP)
11 = Sand and fiber (Papago types)
12 = Sherd temper (no sand)

27. Temper Source Generic (TSG)
-9 = Indeterminate
1 = Igneous volcanic sands (TSS = D, J1, J2, J3, L, R, T, W, and Y)
2 = Igneous plutonic sands (TSS = 3, E1, E2, E3, O, Q, and S)
3 = Metamorphic core complex sands (TSS = 4, 5, 8, A, B, BV, and N)
4 = Sedimentary sands
5 = Crushed rock [Gila or Wingfield Plain-like] (Temper Types = 1, 5, 7, or 10)
6 = Fine paste (low percentage of nonplastics, natural component of clay?)
7 = Mixed volcanic and granitic sands (TSS = C, M, MW, and U)
8 = Sherd, or grog, temper
9 = Mixed volcanic and sedimentary sands
10 = Mixed volcanic, granitic, and sedimentary sands
11 = Mixed metamorphic and sedimentary sands
21 = Santan/Gila Butte schist and sand
29 = Schist sand
30 = Igneous plutonic and mixed lithic (volcanic, metamorphic, and sedimentary) sands (TSS = 1, 2, 6, 9, F, G, H, I, K, and P)
31 = Other metamorphic source (TSS = V)

Table 7.2. Continued.

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33 = Coarse muscovite schist: Santan/Gila Butte schist (crushed or sand)
39 = Sand and sherd
40 = Indeterminate igneous plutonic or metamorphic core complex sands

28. Temper Source Specific (TSS)

-9 = Indeterminate
1 = Santa Cruz River
2 = Brawley Wash
3 = Cañada del Oro
4 = Rillito Creek
5 = Pantano Wash
6 = McClellan Wash
8 = Tanque Verde Creek
A = Rincon
B = Catalina
BV = Catalina Volcanic
C = Samaniego
D = Avra
E1 = Western Tortolita
E2 = Central Tortolita
E3 = Eastern Tortolita
F = Durham
G = Santa Rita
H = Jaynes
I = Airport
J1 = Beehive
J2 = Twin Hills
J3 = Wasson
K = Black Mountain
L = Golden Gate
M = Rillito
MW = Rillito West
N = Owl Head
O = Sierrita
P = Green Valley
Q = Amole
R = Batamote
S = Sutherland
T = Recortado
U = Cocoraque
V = Dos Titos
W = Waterman
Y = Roskruge

29. Modal Temper Grain Size (SIZEMODE)

-9 = Indeterminate
0 = Clay
1 = Silt (<1/16 mm)
2 = Very fine sand (1/16-1/8 mm)
3 = Fine sand (1/8-1/4 mm)

Table 7.2. Continued.

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4 = Medium sand (1/4-1/2 mm)
5 = Coarse sand (1/2-1 mm)
6 = Very coarse sand (1-2 mm)
7 = Gravel (>2 mm)

30. Organic Temper (ORGANIC)
-9 = Indeterminate
0 = Casts absent
1 = Casts present

31. Charcoal Fragments in Paste (CHARCOAL)
-9 = Indeterminate
0 = Absent
1 = Present

32. Location of Incising [if necessary, describe further in COMMENTS, field previously named INCISED] (INCISLOC)
-9 = Indeterminate
0 = Incising absent
1 = Present, location indeterminate
2 = Exterior incised
3 = Interior incised
4 = Interior and rim lip incised
5 = Interior and exterior incised
6 = Rim lip incised
7 = Interior, exterior and rim incised

33. Clay's Moisture Content when Incised (INCISDRY)
-9 = Indeterminate
0 = Incising absent
1 = Soft, elevated margins present
2 = Hard, even margins present (indicating leather-hard clay)
3 = Dry, chipped margins present

34. Shape of Incision (INCISSHP)
-9 = Indeterminate
0 = Incising absent
1 = U-shaped
2 = V-shaped

35. Depth of Incision [in mm] (INCISDTH)
-9 = Indeterminate
0 = Incising absent

36. Width of Incision [in mm] (INCISWTH)
-9 = Indeterminate
0 = Incising absent

Table 7.2. Continued.

37. Coil Type [appearance in cross-section] (COILTYPE)
-9 = Indeterminate
0 = Flattened coil absent
1 = "Clapboard"
2 = "Shiplap"

38. Flattened Coils Visible (FLATCOIL)
-9 = Indeterminate
0 = Flattened coil absent
1 = Flattened coil visible (on interior and exterior surfaces)
2 = Flattened coil partially visible (in profile and/or remnant on smoothed-over surface)

39. Coil Width [in mm] (COILWIDE)
-9 = Indeterminate (includes all cases where coils are absent)

40. Worked Sherd (WORKED)
-9 = Indeterminate
0 = Not worked
1 = Mendhole
2.0 = One edge ground (shape indeterminate)
2.1 = One edge ground straight
2.2 = One edge ground rounded (convex)
3.1 = Two edges ground straight
3.2 = Two edges ground rounded (convex)
3.3 = Two edges ground, one straight and one rounded (convex)
4.0 = Indeterminate disc fragment
4.1 = Unperforated disk
4.2 = Semi-perforated disc (record diameter [in mm] and weight [in gm] in COMMENTS)
4.3 = Perforated disc (record diameter [in mm] and weight [in gm] in COMMENTS)
5 = Rim ground
6 = Shaped (list type in COMMENTS)
7 = Other type of working (list type in COMMENTS)
8 = Notched rim
9.0 = Scraper (edge type not specified)
9.1 = Scraper (*kajepe*, not bevel-edged)
9.2 = Scraper (bevel-edged)
10 = Puki
11 = Jar lid

COMMENTS
41. Comments [list] (COMMENTS)

Simulation studies by David (1972:Table 2) and DeBoer (1974:Table 1) indicate that, after 100 years of deposition, vessel class frequencies determined from archaeological deposits are likely to be in error by a maximum of ±12 percent. None of the Rio Nuevo deposits are thought to have accumulated trash for anywhere near 100 years; therefore, the magnitude of difference between the archaeological frequencies reported here and their original, systemic frequency should be less than 12 percent. It is also likely that the maximum error may be considerably less than ±12 percent, because: (1) cooking jars are likely to be among the most overrepresented of forms (due to their relatively short use-lives); (2) storage jars are probably the most underrepresented of forms (due to their relatively long use-lives) (David 1972:Table 2); and (3) it is difficult to discriminate between cooking and storage jars in archaeological collections of rim sherds.

Table 7.3. Attribute index used to record supplemental information from prehistoric, Protohistoric, and Historic sherds and vessels recovered at the Clearwater site, AZ BB:13:6 (ASM), and the Tucson Presidio, AZ BB:13:13 (ASM).

PROVENIENCE ATTRIBUTES

1. ASM Site Number (ASMSITE)

2. Primary Feature Number (FEATNUM)

3. Field Number (FN)

4. Observation Number [assigned 1-n for each FIELDNUM] (OBS)

5. Sherd Number (conjoin/match) (SHERDNUM)

MORPHOLOGICAL, TECHNOLOGICAL, AND USE-WEAR/REUSE ATTRIBUTES

6. Sherd Size (CERSIZE)
-9 = Indeterminate
99 = <5 cm^2
1 = 5-16 cm^2
2 = 16-49 cm^2
3 = 49-100 cm^2
4 = 100 cm^2-RV

7. Ceramic Class (CERCLASS)

8. Ceramic Type (CERTYPE)

9. Vessel Part (VESPART)
1 = Body (see also VESPART = 21, below)
2 = Rim
3.0 = Partial RV (25-75% complete)
3.1 = Partial RV (25-50% complete)
3.2 = Partial RV (50-75% complete)
4.0 = RV (75-100% complete)
4.1 = Partial RV (75-99% complete)
4.2 = RV (100% complete)
5 = Gila shoulder
6 = Transitional Gila/Classic shoulder
7 = Classic shoulder
8.0 = Classic indented base (thickness/uniformity indeterminate or unspecified)
8.1 = Classic indented base (thickened)
8.2 = Classic indented base (uniform)
9 = Handle (unspecified type)
10 = Tabular handle/Spout
11 = Strap handle
12 = Tall, vertical jar neck
13 = Indeterminate shoulder type
14 = Miscellaneous appendage
15 = Base
16 = Knob handle
17 = Ladle handle
18.0 = Indeterminate coil handle
18.1 = Single coil handle

Table 7.3. Continued.

18.2 = Side-by-side coil handle
18.3 = Braided coil handle
19.0 = Indeterminate lug handle
19.1 = Solid lug handle
19.2 = Pierced lug handle
19.9 = Other lug handle
20 = Field identified RV; ceramic analysis indicates reworked/recycled sherd/vessel
21 = Body sherd with compound curvature, but no rim (in jars a "neck")

10. Vessel Shape (SHAPE)

-9 = Indeterminate vessel form
0 = Indeterminate bowl or jar
1 = Bowl
2 = Jar
3 = Scoop
4 = Indeterminate "flare-rim"
5 = Pitcher
6 = Ladle
7 = Effigy vessel
8 = Legged vessel
9 = Cup
10 = Elongated vessel
11 = Ceramic censer
12 = Canteen
13 = Pinch pot
14 = Indeterminate bowl or seed jar
15 = Indeterminate bowl or scoop
16 = Cornucopia
90 = Other ceramic item

11. Vessel Form (VESFORM)

-9 = Indeterminate vessel form
0 = Indeterminate bowl or jar
100 = Indeterminate bowl
101 = Flare-rim bowl
102 = Plate/Platter
103 = Outcurved bowl
104 = Hemispherical bowl
105 = Cauldron
106 = Incurved bowl
107 = Indeterminate semi-flare-rim bowl form
108 = Semi-flare-rim, outcurved bowl
120 = Semi-flare-rim, hemispherical bowl
121 = Semi-flare-rim, incurved bowl
122 = Straight-walled or vertical-sided bowl
123 = Double bowl
124 = Recurved bowl
127 = Low-shouldered bowl
190 = Other bowl (list type in COMMENTS)

Table 7.3. Continued.

200 = Indeterminate jar
209 = Flare-rim, height indeterminate
210 = Tall flare-rim jar
211 = Short flare-rim jar
212 = Returned rim jar
213 = Short straight-collared jar
214 = Tall straight-collared jar
215 = Seed jar
216 = Knobby "datura" pot
217 = Neckless, or rimless, jar
218 = Semi-flaring tall straight-collared jar
219 = Incurved short straight-collared jar
230 = Double jar form
231 = Jar-in-a-bowl form
242 = Semi-flaring angled long-collared jar
243 = Semi-flaring short straight-collared jar
244 = Angled, straight-collared jar
290 = Other jar (list type in COMMENTS)
300 = Indeterminate-shaped scoop
310 = Teardrop-shaped scoop
320 = Oval-shaped scoop
330 = Keyhole-shaped scoop
340 = Elongated scoop
390 = Other scoop (list type in COMMENTS)
400 = Indeterminate flare-rim bowl or jar, or semi-flare-rim bowl or short straight-collared jar
500 = Indeterminate pitcher
600 = Indeterminate ladle
610 = Oval bowl ladle
620 = Circular bowl ladle
690 = Other ladle (list type in COMMENTS)
710 = Bird effigy vessel
720 = Anthropomorphic effigy vessel
730 = Shell effigy vessel
790 = Effigy vessel (describe in COMMENTS)
800 = Indeterminate legged vessel part
810 = Leg
890 = Other legged vessel part (describe part in COMMENTS)
900 = Indeterminate cup
1000 = Indeterminate elongated vessel
1100 = Indeterminate censer
1190 = Other censer (list type in COMMENTS)
1200 = Indeterminate canteen
1290 = Other canteen (list type in COMMENTS)
1400 = Indeterminate bowl or seed jar
1500 = Indeterminate bowl or scoop
1600 = Cornucopia
9000 = Other ceramic vessel/item (list type in COMMENTS)

Table 7.3. Continued.

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12. Rim Length (RIMLENG)

-9 = Not a rim or indeterminate (i.e., unusual curvature of a scoop, etc.)
0 = 0-5%
1 = 5-10%
2 = 10-15%
3 = 15-20%
4 = 20-25%
5 = 25-30%
6 = 30-35%
7 = 35-40%
8 = 40-45%
9 = 45-50%
10 = >50%

13. Orifice Diameter [in cm] (ORIFDIA)

-9 = Not a rim, or indeterminate orifice diameter

14. Aperture Diameter [in cm] (APETDIA)

-9 = Not a jar rim, or indeterminate aperture diameter

15. Rim Shape (RIMSHAPE)

-9 = Not a rim
0 = Indeterminate rim shape
1.0 = Tapered (length unspecified)
1.1 = Long taper
1.2 = Short taper
2 = Rounded
3 = Squared
4.0 = Sharp bevel
4.1 = Sharp exterior bevel
4.2 = Sharp interior bevel
5 = Other or miscellaneous
6.0 = Rounded bevel
6.1 = Rounded exterior bevel
6.2 = Rounded interior bevel
7 = Flattened exterior bulge
8 = Flattened interior and exterior bulge
9 = Rounded exterior bulge
10 = Rounded interior and exterior bulge
11 = Rounded interior bulge

16. Vessel Wall Thickness [in mm] (BODTHICK)

-9 = Indeterminate

17. Carbon Core (CARBON)

-9 = Indeterminate
0 = Absent
1 = Middle, thin (<half)
2 = Middle, thick (>half)
3 = Exterior edge

Table 7.3. Continued.

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4 = Interior edge
5 = Fully carbonized
6 = Interior and exterior edges carbonized, core clear
8 = Present, location unspecified

18. Slip Location (LOCATION)
-9 = Indeterminate
0 = Slip absent (plain ware, red-on-brown, etc.)
1 = Interior only
2 = Interior and rim
3 = Interior, rim, and exterior band
4 = Full slip (for rims = all interior, rim, and exterior surfaces; for body = all interior and exterior)
5 = Exterior and rim
6 = Exterior only
7 = Other slip location (describe in COMMENTS)
8 = Exterior, rim, and interior band below rim

19. Surface Cast of Organic Inclusion (CAST)
-9 = Indeterminate
0 = Absent
1 = Present

20. Multiple, Small, Round Voids of Perfect Preferred Orientation (VOIDS)
-9 = Indeterminate
0 = Absent
1 = Present

21. Temper Type (TT)
-9 = Indeterminate
1 = High LMT (>25% gneiss/schist)
2 = High LMT/low sand (7-25% gneiss/schist)
3 = Low LMT/high sand (1-7% gneiss/schist)
4 = High sand (<1% gneiss/schist)
5 = High muscovite mica (>25% MUSC)
6 = Mixed sand and muscovite mica (1-25% MUSC)
7 = Gneiss/schist and muscovite mica (>25% LMT+MUSC)
8 = Mixed sand, gneiss/schist, and muscovite mica (1-25% LMT+MUSC)
9 = Sand and crushed sherd
10 = High phyllite (>25% LMTP)
11 = Sand and fiber (Papago types)
12 = Sherd temper (no sand)
13 = Transitional (?) sand and manure/fiber (no black core and fewer casts than TT = 11)

22. Temper Source Generic (TSG)
-9 = Indeterminate
1 = Igneous volcanic sands (TSS = D, J1, J2, J3, L, R, T, W, and Y)
2 = Igneous plutonic sands (TSS = 3, E1, E2, E3, O, Q, and S)
3 = Metamorphic core complex sands (TSS = 4, 5, 8, A, B, BV, and N)
4 = Sedimentary sands
5 = Crushed rock [Gila or Wingfield Plain-like] (Temper Types = 1, 5, 7, or 10)
6 = Fine paste (low percentage of nonplastics, natural component of clay?)

Table 7.3. Continued.

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7 = Mixed volcanic and granitic sands (TSS = C, M, MW, and U)
8 = Sherd, or grog, temper
9 = Mixed volcanic and sedimentary sands
10 = Mixed volcanic, granitic, and sedimentary sands
11 = Mixed metamorphic and sedimentary sands
21 = Santan/Gila Butte schist and sand
29 = Schist sand
30 = Igneous plutonic and mixed lithic (volcanic, metamorphic, and sedimentary) sands (TSS = 1, 2, 6, 9, F, G, H, I, K, and P)
31 = Other metamorphic source (TSS = V)
33 = Coarse muscovite schist: Santan/Gila Butte schist (crushed or sand)
39 = Sand and sherd
40 = Indeterminate igneous plutonic or metamorphic core complex sands
45 = Indeterminate igneous plutonic or igneous plutonic and mixed lithic sands
50 = Fine crystalline sand

23. Temper Source Specific [Petrofacies character variable] (TSS)

-9 = Indeterminate
1 = Santa Cruz River
2 = Brawley Wash
3 = Cañada del Oro
4 = Rillito Creek
5 = Pantano Wash
6 = McClellan Wash
7 = West Branch of the Santa Cruz River
8 = Tanque Verde Creek
A = Rincon
B = Catalina
BV = Catalina Volcanic
C = Samaniego
D = Avra
E1 = Western Tortolita
E2 = Central Tortolita
E3 = Eastern Tortolita
F = Durham
G = Santa Rita
H = Jaynes
I = Airport
J1 = Beehive
J2 = Twin Hills
J3 = Wasson
K = Black Mountain
L = Golden Gate
M = Rillito
MW = Rillito West
N = Owl Head
O = Sierrita
P = Green Valley
Q = Amole
R = Batamote
S = Sutherland

Table 7.3. Continued.

T = Recortado
U = Cocoraque
V = Dos Titos
W = Waterman
Y = Roskruge

24. Thin Section Number (TSNUM)

25. Worked Sherd (WORKED)
-9 = Indeterminate
0 = Not worked
1 = Mend hole
2.0 = One edge ground (shape indeterminate)
2.1 = One edge ground straight
2.2 = One edge ground rounded (convex)
3.1 = Two edges ground straight
3.2 = Two edges ground rounded (convex)
3.3 = Two edges ground, one straight and one rounded (convex)
4.0 = Indeterminate disc fragment
4.1 = Unperforated disk
4.2 = Semi-perforated disc (record diameter [in mm] and weight [in gm] in COMMENTS)
4.3 = Perforated disc (record diameter [in mm] and weight [in gm] in COMMENTS)
5 = Rim ground
6 = Shaped (list type in COMMENTS)
7 = Other type of working (list type in COMMENTS)
8 = Notched rim
9.0 = Scraper (edge type not specified)
9.1 = Scraper (*kajepe*, not bevel-edged)
9.2 = Scraper (bevel-edged)
10 = Puki
11 = Jar lid

COMMENTS
26. Illustrated? (ILLUS)

27. Comments [list] (COMMENTS)

As mentioned above, a matrix containing 24 potential vessel form classes, designated A-TT during analysis, was created by cross-tabulating values for the containment security and frequency of access attributes. Containment security follows from Shepard's (1995:230) geometric taxonomy of vessel shape.

> In terms of basic contour, the *unrestricted vessel* has an open orifice marked by an end-point tangent that is vertical or inclined outward, and at no point in the contour is there a constriction marked by a corner or inflection point. The tangent at the end point of *simple* and *dependent restricted vessels* is inclined inward, but the profile also lacks a constriction marked by a corner or inflection point. The third class includes most neck vessels. . . . The base of a neck is frequently marked by a corner point (angle at juncture of neck and body) or, if there is a smooth curve between neck and body, an inflection point occurs somewhere between constriction of neck and the equator of the body. This characteristic of contour, a corner point or an inflection point above a *major point* (point at the equator of the body), defines the third class, the *independent restricted vessel* (Shepard 1995:230, emphasis in original).

Braun (1980:181) makes a useful distinction between shallow, unrestricted vessels—representing plates and platters—and other, deeper unrestricted vessels; that distinction is followed here. Therefore, each vessel was assigned to one of four shape classes based on its morphology: independent restricted vessels; simple and dependent restricted vessels; deep, unrestricted vessels; and shallow, unrestricted vessels. Class boundaries within the continuous frequency of access attribute follow Braun (1980) and previous studies of Tucson area pottery (Heidke 2000). The opening measurement in the unrestricted vessel forms represents the maximum diameter of the mouth of the vessel; the opening measurement in the restricted vessel forms represents the diameter at the point of maximum constriction below the mouth. Finally, the relationship between vessel form class and ceramic ware used throughout the rest of this chapter to interpret vessel function is shown in Table 7.5.

Many Historic era sherds could not be assigned to a vessel form; those rims were usually classified as an indeterminate flare-rim form. Indeterminate flare-rim vessels may represent as many as seven different Tohono O'odham vessel forms: the *hí-to-ta-kut*, *í-o-la-ki-ta-kut*, *bí-kut*, *há-a-i-cú-kai-tu-ta-kut*, *sú-u-te-ki-wá-i-kut, sí-to-ta-kut,* and the *wá-i-kut*. All seven of those vessel forms have everted, or flaring, rims and often cannot be differentiated in archaeological collections because the rim broke away from the body of the vessel at its neck.

Hí-to-ta-kut refers to any pot in which something is boiled, although the Tohono O'odham generally use the term to mean a bean boiling pot (Fontana et al. 1962:37, Figures 29-30). *Í-o-la-ki-ta-kut* refers to the pot used to make refried beans, or *refritos* (Fontana et al. 1962:47, Figures 31-32); *bí-kut* refers to a serving dish (Fontana et al. 1962:47-48, Figure 37). *Há-a-i-cú-kai-tu-ta-kut* refers to dry seed storage vessels (Fontana et al. 1962:47, Figure 36), and *sú-u-te-ki-wá-i-kut* refers to a large jar, or *olla*, used for both permanent water storage and as a drinking water container (Fontana et al. 1962:34, Figures 18-20). *Sí-to-ta-kut* refers to saguaro syrup and saguaro wine storage vessels; both small family and large ceremonial variants have been noted (Fontana et al. 1962:37, Figures 23-27). Finally, *wá-i-kut* refers to water transport vessels (Fontana et al. 1962:47, Figure 35).

EARLY AGRICULTURAL PERIOD POTTERY FROM THE CLEARWATER SITE, AZ BB:13:6 (ASM)

The pottery discussed in this section relates to the inception and development of the craft in the middle and lower Santa Cruz River Valley. The earliest pottery discussed in this section was recovered from contexts securely dated to the unnamed phase that falls between the end of the Middle Archaic (circa 2100 B.C.) and the beginning of the San Pedro phase (circa 1200 B.C.); a much larger sample of early pottery was recovered from Early Cienega phase (circa 800-400 B.C.) contexts. All of these sherds were recovered from BB:13:6.

Summary of Previous Early Agricultural Period Research

Kisselburg (1993) first described Late Cienega phase pottery in an analysis of the ceramics recovered from the Coffee Camp site, AZ AA:6:19 (ASM). Recently, seven additional collections of early pottery have been unearthed. San Pedro phase pottery has been recovered from two sites: Las Capas, AZ AA:12:111 (ASM) (Heidke 2005a), and El Taller, AZ AA:12:92 (ASM) (Stinson and Heidke 2006). Early Cienega phase pottery has also been recovered from two sites: Clearwater (Heidke and Ferg 1997) and Wetlands, AZ AA:12:90 (ASM) (Heidke 1998); the ceramics recovered during another phase of work at the Clearwater site are reported here. Late Cienega phase pottery has been recovered from Julian Wash, AZ BB:13:17 (ASM) (Heidke 2006); Los Pozos, AZ AA:12:91 (ASM) (Heidke 2005a; Heidke and Ferg 2001); and Santa Cruz Bend, AZ AA:12:746 (ASM) (Heidke et al. 1998a). Other Cienega phase sites, such as the Donaldson site, AZ EE:2:30 (ASM) (Huckell 1995), and Stone Pipe, AZ BB:13:425 (ASM) (Swartz and Lindeman 1997), have not yielded ceramics.

To date, only plain ware pottery has been recovered from typologically unmixed contexts, even though significant quantities of processed iron oxides (that is, ochre) have been recovered from some of the pottery-bearing sites (Miksa and Tompkins 1998). Given the position these pots hold at the beginning of the regional ceramic sequence, and the fact that they do not resemble later, Tucson Basin Hohokam plain ware (Kelly 1978:69-76), the term "Incipient Plain" has been proposed to refer to them (Heidke 2005a, 2005c; see also Heidke 1997, 1998, 1999; Heidke and Ferg 1997, 2001; Heidke and Habicht-Mauche 1999; Heidke and Stark 1996; Heidke et al. 1998a). Previously, five distinct kinds of incipient plain ware have been identified, based on differences in primary forming technique and surface treatment; the Early Cienega phase collection from the Clearwater site documents the presence of a sixth kind—Incipient Plain: Coiled and Incised variety.

A total of 219 incipient plain ware sherds, representing portions of 174 vessels, have been recovered and analyzed to date. Seven sherds (six vessels) were recovered from contexts dating to circa 2100 B.C., within the unnamed phase of the Early Agricultural

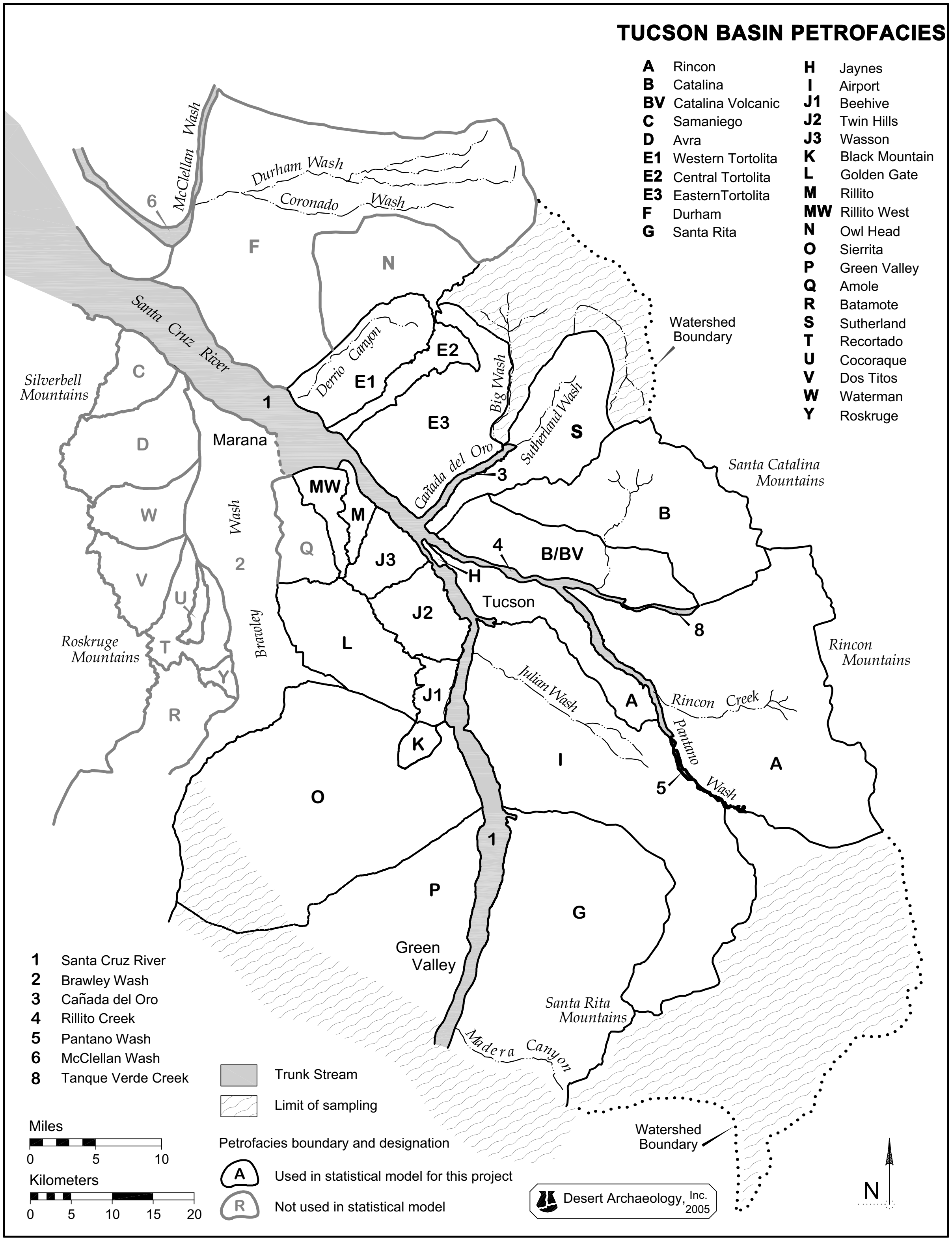

Figure 7.1. Current petrofacies map of the Tucson Basin and Avra Valley.

period (circa 2100-1200 B.C.) at Clearwater; 21 sherds (14 vessels) from the two San Pedro phase sites mentioned above (circa 1200-800 B.C.); 93 sherds (70 vessels) from the two Early Cienega phase sites mentioned above (circa 800-400 B.C.); and 90 sherds (76 vessels) from four Late Cienega phase sites (circa 400 B.C.-A.D.

Table 7.4. Vessel form classes, designated A-TT, created by cross-tabulating values for containment security and frequency of access (after Braun 1980).

Shepard/Braun Shape Class	Diameter of Opening (in cm)					
	<6.0	6.0-12.5	13.0-25.5	26.0-31.5	32.0-38.5	>38.5
Independent restricted vessels	A	B	C	D	E	EE
Simple and dependent restricted vessels	F	G	H	I	J	JJ
Unrestricted vessels (deep)	K	L	M	N	O	OO
Unrestricted vessels (shallow)	P	Q	R	S	T	TT

Table 7.5. Relationship between the vessel form class and ceramic ware.

Function	Ware	
	Plain[a, b, c]	Slipped and/or Decorated/Painted[b, c]
Cooking	C, D, E, EE, M, R, S, T, TT	N/A
Storage	A, B, F, G, H, I	A, B, C, D, E, EE, F, G, H, I
Individual serving	L, Q	L, Q
Small group serving	R	M, R
Large group serving	N, O, OO	N, O, OO, S, T, TT
Specialized	K, P	K, P
Unknown	J, JJ	J, JJ

[a] Untempered, Early Agricultural period incipient plain ware containers would not have made useful cooking vessels; therefore, incipient plain ware vessels assigned to category "R" are reassigned from cooking to the small group serving function.

[b] Historic era cups assigned to category "A" are reassigned from storage to a newly defined liquid serving function.

[c] Historic era pitchers assigned to category "B" are reassigned from storage to a newly defined liquid serving function.

50). The remaining eight sherds/vessels were recovered from temporally mixed or undatable contexts.

Most of the 174 analyzed vessels are represented by body sherds rather than rim sherds, a fact that limits our ability to understand vessel form and size. Most incipient plain ware vessels appear to have been small bowls, based on the rim sherds that have been recovered. The low diversity in vessel shape and size documented in the extant collection suggests these plain ware bowls served one or more highly specialized uses. Their untempered paste, small size, and rarity in the archaeological record suggest they were not used for domestic tasks, such as cooking or storage. Their low numbers and small size make it unlikely they were used in competitive feasting, as has been argued for many other early pottery traditions (Hayden 1995). However, the ritual use of small containers is reported in ethnographic descriptions of Sonoran (Tohono O'odham) and northern Mesoamerican (Huichol [Wixárika] and Cora [Náyari]) peoples, and the functions that those containers serve provides a way to speculate about how incipient plain ware pots may have been used during the Early Agricultural period, a topic addressed further below.

Incipient Plain Ware Production Sequence Attribute Data

This attribute analysis is structured in terms of the operational tasks involved in the production sequence of hand-made pottery (Rye 1981), and follow a format used in previous studies of Early Agricultural period pottery (Heidke 1998:Table 10.3, 2005a:Tables 9.2 and 9.4; Heidke and Ferg 1997:Table 7.3, 2001:Table 8.2; Heidke et al. 1998a:Table 13.7). Material correlates of multiple production steps were recorded: raw material procurement attributes; forming, finishing, and decorative attributes; and firing attributes. Provenience, contextual, and typological attributes were also recorded. Attributes recorded during analysis are defined in Heidke (2001; see also Table 7.2).

Pottery recovered from the 1995 excavation at Clearwater is discussed in Heidke and Ferg (1997); the material recovered from the 2000-2003 excavations is discussed here. Recovery contexts are listed in Table 7.6. Each row represents an individual vessel. The quantity of conjoining and/or matching sherds recovered from each vessel is reported in the "Number of Sherds" column; only four vessels are

Table 7.6. Incipient plain ware recovery contexts at the Clearwater site, AZ BB:13:6 (ASM).

Feature Number	Stratum[a]	Incipient Plain Ware Variety	Number of Sherds	Sherd Size	Vessel Part	Phase or Occupation	Figure Number(s)
0	4	Incipient Plain: Coiled variety	1	<5 cm^2	Body sherd	Mission	
1	4	Incipient Plain	1	5-16 cm^2	Body sherd	Mission	–
64	4	Incipient Plain	1	<5 cm^2	Body sherd	Mission	–
178	50	Incipient Plain	1	5-16 cm^2	Rim sherd	Mission	–
178	50	Incipient Plain	1	5-16 cm^2	Rim sherd	Mission	7.4c
178	50	Incipient Plain	1	<5 cm^2	Rim sherd	Mission	7.4g
193	50	Incipient Plain	1	5-16 cm^2	Rim sherd	Mission	–
15	11	Incipient Plain: Incised and Impressed variety	1	5-16 cm^2	Body sherd	Early Cienega	7.2k
100	10	Incipient Plain	1	<5 cm^2	Body sherd	Early Cienega	–
112	11	Incipient Plain	1	<5 cm^2	Body sherd	Early Cienega	7.2g
3220	10	Incipient Plain: Coiled and Incised variety	1	<5 cm^2	Rim sherd	Early Cienega	7.2n, 7.3, 7.4f
3294	10	Incipient Plain: Coiled variety	1	<5 cm^2	Body sherd	Early Cienega	–
3294	10	Incipient Plain	1	<5 cm^2	Body sherd	Early Cienega	–
3294	11	Incipient Plain: Coiled and Incised variety	1	<5 cm^2	Rim sherd	Early Cienega	7.2m, 7.4b
3294	11	Incipient Plain: Coiled variety	1	<5 cm^2	Body sherd	Early Cienega	–
3294	11	Incipient Plain: Coiled variety	2	<5 cm^2	Body sherd	Early Cienega	–
3294	11	Incipient Plain: Coiled variety	1	<5 cm^2	Body sherd	Early Cienega	–
3294	11	Incipient Plain: Coiled variety	1	<5 cm^2	Body sherd	Early Cienega	–
3325.01	30	Incipient Plain: Coiled variety	1	<5 cm^2	Body sherd	Early Cienega	–
3327	11	Incipient Plain: Coiled variety	1	<5 cm^2	Rim sherd	Early Cienega	7.4d
3327	11	Incipient Plain: Coiled and Incised variety	1	<5 cm^2	Rim sherd	Early Cienega	7.2l
3327	11	Incipient Plain	1	<5 cm^2	Rim sherd	Early Cienega	7.4a
3332	11	Incipient Plain: Coiled variety	1	<5 cm^2	Rim sherd	Early Cienega	7.2i, 7.4e
3332	11	Incipient Plain: Coiled variety	2	<5 cm^2	Body sherd	Early Cienega	7.2j
3332	20	Incipient Plain	1	<5 cm^2	Body sherd	Early Cienega	7.2h
3357	50	Incipient Plain	1	5-16 cm^2	Rim sherd	Early Cienega	–
9372	11	Incipient Plain: Coiled variety	2	<5 cm^2	Body sherd	Early Cienega	–
0	504	Incipient Plain: Incised variety	1	<5 cm^2	Rim sherd	Unnamed	7.2c
581	10	Incipient Plain: Incised variety	1	<5 cm^2	Body sherd	Unnamed	7.2d
628	50	Incipient Plain: Incised and Punctate variety	1	5-16 cm^2	Rim sherd	Unnamed	7.2f
3359	10	Incipient Plain: Incised variety	1	<5 cm^2	Body sherd	Unnamed	7.2
3359	10	Incipient Plain	1	<5 cm^2	Body sherd	Unnamed	7.2b
3359	10	Incipient Plain	2	<5 cm^2	Body sherd	Unnamed	7.2a

[a] Stratum 4 is sheet trash, Stratum 10 is undifferentiated structure fill, Stratum 11 is roof or wall fall, Stratum 20 is floor contact, Stratum 30 is fill of a secondary feature within a structure, Stratum 50 is fill of an extramural feature, Stratum 504 is that in which features belonging to the unnamed phase are located.

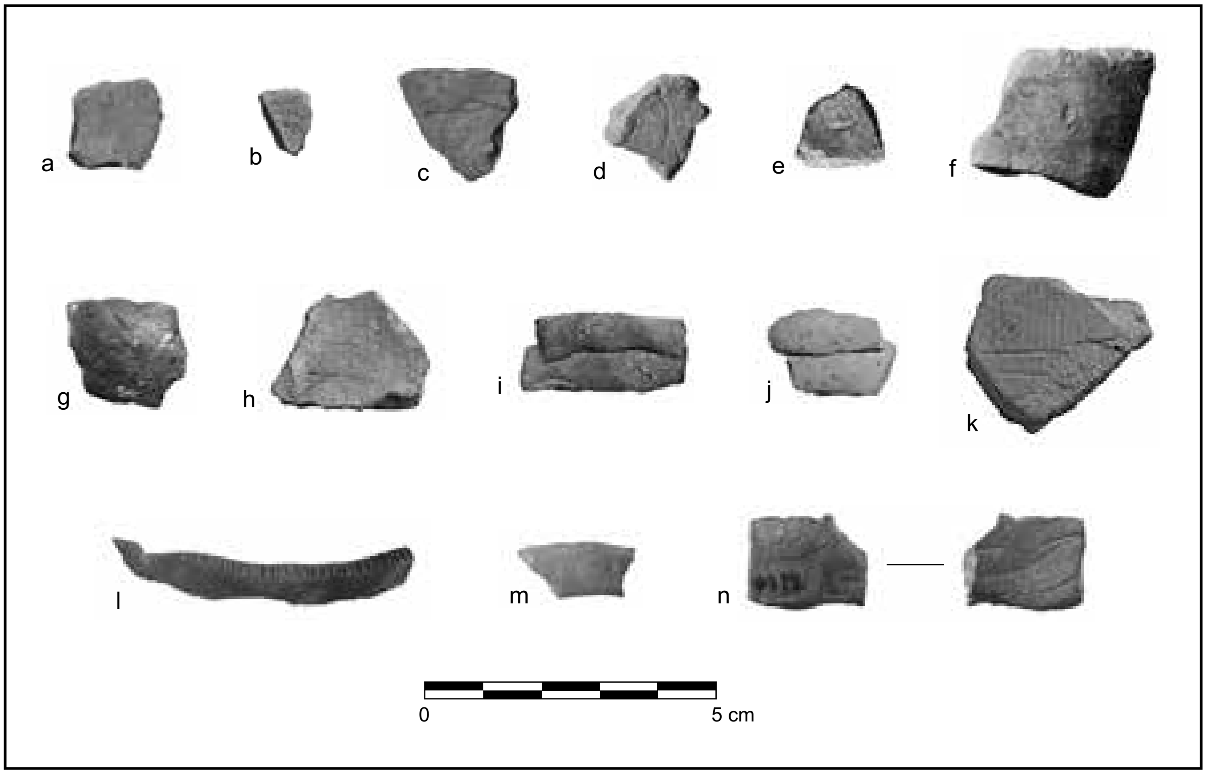

Figure 7.2. Incipient plain ware sherds recovered from the Clearwater site, AZ BB:13:6 (ASM): (a-f) were recovered from unnamed phase contexts dating to circa 2100 B.C.; (g-n) were recovered from Early Cienega phase contexts (circa 800-400 B.C.). (a-b, g-h) were typed as Incipient Plain; (c-e) were typed as Incipient Plain: Incised variety; (f) was typed as Incipient Plain: Incised and Punctate variety; (i-j) were typed as Incipient Plain: Coiled variety; (k) was typed as Incipient Plain: Impressed and Incised variety; (l-n) were typed as Incipient Plain: Coiled and Incised variety.

represented by more than one sherd. Thirty-eight additional "ceramic" objects were collected by field personnel. All were quite soft (less than 2.5 on the Mohs scale of hardness) and appear to be unfired, consolidated sediments. These objects were not discarded, and they are curated with the Clearwater ceramics, allowing others to examine them. They are not, however, discussed further in this chapter.

The incipient plain ware sherds are generally quite small (less than 5 cm^2), and none is larger than 16 cm^2. The collection contains portions of 20 vessels represented by body sherds and 13 vessels represented by rim sherds. Six of the vessels display incised decoration, one displays incised and punctate decoration, one displays an incised and impressed surface, and the remaining 25 vessels lack surface elaboration altogether. Six of the vessels were recovered from circa 2100 B.C. contexts, 20 were recovered from Early Cienega phase contexts, another six of the vessels were incorporated into mission deposits, and one sherd was recovered from a nonfeature sheet trash context. The latter seven vessels are not included in the following discussion of production sequence attribute data because they could not be assigned to a specific time span.

Materials Procurement

The manufacture of pottery begins with the collection of raw materials—primarily water, clay, temper (if added), and fuel (Crown and Wills 1995:247; Rye 1981:29). Material procurement attributes recorded in this study were limited to aspects of the temper, which provide evidence regarding production technology and resource provenance. The modal size of nonplastic grains was recorded after comparing the sand grains in the body of a vessel against reference samples mounted on a W. F. McCollough "sand-gauge."

Six raw material procurement attributes were recorded. Three of the attributes—temper type, generic temper source, and specific temper source—provided little information, because all the incipient plain ware recovered from the Clearwater site appears to have been made from untempered clay (Table 7.7). Seven of the sherds lacked silt- or sand-sized nonplastics altogether; the other 19 sherds contained less than 10 percent nonplastics in their paste, based on comparison with visual estimation charts reproduced in Matthew et al. (1991:240). The modal nonplastic grain size in those 19 sherds ranged from silt (<1/16 mm),

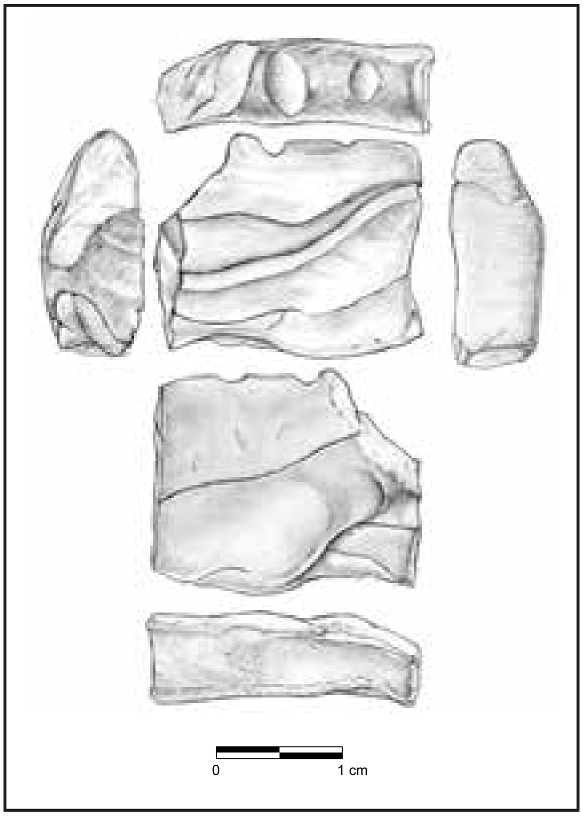

Figure 7.3. Illustration showing unusual aspects of the manufacture of one Early Cienega phase Incipient Plain: Coiled and Incised variety sherd from the Clearwater site, AZ BB:13:6 (ASM).

to fine sand (1/8-1/4 mm). Grain shapes ranged from subangular to rounded.

Based on binocular microscopic examination, natural nonplastics appear to have been present in the clay body, rather than added separately. Clay deposits located at the site or along the Santa Cruz River could have provided the raw material. None of the sherds displayed charcoal flecks in their paste, and only one sherd displayed casts resulting from organic material that had burned out of the paste during firing. Both of those characteristics were noted by Kisselburg (1993) in some of the Late Cienega phase incipient plain ware recovered from Coffee Camp.

Forming, Finishing, and Decorative Techniques

Rye (1981:62) distinguishes three main stages of vessel forming: primary forming, secondary forming, and surface modification. During primary forming, the prepared clay body is manipulated into a form resembling the finished vessel (Rye 1981:62); the vessel shape attribute qualitatively characterizes the primary form of a pot. During secondary forming, the shape of the vessel is further refined, and the final, relative proportions of the pot are established (Rye 1981:62). In the current study, the vessel form attribute qualitatively characterizes the final proportions of a pot, whereas the orifice diameter and vessel wall thickness measurements provide quantitative data on those proportions. The final shape of the lip of a vessel was characterized qualitatively by a rim shape attribute (Colton 1953). Surface modifications considered part of the forming sequence include polishing, scraping, smoothing, incising, impressing, and punctation (Rye 1981:62).

No attributes characterizing primary forming technique—such as coiling, pinching, preparation and joining of slabs, throwing, or molding (Rye 1981:62)—or secondary forming technique—such as coiling, joining, beating, scraping, trimming, turning, or throwing (Rye 1981:62)—were explicitly recorded in this study. Coiling and pinching (Rye 1981:70) appear to be the primary forming techniques used to create these incipient plain wares.

Portions of 13 vessels were definitely formed by coiling. Superficially, the coiled variety of incipient plain ware resembles later corrugated pottery. However, unlike corrugated wares, coil junctures are clearly visible on both the interior and exterior surfaces of nearly all specimens. Coils were pressed together and overlap. In cross section, some of the overlapping coils produce a "clapboard" appearance, while others produce a "shiplap" appearance (Heidke 1998:Figure 10.3). Coil widths range from 5.2 mm to 9.8 mm, with an average width of 6.9 mm. The rim of one vessel displays a tapered point at the end of its terminal coil; this aspect makes the rim resemble a basket made of clay. Another one of the coiled and incised sherds is unusual in that the coils were partially obliterated by first smoothing a thin layer of clay over them and then emphasizing coil junctures with fine incised lines (see Figures 7.2n, 7.3). Subsequently, unrelated wider lines were incised into the interior surface and lip of the vessel.

Vessel Shape and Form, Orifice Diameter, and Rim Shape. The vessel form of most incipient plain ware recovered from the Clearwater site could not be determined because most vessels are represented by body sherds. Among the sherds that could be determined, all are bowls. Four bowl vessel forms were documented: outcurved bowl (see Figure 7.4b-e), plate (see Figure 7.4a), hemispherical bowl (see Figure 7.4f), and incurved bowl (see Figure 7.4g). Nine bowl rim sherds were large enough to provide orifice diameter measurements. The orifice diameter of those pots ranged from 3.0-14.0 cm, with an average orifice diameter of 8.0 cm. The small size of these vessels may help explain why untempered clay was used in their manufacture. Tohono O'odham (Papago) potters temper clays intended for

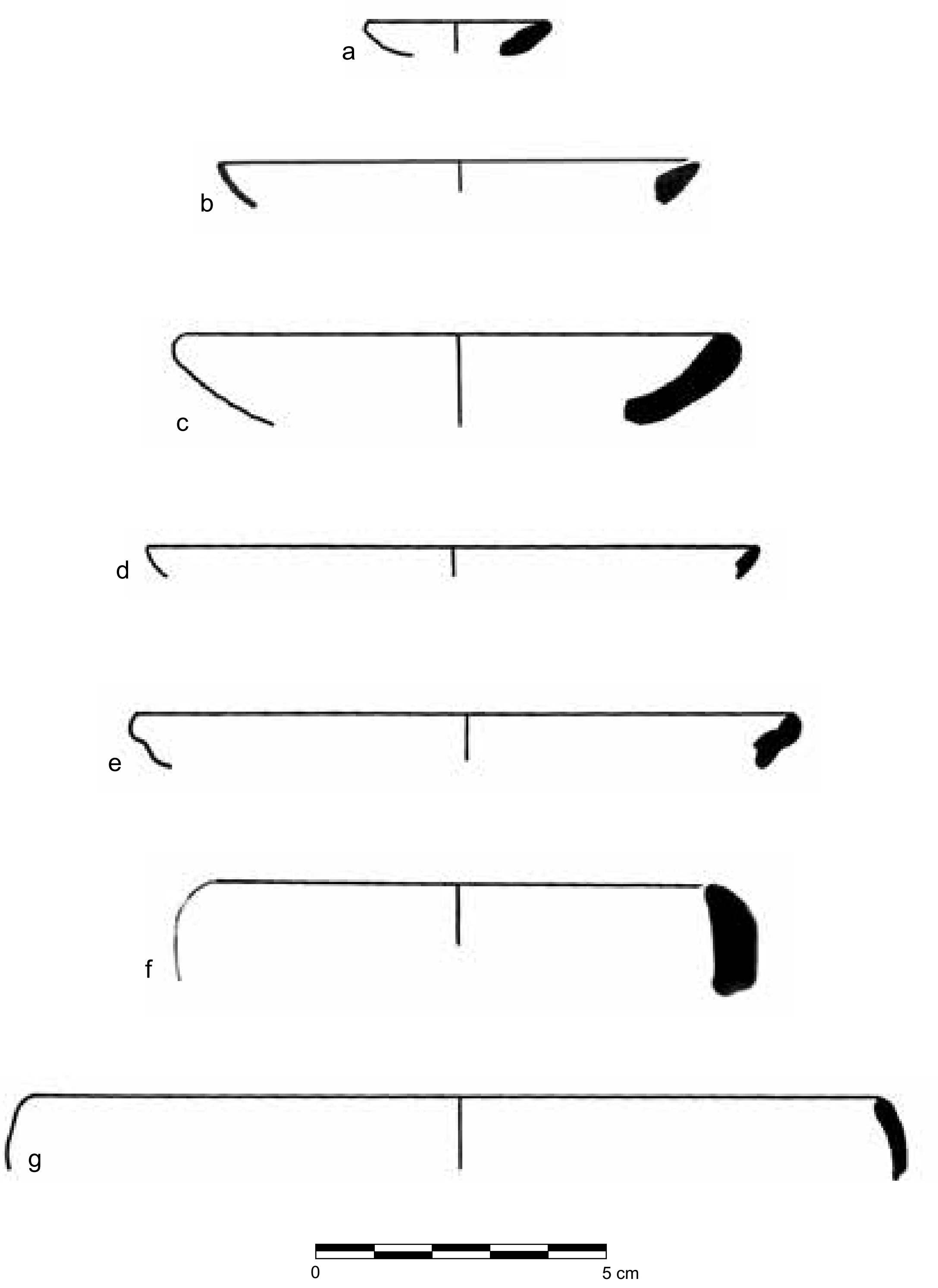

Figure 7.4. Incipient plain ware bowl vessel forms from the Clearwater site, AZ BB:13:6 (ASM): (a) plate; (b-e) outcurved bowls; (f) hemispherical bowl; and (g) incurved bowl. (a-b) and (d-f) were recovered from Early Cienega phase contexts (circa 800-400 B.C.); (c, g) were recovered from Feature 178, a mission deposit located at the San Agustín Mission locus.

Table 7.7. Clearwater site, AZ BB:13:6 (ASM), incipient plain ware production sequence attribute data.

	Unnamed Phase Varieties			Early Cienega Varieties			
Attribute	Incipient Plain	Incipient Plain: Incised Variety	Incipient Plain: Incised and Punctate Variety	Incipient Plain	Incipient Plain: Coiled Variety	Incipient Plain: Coiled and Incised Variety	Incipient Plain: Incised and Impressed Variety
Body Composition							
Untempered clay	2	3	1	6	10	3	1
Modal Nonplastic Grain Size							
Indeterminate	0	1	1	0	2	0	0
Clay	2	1	0	0	2	2	0
Silt	0	0	0	1	5	0	1
Very fine sand	0	1	0	4	1	1	0
Fine sand	0	0	0	1	0	0	0
Organic Temper Casts Visible							
Indeterminate	0	0	0	0	2	0	0
Absent	1	3	1	6	8	3	0
Present	1	0	0	0	0	0	1
Charcoal Fragments in Paste							
Indeterminate	0	0	0	0	2	0	0
Absent	2	3	1	6	8	3	1
Coil Type							
Indeterminate	–	–	–	–	1	0	–
"Clapboard"	–	–	–	–	5	3	–
"Shiplap"	–	–	–	–	4	0	–
Coil Width (mm)							
Number of cases	N/A	N/A	N/A	N/A	10	3	N/A
Range	–	–	–	–	5.20-9.00	5.20-9.80	–
Mean	–	–	–	–	6.83	7.13	–
Standard deviation	–	–	–	–	1.26	2.39	–
Vessel Form							
Indeterminate	2	1	0	4	8	0	1
Indeterminate bowl	0	1	1	0	0	0	0
Outcurved bowl	0	0	0	0	2	1	0
Plate	0	1	0	1	0	1	0
Hemispherical bowl	0	0	0	0	0	1	0
Incurved bowl	0	0	0	1	0	0	0
Bowl Orifice Diameter (cm)							
Number of cases	N/A	1	1	2	2	3	N/A
Range	–	8	5	3.00-5.00	10.00-11.00	8.00-14.00	–
Mean	–	–	–	4.00	10.50	10.00	–
Standard deviation	–	–	–	1.41	0.71	3.46	–
Rim Shape							
Rounded	–	0	1	2	2	2	–
Tapered	–	1	0	0	0	1	–

Table 7.7. Continued.

	Unnamed Phase Varieties			Early Cienega Varieties			
Attribute	Incipient Plain	Incipient Plain: Incised Variety	Incipient Plain: Incised and Punctate Variety	Incipient Plain	Incipient Plain: Coiled Variety	Incipient Plain: Coiled and Incised Variety	Incipient Plain: Incised and Impressed Variety
Average Vessel Wall Thickness (mm)							
Number of cases	1	2	1	4	10	3	–
Range	5.00	4.30-4.50	6.40	2.50-6.80	2.80-4.90	4.00-6.70	–
Mean	–	4.40	–	4.12	4.01	4.97	–
Standard deviation	–	0.14	–	1.86	0.58	1.50	–
Minimum Vessel Wall Thickness (mm)							
Number of cases	2	2	1	6	10	3	1
Range	3.40-4.40	2.00-3.30	5.60	2.00-7.00	2.00-4.60	2.00-5.40	4.40
Mean	3.90	2.65	–	3.88	3.64	3.50	–
Standard deviation	0.71	0.92	–	1.86	0.74	1.73	–
Maximum Vessel Wall Thickness (mm)							
Number of cases	2	2	1	6	10	3	1
Range	4.10-5.20	4.80-5.00	6.70	3.30-8.40	3.60-5.30	4.80-7.70	6.90
Mean	4.65	4.90	–	5.87	4.47	5.87	–
Standard deviation	0.78	0.14	–	2.42	0.54	1.59	–
Difference between Minimum and Maximum Vessel Wall Thickness (mm)							
Number of cases	2	2	1	6	10	3	1
Range	0.70-0.80	1.50-3.00	1.10	0.80-5.20	0.10-1.70	1.70-3.10	2.50
Mean	0.75	2.25	–	1.98	0.83	2.37	–
Standard deviation	0.07	1.06	–	1.72	0.57	0.70	–
Interior Surface Treatment							
Indeterminate	0	1	0	0	3	0	0
Hand-smoothed	1	0	0	5	4	0	0
Lightly polished (“chalky feel”)	0	0	0	1	3	3	0
Lightly burnished (“waxy feel”)	1	2	1	0	0	0	0
Basket-impressed	0	0	0	0	0	0	1
Exterior Surface Treatment							
Indeterminate	0	2	0	1	1	0	1
Hand-smoothed	1	0	0	4	4	0	0
Lightly polished (“chalky feel”)	0	1	1	1	5	2	0
Lightly burnished (“waxy feel”)	1	0	0	0	0	1	0
Location of Incising							
Interior	–	3	0	–	–	0	1
Rim lip	–	0	1	–	–	2	0
Interior, exterior, and rim lip	–	0	0	–	–	1	0

Table 7.7. Continued.

	Unnamed Phase Varieties			Early Cienega Varieties			
Attribute	Incipient Plain	Incipient Plain: Incised Variety	Incipient Plain: Incised and Punctate Variety	Incipient Plain	Incipient Plain: Coiled Variety	Incipient Plain: Coiled and Incised Variety	Incipient Plain: Incised and Impressed Variety
Moisture Content When Incised							
Leather-hard	–	1	0	–	–	3	0
Soft/Moist	–	1	1	–	–	0	1
Dry	–	1	0	–	–	0	0
Shape of Incision							
Indeterminate	–	1	0	–	–	0	0
U-shaped	–	1	1	–	–	1	1
V-shaped	–	1	0	–	–	2	0
Depth of Incision (mm)							
Number of cases	N/A	2	1	N/A	N/A	3	1
Range	–	0.20-0.60	0.50	–	–	0.40-0.50	0.20
Mean	–	0.40	–	–	–	0.43	–
Standard deviation	–	0.28	–	–	–	0.06	–
Width of Incision (mm)							
Number of cases	N/A	2	1	N/A	N/A	3	1
Range	–	0.80-1.10	0.90	–	–	0.30-0.60	0.70
Mean	–	0.97	–	–	–	0.43	–
Standard deviation	–	0.15	–	–	–	0.15	–
Carbon Core							
Indeterminate	0	0	0	0	4	0	0
Absent	1	3	1	6	6	3	1
Full (edge-to-edge)	1	0	0	0	0	0	0
Fire Cloud							
Indeterminate	0	1	0	0	2	1	0
Absent	2	2	1	4	7	1	1
Interior and exterior	0	0	0	2	0	1	0
Exterior	0	0	0	0	1	0	0

making large vessels, but do not add temper when making small bowls or plates (Fontana et al. 1962:57-58). Two rim shapes were observed: rounded and tapered.

Classification of vessel function, using the Shepard/Braun approach described above (Table 7.8), reveals that most incipient plain ware pots recovered from the Clearwater site would have made excellent individual serving vessels, although storage and unknown, specialized tasks are also indicated.

Vessel Wall Thickness. Analysis of the incipient plain ware pottery recovered from the Santa Cruz Bend site showed that the vessel wall thickness of individual pots can be highly variable (Heidke et al. 1998a). Therefore, four measurements of vessel wall thickness (average, minimum, maximum, and difference between minimum and maximum thickness) are reported in Table 7.7. The overall range of the incipient plain ware sherds is 2.0-8.4 mm, with a mean average vessel wall thickness of 4.38 mm.

Interior and Exterior Surface Treatments. All the incipient plain ware had interior and exterior surfaces displaying dull hand-smoothed surfaces (Rye 1981:89-90) or polishing/burnishing (Rye 1981:90). Exterior

Table 7.8. Frequency of incipient plain ware sherds in each vessel form class, reported by time, from the Clearwater site, AZ BB:13:6 (ASM).

	Recovery Context Date			
Functional Category (Final Vessel Form Class)	Unnamed Phase	Early Cienega	Mission	Row Total
Simple and Dependent Restricted Vessels				
F: Seed storage (<6.0 cm orifice diameter)	0	1	0	1
H: Specialized, temporary dry storage (13.0-25.5 cm orifice diameter)	0	0	1	1
Unrestricted Vessels (Deep)				
L: Individual serving in domestic context (6.0-12.5 cm orifice diameter)	0	4	1	5
Unrestricted Vessels (Shallow)				
P: Specialized, infrequently used miniature (<6.0 cm orifice diameter)	0	1	0	1
Q: Individual serving (6.0-12.5 cm orifice diameter)	1	0	0	1
R: Collecting, processing, and/or individual-to-large group serving (13.0-25.5 cm orifice diameter)	0	1	0	1
Column total	1	7	2	10

surfaces are often somewhat irregular ("bumpy"), while interior surfaces are less so and are usually uniformly curved.

Incising. Incising is a decorative forming technique produced by cutting into the surface of the pot (Rye 1981:66, 90). Eight incipient plain ware vessels display incised decoration. Three different design fields were documented. Four vessels were incised on their interior surface and nowhere else (see Figure 7.2c-e); one of those sherds also displays an impressed surface that may have resulted from pressing the wet clay against a basket (see Figure 7.2k). Three vessels were incised on the lip of their rim and nowhere else (see Figure 7.2l-m); one of the vessels also displays punctation (see Figure 7.2f). Finally, the eighth vessel displayed an incised design on the lip of its rim and on its interior and exterior surfaces (see Figures 7.2n, 7.3). Design elements include straight and curved lines; those elements are common in the contemporary Western Archaic rock art tradition (Wallace and Holmlund 1986:Figure D-3).

Examination of an incised surface can provide clues about the stage of drying a vessel was in when it was incised. Four of the sherds display clean lines, indicating the design was cut into the clay when it was in a leather-hard condition; three of the sherds display elevated ridges along both sides of the incised lines, indicating a soft, plastic condition; and one of the sherds displayed the chipped edges diagnostic of incising that occurred after the vessel has dried hard (Rye 1981:Figure 47).

In cross section, three of the four vessels incised when the clay was leather-hard display V-shaped incisions. The fourth vessel incised when the clay was leather-hard, as well as the three vessels incised when the clay was soft, display U-shaped incisions. The shape of the incised grooves on the eighth vessel could not be determined. Lines incised into leather-hard clay range from 0.4 mm to 0.5 mm deep (average 0.43 mm) and from 0.3 mm to 0.8 mm wide (average 0.52 mm). Lines incised into soft clay range from 0.2 mm to 0.6 mm deep (average 0.43 mm), and from 0.7 mm to 1.0 mm wide (average 0.87 mm). Lines incised into dry clay are 0.2 mm deep and 1.1 mm wide.

Firing Conditions

The purpose of firing is to subject the formed vessel to a high enough heat for a sufficient time to insure the complete destruction of the clay mineral crystals and to insure the vessel exhibits the performance characteristics required of it (Rye 1981:96). Core color and fire clouding—qualitative measures of firing conditions—were recorded in this study (Rice 1987:343-345, 476; Rye 1981:114-118). Carbon cores are black-to-gray areas observable in the interior cross section of a vessel wall and are associated with the incomplete removal of carbonaceous matter from the clay during firing (Rice 1987:474). Carbon cores were absent from most specimens, indicating vessels were probably fired in an incompletely oxidizing atmosphere (Rye 1981:115-116; Shepard 1995:221). Fire clouds are darkened areas on the surface of a vessel and are characteristic of firing conditions in which fuel comes in contact with the vessel (Rice 1987:476). Eighteen of the incipient plain ware sherds lacked fire clouds, three displayed fire clouds on both their interior and exterior surfaces, one displayed fire clouds only on its exterior surface, and in four cases, the presence or absence of fire clouds was recorded as indeterminate.

Discussion

During the last decade, a previously unknown, early stage of ceramic development has been documented at numerous archaeological sites located in the middle and lower Santa Cruz River Valley (Heidke 1997, 1998, 1999, 2005a; Heidke and Ferg 1997, 2001; Heidke and Habicht-Mauche 1999; Heidke and Stark 1996; Heidke et al. 1998a; Kisselburg 1993; Stinson and Heidke 2006). The research presented here has furthered current knowledge of this stage in numerous ways.

First, the size of the incipient plain ware sample has increased greatly, from 141 to 174 vessels. Second, the time depth of ceramic container production has increased with evidence from contexts assigned to the interval between the end of the Middle Archaic and the beginning of the San Pedro phase. The incipient plain ware pottery recovered from unnamed phase contexts dating to circa 2100 B.C. (Chapter 19, this report) represents the earliest ceramic containers recovered from archaeological deposits in the Greater Southwest, and they are accompanied by other types of fired clay objects, including figurines (Chapter 8, this report).

Hill (1996) presented linguistic evidence that the diffusion of maize into the Southwest occurred during a period of coherence among the southern Uto-Aztecan languages, while the appearance of pottery occurred at a later time, when linguistic boundaries were starting to emerge among the languages. Evidence from the Clearwater site questions Hill's interpretation, however, as some of the earliest maize remains currently known from the Greater Southwest occur in the same deposits as the earliest pottery.

Current knowledge is compatible with at least two hypotheses: either the diffusion of maize predates the beginning of the unnamed phase, or a different, perhaps extinct, word root was used to refer to the small fired clay containers described here. The second hypothesis seems more likely, given that maize remains are currently unknown from Middle Archaic contexts. Perhaps it is the well-made, tempered seed jars of the later plain ware horizon (Crown and Wills 1995:249; Deaver and Ciolek-Torrello 1995:484-485, 512; Di Peso 1979:92; Doyel 1991:239, 259; Fish et al. 1992:64; Gladwin et al. 1965:303; Haury 1978:16 in Weaver et al. 1978; Huckell 1993:6; LeBlanc 1982; Martin 1952:79; Sayles 1983:132; Schroeder 1982:9-10; Stark 1995:249; Wendorf 1953; Wheat 1955:84; Wilson and Blinman 1993; Wilson et al. 1992:2, 8-12) that linguistically mark the appearance of pottery noted by Hill (1996).

Third, pottery from the unnamed phase is very similar to that recovered from San Pedro phase contexts at Las Capas (Heidke 2005a), with plain, incised, and incised and punctate varieties present. Fourth, the hypothesis that Incipient Plain: Coiled variety pottery may be diagnostic of the Early Cienega phase (Heidke 1998; Heidke and Ferg 1997) is supported by the evidence from the Clearwater site. Fifth, a new variety—Incipient Plain: Coiled and Incised variety—was documented in two Early Cienega phase contexts, Features 3294 and 3327.

The exact function(s) of Early Agricultural period incipient plain ware containers remains something of a mystery. Analysis of their morphology, size, and performance characteristics (Heidke 2005a) indicates most were well suited to serving tasks, but begs the question as to what was served in them. Saguaro wine, decoctions containing tobacco or another member of the Solanaceae family (such as datura), medicinal infusions and/or teas made from creosotebush, globemallow, Mormon tea, morning-glory, pigweed, sage, sumac, and tansy mustard—all of which have been documented in the pollen and/or macrobotanical data recovered from Early Agricultural period sites and are documented uses by Native American peoples—have been suggested (Heidke 1999, 2005a). Alternatively, incipient plain ware vessels may have been used to hold offerings of food, sanctified water, or flowers (Coyle 2000:121-122; Kindl 2000; Vázquez 2000:65-66; Wyckoff 1990:16), or even to transfer live coals (Patencio 1969:43, 120 in Griset 1990:184). Residue analysis holds the promise of answering what purpose these vessels served (Longacre 1995:279), and is an avenue of research that should be pursued in the future.

Wilcox (1987:152, 1991:49; see also Bohrer 1994 and Hastorf and Johannessen 1994) has suggested that the quartered design layouts painted on Pioneer period, Hohokam bowl interiors may have symbolized a cosmological belief in a universe divided into four quarters, although a fifth direction, the center, forming an *axis mundi* linking zenith and nadir, was also likely implied by these designs (Coyle 2000; Kindl 2000; Neurath 2000; Vázquez 2000). That symbolism may reflect an ancient Uto-Aztecan cosmological view that has continued to be expressed to the present. Ancient because a five- or six-fold view of the world is expressed in Uto-Aztecan languages as far removed in time and space as Cora-Huichol and Hopi.

According to Miller (1983:Figure 2), the Hopi language branched from the rest of the Uto-Aztecan family somewhere between 6,000 B.C. and 5,500 B.C., yet contemporary Cora and Huichol bowl (Coyle 2000:121; Kindl 2000:49; Vázquez 2000:67-69) and Hopi altar (Hieb 1979) symbolism appears to be very similar. That similarity suggests belief in a universe divided into quarters with an *axis mundi* running through the center is: (1) at least as old as the split between the Cora-Huichol and Hopi languages; and (2) may well have been shared with other Uto-Aztecan speakers, as the Early Agricultural period inhabitants of the Clearwater site presumably would have been (Hill 2001). If the last points are true, the materialized expression of cosmology posited by Wilcox (1987, 1991) for Pioneer period pottery should be extended back in time. The small clay bowls produced throughout the Early Agricultural period may have provided their makers with a means to think about the larger, sacred territory that they, and their divine ancestors, inhabited.

Finally, sherds of incipient plain ware are relatively rare in the archaeological record. A recent study comparing Munsell colors of the surfaces and cores of incipient plain ware sherds with the Munsell color of fired clay samples (Roos 2005) suggests why that may be the case. In an extension of Roos' study, Heidke (2005c) found that 47 percent of incipient plain ware surface and core colors suggest some vessels were fired at temperatures less than 550°C, 28 percent of surface colors and 18 percent of core colors suggest firing temperatures between 550°C and 650°C, with the remaining surface and core colors suggesting firing temperatures greater than 650°C. These values confirm Kisselburg's (1993:294) hypothesis that incipient plain ware pottery was fired at relatively low temperatures. As Kisselburg (1993) suggested, and Roos (2005) has argued, incipient plain ware containers were almost certainly subjected to greater moisture-related weathering than pottery made later in time (when most settlements were located on better-drained soils and firing temperatures were higher), and this aspect of preservation likely lowered their incidence of recovery. It also leads one to wonder if, like the Huichol's gourd effigy bowls (Kindl 2000:57), their disintegration should be considered one aspect of a universe capable of regenerating and transforming itself as it passes through cycles of life and death.

AGUA CALIENTE PHASE POTTERY FROM THE MISSION GARDENS LOCUS, THE CLEARWATER SITE, AZ BB:13:6 (ASM)

A total of 812 pottery sherds—representing portions of at least 32 individual vessels—was recovered from Features 3014 and 3038 at the Mission Gardens locus of the Clearwater site (Table 7.9). Additional information regarding characteristics of the one red-slipped sherd recovered from those deposits is provided in Table 7.10, while Table 7.11 reports the size (diameter) of 12 perforated and unperforated worked sherd discs recovered from them.

An incised body sherd recovered from Feature 3014 is illustrated in Figure 7.5a. The raised margins of the incised design indicate it was inscribed while the clay was in a plastic condition (Rye 1981:66,

Table 7.9. Pottery types recovered from Agua Caliente phase deposits at the Mission Gardens locus, the Clearwater site, AZ BB:13:6 (ASM).

	Vessel Part[a]							
	Body Sherd		Rim Sherd		Neck		Row Total	
Ceramic Type	Sherd Count	MNV[b]	Sherd Count	MNV	Sherd Count	MNV	Sherd Count	MNV
Tucson Basin Types								
Plain ware[c]	763	N/A	33	29	6	N/A	802	29
Red ware	0	0	8	1	0	0	8	1
Indeterminate red-on-brown ware	1	1	0	0	0	0	1	1
Possible Papago Plain	1	1	0	0	0	0	1	1
Column total	765	2	41	30	6	0	812	32

[a] Plain ware body and neck sherds were not inspected for conjoins; therefore, minimum number of vessel estimates are not available (N/A) for those ware and vessel part combinations.

[b] MNV = Minimum number of vessels.

[c] Sherd count includes 15 worked plain ware sherds (12 discs and 3 sherds with one edge ground).

Table 7.10. Location of slip on Agua Caliente phase red ware rim sherd recovered from the Clearwater site, AZ BB:13:6 (ASM).

Slip Location	Bowl Rim Sherd
Fully slipped on all visible interior and exterior surfaces	1

Table 7.11. Plain ware sherd discs recovered from Agua Caliente phase features at the Mission Gardens locus, the Clearwater site, AZ BB:13:6 (ASM).

Type of Disk	Diameter (cm)	Quantity
Feature 3014		
Unperforated disc	2.5 to 3.0	1
Unperforated disc	4.0	1
Feature 3038		
Indeterminate disc fragment	4.0	1
Unperforated disc	2.4	1
Unperforated disc	2.6	3
Unperforated disc	2.7	1
Unperforated disc	3.0	1
Unperforated disc	4.5	1
Unperforated disc	6.0	1
Perforated disc	4.0 to 5.0	1

Figure 47). This is the first example of incised decoration documented in an Agua Caliente phase pottery collection. It is also one of the reasons why these two features were once thought to be Protohistoric in age (Heidke and Thiel 2003:10)—before radiocarbon samples drawn from both deposits proved that hypothesis wrong (see Chapter 19).

A small piece of a red-on-brown vessel was also recovered from Feature 3014 (Figure 7.5b). The red paint was applied to the interior surface of the pot. Approximately half of that surface is plain, while the other half displays the red-painted surface (on top of the base brown ware paste). A relatively straight line separates painted and unpainted parts. Ground stone analyst Jenny Adams examined the surfaces at 40x magnification. Her observations indicate that all surfaces—the painted and unpainted portions of the interior surface, as well as the unpainted exterior surface—were polished in the same way using a stone tool. Stone polishing gave the paint a smooth texture and created a feathered appearance at its border. These characteristics do not resemble those produced by ochre precipitates on sherds (Jenny Adams, personal communication 2005), lending credence to the idea that the vessel was indeed painted.

The area of the red-on-brown sherd is only about 5 cm^2; therefore, unfortunately, it is impossible to determine what the complete design may have been. However, the characteristic of polishing over paint has been noted on many other early Southwestern pottery types, such as Estrella Red-on-gray (Haury 1965), Dos Cabezas Red-on-brown (Sayles 1945), Anchondo Red-on-brown (Di Peso 1966; Di Peso et al. 1974:57-59), the unnamed red-on-brown Mogollon ceramics described by Haury (1936:9) and Wheat (1954:89), and the unnamed red-on-brown and purple-on-red Hohokam ceramics described by Heidke (1989:81-82, 1993:107, 2003c:163). All of those types were painted with broad lines, and use an iconography that Wallace (1995) has termed Style 1. The width of the Agua Caliente phase red-on-brown sherd from Clearwater is at least 13.5 mm, suggesting it was also painted with broad lines and probably, in a design comprised of Style 1 motifs.

Temper Attributes

Temper Type

The temper type data are summarized in Table 7.12. Two compositions dominate the collection: sand temper (69.0 percent of examined sherds) and a mixture of sand and crushed sherd temper (27.6 percent). The use of crushed sherd temper makes the ceramics from these two features distinct from most prehistoric pottery. No cases of sand and crushed sherd temper were recognized in a previous study of Agua Caliente phase ceramics (Heidke et al. 1998a:504, Tables 13.6 and 13.8); however, petrographic analysis of 10 rim sherds drawn from the same contexts

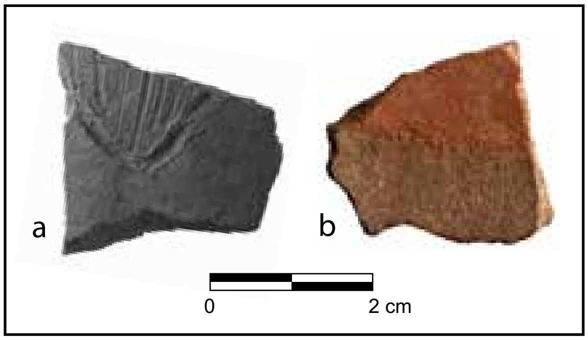

Figure 7.5. Incised Agua Caliente phase (circa A.D. 50-500) plain ware body sherd (a) and red-on-brown sherd (b) recovered from Feature 3014, the Mission Gardens locus, the Clearwater site, AZ BB:13:6 (ASM).

Table 7.12. Three-way classification of Agua Caliente phase pottery from the Mission Gardens locus, Clearwater site, AZ BB:13:6 (ASM), by ceramic type, vessel part, and temper type. (The "body" category includes body and neck sherds.)

	Plain Ware		Red Ware	Possible Papago Plain	
Temper Type	Rim	Body	Rim	Body	Row Total
Sand	17	534	1	0	552
Sand and crushed sherd	12	209	0	0	221
>25 percent gneiss/schist	0	8	0	0	8
>25 percent muscovite mica	0	1	0	0	1
Sand and fiber	0	0	0	1	1
Indeterminate	0	17	0	0	17
Column total	29	769	1	1	800

documented a small amount of crushed sherd temper in three of the samples (IFT-15, -22, and -23; see Heidke et al. 1998b:Table E.8). Therefore, the percentage of sherds tempered with a mixture of sand and crushed sherd documented in this study—27.6 percent—is nearly identical to the 30.0 percent figure that had been previously identified petrographically. Importantly, Agua Caliente phase potters generally used lesser amounts of grog temper than later, Historic era potters (less than 10 percent and greater than 10 percent, respectively).

Three additional temper types were also observed: greater than 25 percent crushed gneiss or schist temper, greater than 25 percent muscovite mica temper, and sand and fiber (presumably manure) temper. The gneiss/schist- and muscovite mica-tempered sherds may represent mixing of later, prehistoric sherds into the deposits, as those temper types are known to have been commonly used from approximately A.D. 850 to 1100 (Deaver 1984:397-398, Figure 4.69; Kelly 1978:72-76; Wallace et al. 1995:607, Figure 6). The sand- and fiber-tempered sherd may also represent mixing of a later sherd into those deposits, as that temper type is unknown prior to the Historic era.

Temper Provenance

The temper provenance data are summarized in Table 7.13. Half the characterized vessels contain sand temper from the volcanic Twin Hills Petrofacies, and approximately one-third contain sand from one of the area's volcanic sources (but could not be assigned with confidence to a specific source). The Clearwater site is located within the Twin Hills Petrofacies, indicating that at least half—and perhaps as much as 80 percent—of the pottery was locally produced. A few sherds contain sand from a granitic source (but, again, it could not be assigned with confidence to a specific petrofacies), while a single sherd contains sand from the volcanic Beehive Petrofacies.

Pottery Function

Two different approaches were utilized to assess the likely uses that pottery played in the lives of the Agua Caliente phase inhabitants of the Mission Gardens locus. The first approach was strictly typological and entailed the assignment of rim sherds to vessel form categories originally created to classify prehistoric pottery from the region. The second approach examined a subset of the rim sherds, placing them into functional categories determined by their overall morphology and size.

Typological Approach

The vessel forms of Agua Caliente phase pottery recovered from the Mission Gardens locus are reported in Table 7.14. Some of the common vessel forms are illustrated in Figures 7.6-7.7, with exterior and interior photographs of those rim sherds shown in Figures 7.8 and 7.9.

Shepard-Braun Approach

The count of sherds in each vessel form class are summarized in Table 7.15 by ceramic type. The functional interpretation of each vessel form class follows the method shown in Table 7.5. If the plain ware in vessel form class C is assumed to have been used for food preparation and cooking, and if the data set is representative, 7.7 percent of the Agua Caliente phase pottery from the Mission Gardens locus may have been used for cooking. Similarly, if

Table 7.13. Three-way classification of Agua Caliente phase pottery from the Mission Gardens locus, Clearwater site, AZ BB:13:6 (ASM), by ceramic type, vessel part, and temper source.

	Plain Ware	Red Ware	
Temper Source	Rim	Rim	Row Total
Twin Hills Petrofacies (volcanic)	15	0	15
Indeterminate volcanic source	9	0	9
Indeterminate granitic source	2	1	3
Beehive Petrofacies (volcanic)	1	0	1
Indeterminate source	2	0	2
Column total	29	1	30

Table 7.14. Frequency of Agua Caliente phase rim sherds in each vessel form class, reported by ceramic type, the Mission Gardens locus, the Clearwater site, AZ BB:13:6 (ASM).

	Ceramic Type		Row Total
Vessel Form	Plain	Red	
Bowl Forms			
Incurved	3	0	3
Plate/Platter	2	0	2
Semi-flare-rim, hemispherical	1	1	2
Outcurved	1	0	1
Indeterminate bowl form	4	0	4
Jar Forms			
Seed	8	0	8
Short straight-collar	2	0	2
Neckless	1	0	1
Indeterminate jar form	1	0	1
Indeterminate Forms			
Indeterminate flare-rim form	4	0	4
Indeterminate bowl or seed jar	1	0	1
Indeterminate form	1	0	1
Column total	29	1	30

the plain ware in vessel form classes G and H is assumed to have been used for storage, and if the data set is representative, 69.2 percent of the pottery may have been used for storage. Finally, 23.1 percent of the pottery may have been used for serving if the plain ware in vessel form class Q is assumed to have been used for individual servings, if the red ware in vessel form class M was used for small group servings, and if the data set is representative. Other collections of Agua Caliente phase pottery have also been dominated by storage containers (Heidke et al. 1998a; Huckell 1987a, 1987b; Whittlesey 1998).

CAÑADA DEL ORO PHASE POTTERY FROM THE CLEARWATER SITE, AZ BB:13:6 (ASM)

A total of 2,354 pottery sherds—representing portions of at least 173 individual vessels—was recovered from Cañada del Oro phase Feature 308 at the Clearwater site (Table 7.16).

Temper Attributes

Temper Type

The temper type data are summarized in Table 7.17. One composition dominates the collection—sand temper, 81.2 percent of examined sherds. Six additional temper types were observed: all six contain metamorphic rocks and/or minerals (gneiss/schist and/or muscovite mica [with or without sand]). The gneiss/schist- and muscovite mica-tempered sherds represent the beginning of a technological style that reached its peak in the subsequent Rillito phase (circa A.D. 850-950), and largely died out by A.D. 1100 (Deaver 1984:397-398, Figure 4.69; Kelly 1978:72-76; Wallace et al. 1995:607, Figure 6).

Temper Provenance

The temper provenance data are summarized in Table 7.18. Approximately 61 percent of the characterized vessels contain sand temper from the volcanic Twin Hills Petrofacies. Another 9 percent contain sand from one of the area's volcanic sources (but could not be assigned with confidence to a specific source). The Clearwater site is located within the Twin Hills Petrofacies, indicating at least 61 percent, and perhaps as much as 70 percent, of the pottery was locally produced. Two additional source areas were identified: the volcanic Beehive Petrofacies (four sherds) and the metamorphic Catalina Petrofacies (three sherds). The remaining sherds

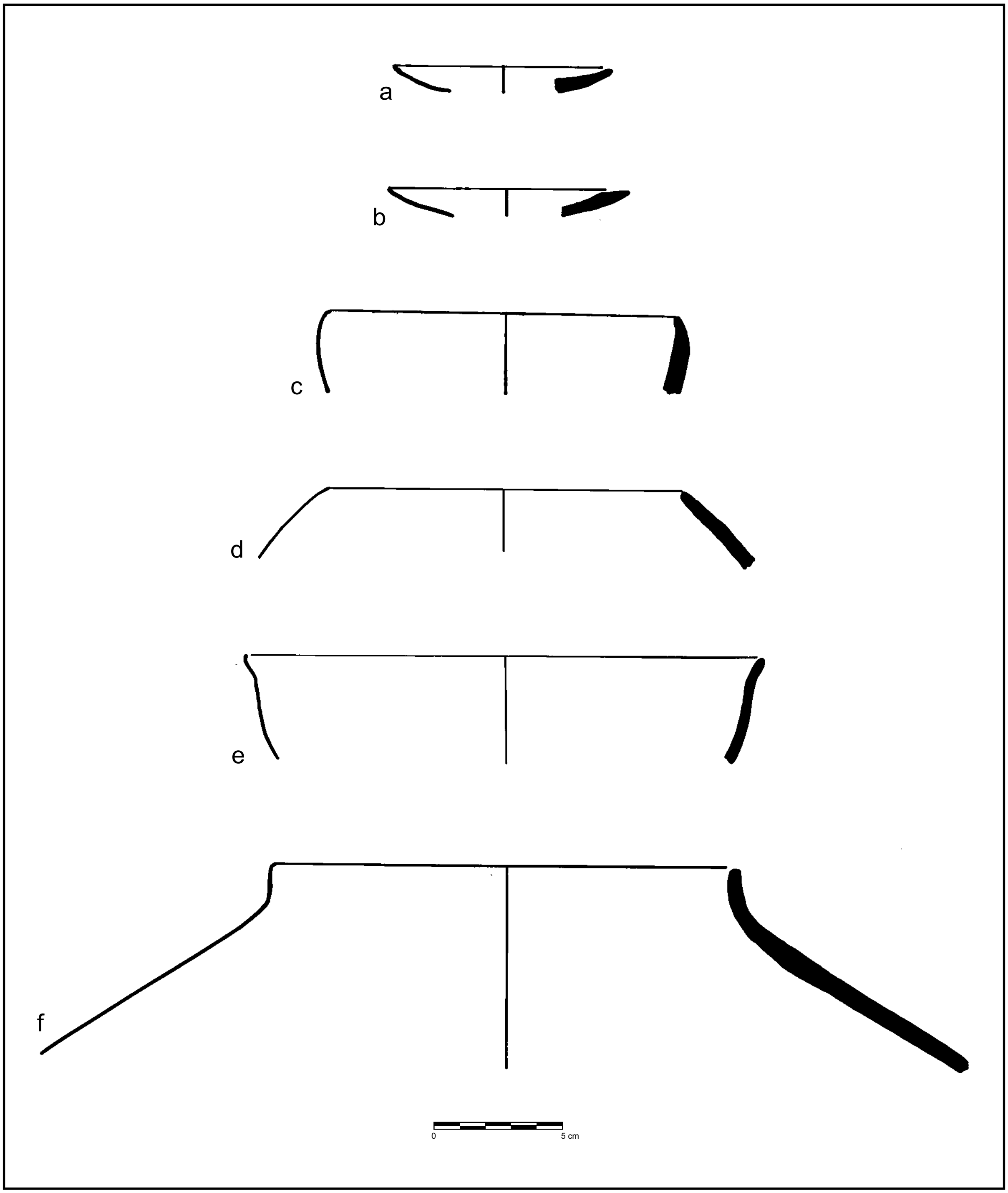

Figure 7.6. Agua Caliente phase (circa A.D. 50-500) vessel forms from the Clearwater site, AZ BB:13:6 (ASM): (a-b) plates; (c-d) incurved bowls; (e) semi-flare-rim, hemispherical bowl; (f) short straight-collared jar. (Vessel 7.6e is a red ware; all the other illustrated vessels are plain ware.)

could not be assigned to a specific source using only the binocular microscope. Six sherds contain sand from a granitic source, five sherds contain sand from either a granitic or metamorphic source, and four sherds contain sand from a metamorphic source.

Pottery Function

Two different approaches were used to assess the likely uses that pottery played in the lives of the Cañada del Oro phase inhabitants of the Clearwater site. The

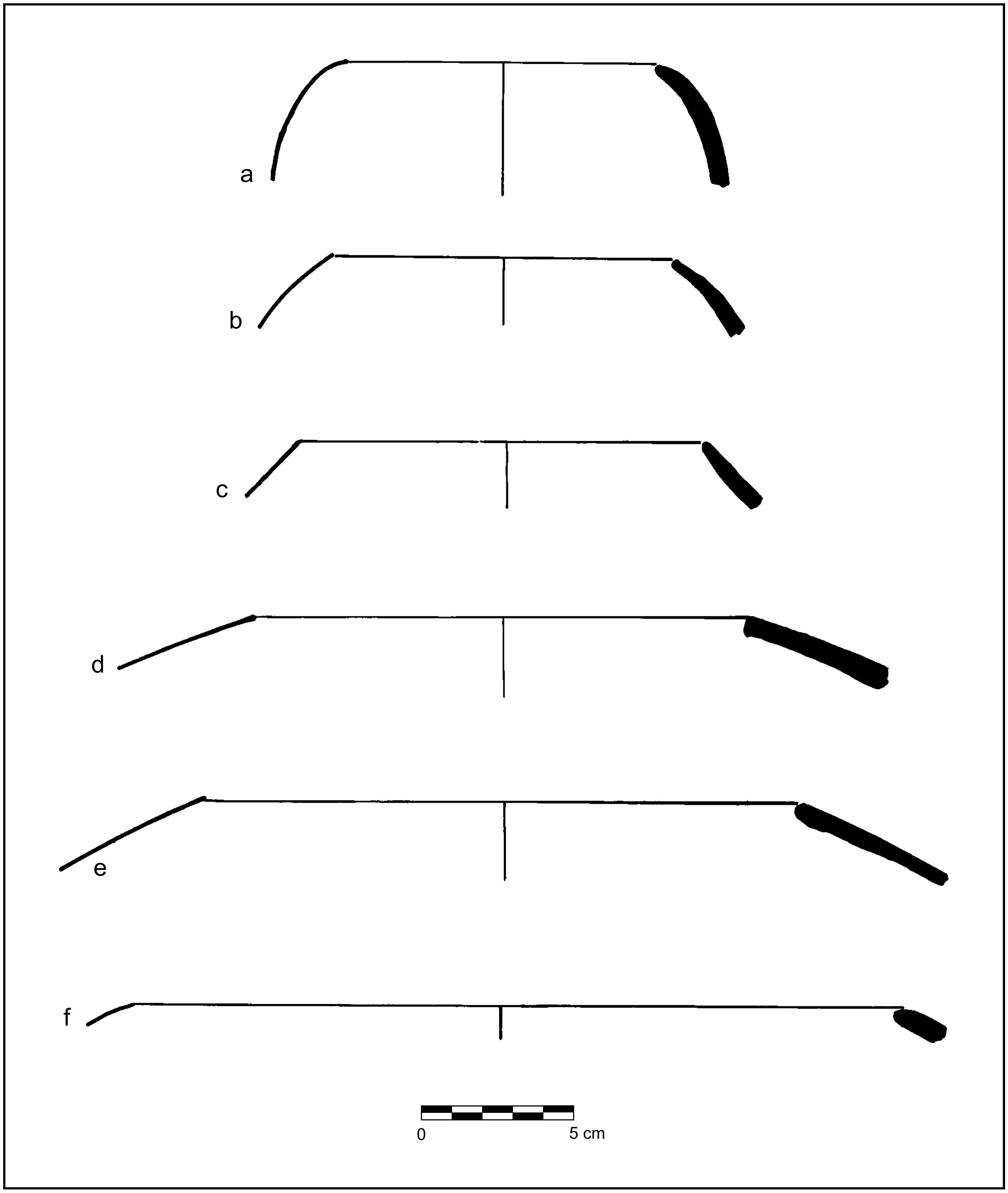

Figure 7.7. Agua Caliente phase (circa A.D. 50-500) seed jars from the Clearwater site, AZ BB:13:6 (ASM).

first approach was strictly typological and entailed the assignment of rim sherds to vessel form categories. The second approach examined a subset of the rim sherds, placing them into functional categories determined by their overall morphology and size.

Typological Approach

The vessel forms of Cañada del Oro phase Hohokam pottery recovered from the Clearwater site are reported in Table 7.19. The bowl-to-jar ratio is 3.7:1.

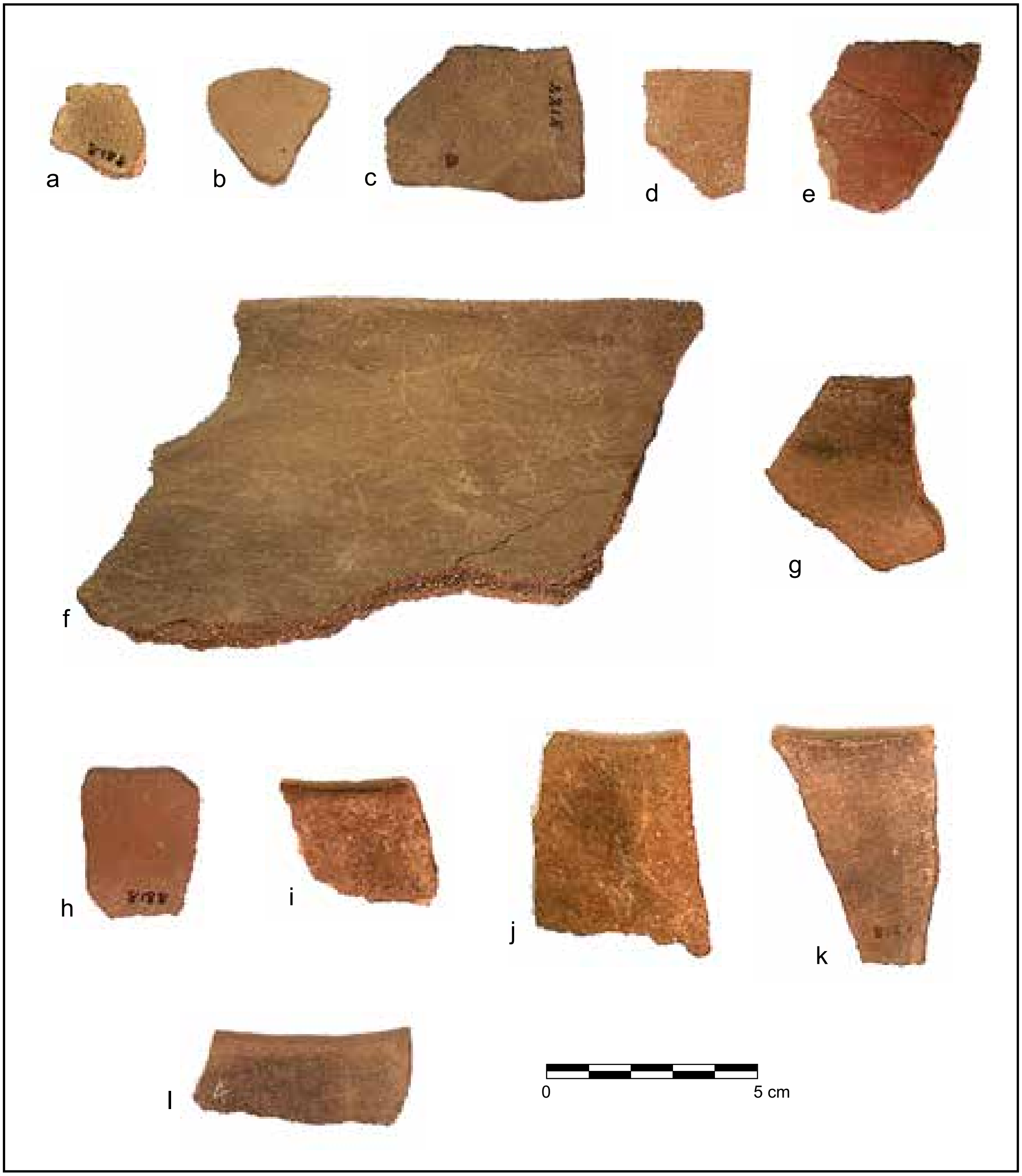

Figure 7.8. Exterior views of Agua Caliente phase (circa A.D. 50-500) rim sherds from the Clearwater site, AZ BB:13:6 (ASM): (a-b) plates; (c-d) incurved bowls; (e) semi-flare-rim, hemispherical bowl; (f) short straight-collared jar; (g-l) seed jars. (Vessel 7.8e is a red ware; all the other vessels are plain ware.)

Shepard-Braun Approach

The count of sherds in each vessel form class is summarized, by ceramic type, in Table 7.20. The functional interpretation of each vessel form class follows the method shown in Table 7.5. If the plain ware in vessel form classes C and M is assumed to have been used for food preparation and cooking, and if the data set is representative, 54.5 percent of the Cañada del Oro phase pottery from the Clearwater site may have been used for cooking. Similarly, if the plain ware in vessel form class A and the red-on-brown pottery in classes F and G is assumed to have been used for storage, and if the data set is representative,

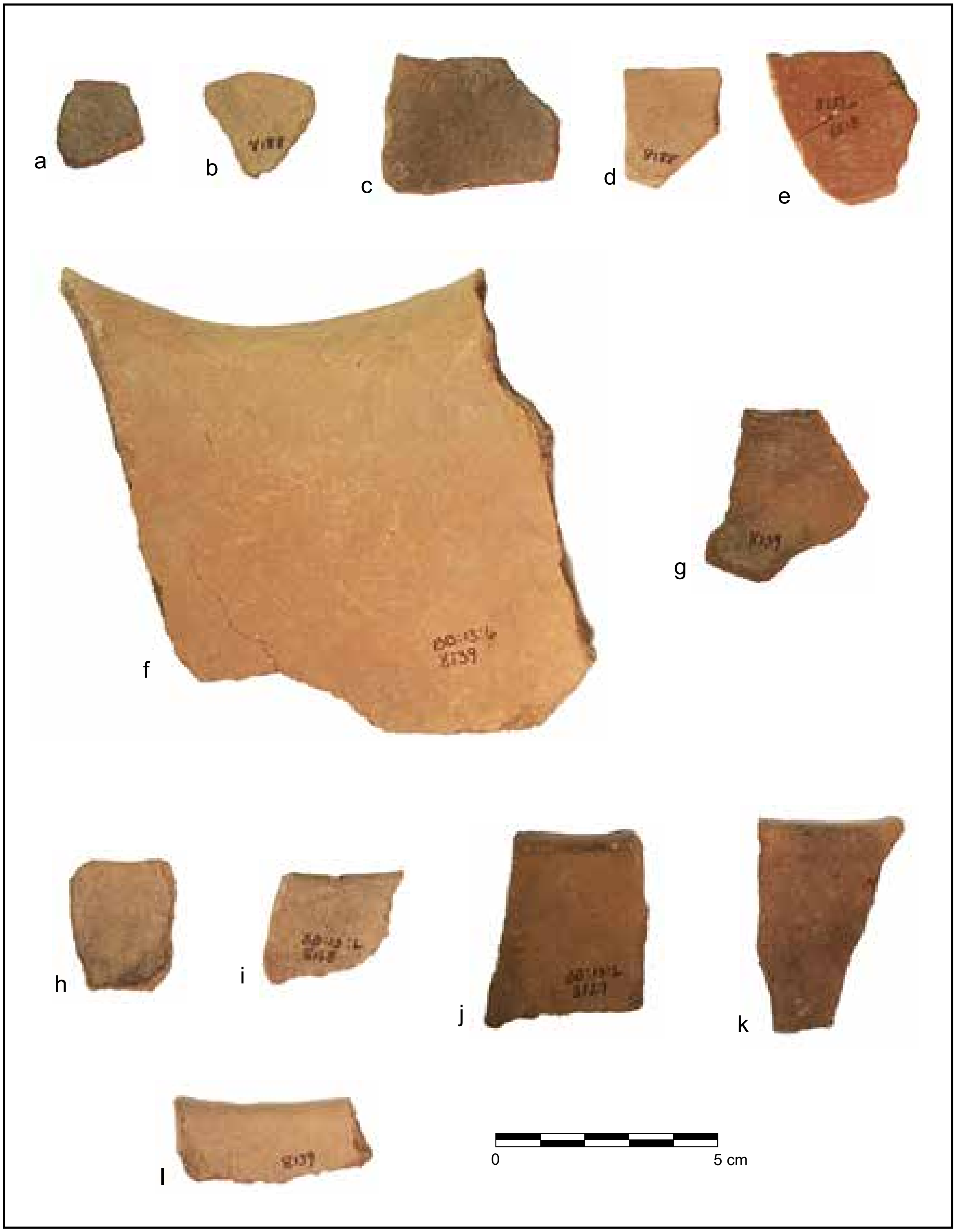

Figure 7.9. Views of the interior surface of the Agua Caliente phase (circa A.D. 50-500) rim sherds shown in Figure 7.8: (a-b) plates; (c-d) incurved bowls; (e) semi-flare-rim, hemispherical bowl; (f) short straight-collared jar; (g-l) seed jars. (Vessel 7.9e is a red ware; all the other vessels are plain ware.)

13.6 percent of the pottery may have been used for storage. Finally, 31.9 percent of the pottery may have been used for serving if the plain ware in vessel form classes L and Q was used for individual servings, if all the pottery in classes N and O was used for large group servings, and if the data set is representative.

Table 7.15. Frequency of Agua Caliente phase rim sherds in each functional category, reported by ceramic type, the Mission Gardens locus, the Clearwater site, AZ BB:13:6 (ASM).

	Ceramic Type		
Functional Category (Final Vessel Form Class)	Plain	Red	Row Total
Independent Restricted Vessels			
C: Cooking (small- to medium-sized groups), temporary storage, and/or water cooling (13.0-25.5 cm aperture diameter)	1	0	1
Simple and Dependent Restricted Vessels			
G: Specialized, temporary dry storage (6.0-12.5 cm orifice diameter)	3	0	3
H: Specialized, temporary dry storage (13.0-25.5 cm orifice diameter)	6	0	6
Unrestricted Vessels (Deep)			
M: Food preparation and/or small group serving (13.0-25.5 cm orifice diameter)	0	1	1
Unrestricted Vessels (Shallow)			
Q: Individual serving (6.0-12.5 cm orifice diameter)	2	0	2
Column total	12	1	13

Table 7.16. Hohokam pottery types recovered from Cañada del Oro phase Feature 308, the Clearwater site, AZ BB:13:6 (ASM).

		Vessel Part							
		Body Sherd		Rim Sherd		Neck		Row Total	
Ceramic Type	Production Date Range (A.D.)	Sherd Count	MNV[a]	Sherd Count	MNV	Sherd Count	MNV	Sherd Count	MNV
Tucson Basin Types									
Indeterminate red-on-brown		7	7	2	2	0	0	9	9
Indeterminate pre-Classic red-on-brown	700-1150	4	4	0	0	0	0	4	4
Snaketown Red-on-brown	700-750	1	1	0	0	0	0	1	1
Cañada del Oro Red-on-brown	750-850	44	31	82	13	0	0	126	44
Cañada del Oro or Rillito red-on-brown	750-950	1	1	5	1	0	0	6	2
Plain		2,020	N/A	110	105	68	N/A	2,198	105
Indeterminate red-on-brown or plain		1	1	1	1	0	0	2	2
Phoenix Basin Types									
Gila Butte Red-on-buff	750-850	3	2	0	0	0	0	3	2
Gila Butte or Santa Cruz red-on-buff	750-950	1	1	0	0	0	0	1	1
Indeterminate Red-on-buff		2	2	0	0	0	0	2	2
Indeterminate Buff		2	1	0	0	0	0	2	1
Column Total		2,086	51	200	122	68	0	2,354	173

[a] MNV = Minimum number of vessels.

HISTORIC ERA POTTERY

Rio Nuevo Archaeology project sites contain Historic era deposits that encompass Tucson's transition from a small Spanish outpost to a thriving American city. The Historic era Native American pottery belongs to the "Papago" (Tohono O'odham) ceramic series, discussed by Haury (1975), Fontana et al. (1962), Doelle (1983), Thiel and Faught (1995), Whittlesey (1997), and Heidke (2005d). Because most potters were probably women, Father Juan Baptista Llorens' 1801 census data suggest that not all of the locally produced Native American ceramics may have actually been made by Papago (Tohono O'odham) potters, as Piman, Gileño, and Papago residents—including married women, widows, and

Table 7.17. Three-way classification of Cañada del Oro phase Feature 308 ceramic types, vessel part, and temper type from the Clearwater site, AZ BB:13:6 (ASM).

	Snaketown Red-on-brown	Cañada del Oro Red-on-brown		Cañada del Oro or Rillito red-on-brown		Indeterminate pre-Classic Red-on-brown	Indeterminate Red-on-brown		Plain	Row Total
Temper Type	Body	Rim	Body	Rim	Body	Body	Rim	Body	Rim	
Sand	1	11	28	1	0	4	2	5	82	134
>25 percent gneiss/schist	0	0	2	0	0	0	0	0	12	14
Mixed sand and 1-7 percent gneiss/schist	0	0	1	0	1	0	0	1	2	5
Mixed sand and 7-25 percent gneiss/schist	0	0	0	0	0	0	0	0	2	2
Mixed sand and 1-25 percent muscovite mica	0	0	0	0	0	0	0	0	2	2
>25 percent gneiss/schist and muscovite mica	0	0	0	0	0	0	0	0	1	1
>25 percent muscovite mica	0	0	0	0	0	0	0	0	1	1
Indeterminate	0	2	0	0	0	0	0	1	3	6
Column total	1	13	31	1	1	4	2	7	105	165

Table 7.18. Three-way classification of Cañada del Oro phase Feature 308 ceramic type, vessel part, and temper source from the Clearwater site, AZ BB:13:6 (ASM).

	Snaketown Red-on-brown	Cañada del Oro Red-on-brown		Cañada del Oro or Rillito red-on-brown		Indeterminate pre-Classic Red-on-brown	Indeterminate Red-on-brown		Plain	Row Total
Temper Type	Body	Rim	Body	Rim	Body	Body	Rim	Body	Rim	
Twin Hills Petrofacies (volcanic)	1	7	25	0	1	3	0	1	62	100
Indeterminate volcanic source	0	2	2	0	0	0	1	1	9	15
Indeterminate granitic source	0	2	0	0	0	0	1	0	3	6
Indeterminate granitic or metamorphic source	0	1	1	0	0	1	0	1	1	5
Beehive Petrofacies (volcanic)	0	0	0	0	0	0	0	0	4	4
Indeterminate metamorphic source	0	0	0	0	0	0	0	0	4	4
Catalina Petrofacies (metamorphic)	0	0	0	0	0	0	0	0	3	3
Indeterminate source	0	1	3	1	0	0	0	4	19	28
Column total	1	13	31	1	1	4	2	7	105	165

Table 7.19. Frequency of rim sherds in each vessel form class recovered from Cañada del Oro phase Feature 308, reported by ceramic type, the Clearwater site, AZ BB:13:6 (ASM).

	Ceramic Type				
Vessel Form	Cañada del Oro Red-on-brown	Cañada del Oro or Rillito red-on-brown	Indeterminate Red-on-brown	Plain	Row Total
Bowl Forms					
Flare-rim	8	0	0	5	13
Outcurved	1	0	0	8	9
Hemispherical	0	0	1	4	5
Semi-flare-rim, outcurved	0	0	0	4	4
Incurved	1	0	1	1	3
Plate/Platter	0	0	0	2	2
Indeterminate bowl form	2	0	0	21	23
Jar Forms					
Tall flare-rim	0	0	0	12	12
Short straight-collar	0	0	0	1	1
Seed	0	1	0	0	1
Neckless	0	0	0	1	1
Indeterminate jar form	0	0	0	1	1
Scoop Forms					
Indeterminate scoop form	1	0	0	1	2
Indeterminate Forms					
Indeterminate flare-rim form	0	0	0	42	42
Indeterminate bowl or scoop	0	0	0	2	2
Column Total	13	1	2	105	121

spinsters—were counted (Dobyns 1976). Accordingly, it is assumed here that, while most of the historic Native American pottery was made by Tohono O'odham potters, the work of potters belonging to all three groups may be represented in the collections.

Protohistoric Period and Historic Era Ceramic Typology

In addition to the "Papago" ceramic series proposed by Fontana et al. (1962), two ceramic types proposed by Di Peso (1953) are of interest here: Whetstone Plain and Sobaipuri Plain. Whetstone Plain has been used as the diagnostic ceramic type for the Protohistoric period (circa 1450-1694; see Dart 1987; Doelle and Holmlund 1986; Heidke et al. 1994; B. Huckell 1984; L. Huckell 1981; Mabry 1992; McGuire and Villalpando 1993; Seymour 1997). Characteristics of Whetstone Plain (Di Peso 1953:154; Doyel 1977:126) that other archaeologists have found useful for its identification include: sand temper, finger- and/or anvil-impressed interior surfaces, thin vessel walls, dull luster, and sandy surface finish. The type Sobaipuri Plain has not been as widely accepted by the discipline. Sobaipuri Plain (Di Peso 1953:148-154) shares many characteristics with Fontana et al.'s (1962:105) ceramic type Papago Plain, Variant 1; both types exhibit casts of burned-out organic temper, medium-to-thick vessel walls, carbon cores, and rim coils.

Di Peso never actually defined what he meant by a rim coil. He refers to a passage in Haury (1950),

> One clear cut diagnostic feature, however, is seen in the rims of both bowls and jars. This is the addition of a coil at the rim, creating a band about the orifice (Haury 1975:344).

Di Peso (1953:Figure 14) illustrates a schematic cross section of a Sobaipuri Plain jar that clearly shows the coil separate from the body of the vessel. Fontana et al. (1962:103) use the term in much the same way, "'Rim-coiled' refers to one or two coils of clay added to the entire circumference of the rim. These added coils are not smoothed out." The author recently examined the type collection of Sobaipuri Plain and Whetstone Plain rim sherds recovered from the Presidio de Santa Cruz de Terrenate.

At 15x magnification, most Sobaipuri Plain coiled vessels appear to have had the rim folded over rather

Table 7.20. Frequency of rim sherds in each functional category recovered from Cañada del Oro phase Feature 308, reported by ceramic type, the Clearwater site, AZ BB:13:6 (ASM).

	Ceramic Type				
Functional Category (Final Vessel Form Class)	Cañada del Oro Red-on-brown	Cañada del Oro or Rillito red-on-brown	Indeterminate Red-on-brown	Plain	Row Total
Independent Restricted Vessels					
A: Water carrying/storage (including cups) and/or permanent storage (<6.0 cm aperture diameter)	0	0	0	1	1
C: Cooking (small- to medium-sized groups), temporary storage, and/or water cooling (13.0-25.5 cm aperture diameter)	0	0	0	7	7
Simple and Dependent Restricted Vessels					
F: Seed storage (<6.0 cm orifice diameter)	0	1	0	0	1
G: Dry storage (6.0-12.5 cm orifice diameter)	0	0	1	0	1
Unrestricted Vessels (Deep)					
L: Individual serving (6.0-12.5 cm orifice diameter)	0	0	0	1	1
M: Food preparation and/or small group serving (13.0-25.5 cm orifice diameter)	0	0	0	5	5
N: Communal serving/eating (26.0-31.5 cm orifice diameter)	1	0	0	2	3
O: Communal serving/eating (32.0-38.5 cm orifice diameter)	1	0	0	1	2
Unrestricted Vessels (Shallow)					
Q: Individual serving (6.0-12.5 cm orifice diameter)	0	0	0	1	1
Column Total	2	1	1	18	22

than applied separately, based on observation of sand and organic temper casts that follow the curvature of the paste up and over the inner vessel wall. The folding process itself usually yielded a smooth, rounded lip. Additionally, examples displaying erosion at the very top of the lip exhibit a homogeneous paste—*not* a coil distinct from the body, which is what would be expected if the coil was attached separately.

Occasionally, the coil looked as if it had been applied separately. In those cases a V- to U-shaped groove is visible at the top of the lip where the two pieces come together, or, if the rim was eroded at the very top of the lip, a line separating the coil paste from the body paste is visible. According to Di Peso (1953:147), Whetstone Plain vessels lack rim coils, but may exhibit a bead rim (Di Peso 1953:154). Again, he left the term undefined. However, examined at 15x magnification, most Whetstone Plain beaded rim vessels appear to have had a small portion of the rim folded over (Masse 1980), leading the author to think the technological procedure leading to vessels with coiled and beaded rims was usually the same.

That technological procedure was also followed by potters in the Tucson area, based on examination of Native American sherds recovered from many Historic era sites, including those from the current project. To track their occurrence, plain ware sherds with folded-over rim coils are reported as Sobaipuri Plain in this and earlier reports (Heidke 2002, 2003a, 2003b, 2005d; Thiel and Faught 1995). As discussed below, in the Tucson area, most of those vessels were tempered with sand or a mixture of sand and crushed potsherds (grog). Moreover, the category's name should not be taken to imply that Sobaipuri potters (Gilpin and Philips 1999; Masse 1981) made all the Sobaipuri Plain pots (e.g., Thiel and Faught 1995:202), just as we know that Tohono O'odham potters also made vessels exhibiting that morphological attribute (Fontana et al. 1962; Haury 1975).

Historic O'odham Pottery from the San Agustín Mission Locus, the Clearwater Site, AZ BB:13:6 (ASM), circa 1771-1821

A total of 3,554 pottery sherds—representing portions of at least 624 individual vessels—was recovered from Features 64, 161, 166, 177, 178, 193, and 203 at the San Agustín Mission locus of the Clearwater site (Table 7.21). These deposits likely date to

Table 7.21. Native American pottery types recovered from mission-time deposits at the San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

	Vessel Part[a]											
	Body Sherd		Rim Sherd		Reconstructible Vessel		Neck		Handle		Row Total	
Ceramic Type	Sherd Count	MNV[b]	Sherd Count	MNV	Sherd Count	MNV	Sherd Count	MNV	Sherd Count	MNV	Sherd Count	MNV
Prehistoric Native American Types												
Indeterminate red-on-brown	36	33	4	4	0	0	2	2	0	0	42	39
Indeterminate pre-Classic red-on-brown	14	13	0	0	0	0	0	0	0	0	14	13
Cañada del Oro Red-on-brown	1	1	0	0	0	0	0	0	0	0	1	1
Rillito or Early Rincon red-on-brown	1	1	0	0	0	0	0	0	0	0	1	1
Early Rincon, Middle Rincon, Late Rincon, or Tanque Verde red-on-brown	0	0	3	3	0	0	0	0	0	0	3	3
Early, Middle, or Late Rincon red-on-brown	1	1	0	0	0	0	0	0	0	0	1	1
Early or Middle Rincon red-on-brown	3	3	2	2	0	0	0	0	0	0	5	5
Middle Rincon Red-on-brown	1	1	0	0	0	0	0	0	0	0	1	1
Middle Rincon, Late Rincon, or Tanque Verde red-on-brown	3	2	0	0	0	0	0	0	0	0	3	2
Late Rincon or Tanque Verde red-on-brown	4	4	0	0	0	0	0	0	0	0	4	4
Tanque Verde Red-on-brown	6	6	4	4	0	0	0	0	0	0	10	10
Indeterminate red-on-buff	13	12	1	1	0	0	0	0	0	0	14	13
Indeterminate black-on-white	1	1	0	0	0	0	0	0	0	0	1	1
Indented Obliterated Corrugated	1	1	0	0	0	0	0	0	0	0	1	1
Historic Native American Types												
Plain ware	2,691	N/A	105	93	37	2	28	N/A	2	2	2,863	97
Sobaipuri Plain (folded-over rim coil)	0	0	32	26	0	0	0	0	0	0	32	26
Red ware[c]	306	263	129	69	0	0	13	10	0	0	448	342
Papago Plain	28	N/A	3	3	0	0	0	N/A	1	1	32	4
Possible Papago Plain	1	N/A	0	0	0	0	0	N/A	0	0	1	0
Papago Red	3	N/A	2	1	0	0	1	N/A	0	0	6	1
Possible Papago Red	1	N/A	0	0	0	0	0	N/A	0	0	1	0

Table 7.21. Continued.

	Vessel Part[a]											
	Body Sherd		Rim Sherd		Reconstructible Vessel		Neck		Handle		Row Total	
Ceramic Type	Sherd Count	MNV[b]	Sherd Count	MNV	Sherd Count	MNV	Sherd Count	MNV	Sherd Count	MNV	Sherd Count	MNV
Papago Black-on-red	1	1	0	0	0	0	0	0	0	0	1	1
Papago Red-on-brown	0	0	4	1	0	0	0	0	0	0	4	1
Possible Papago Red-on-brown	3	1	0	0	0	0	2	1	0	0	5	2
Papago Red-on-buff	1	1	0	0	0	0	0	0	0	0	1	1
Indeterminate Papago Buff	2	1	0	0	0	0	0	0	0	0	2	1
Indeterminate Native American												
Indeterminate Plain or Red ware	4	4	7	7	0	0	0	0	0	0	11	11
Indeterminate Plain or Red-on-brown ware	4	4	1	1	0	0	0	0	0	0	5	5
Indeterminate Red or Red-on-brown ware	11	8	5	5	0	0	1	1	0	0	17	14
Indeterminate Type	18	17	6	6	0	0	0	0	0	0	24	23
Column Total	3,159	379	308	226	37	2	47	14	3	3	3,554	624

[a] Historic plain ware and Papago Red body and neck sherds were not inspected for conjoins; therefore, minimum number of vessel (MNV) estimates are not available (N/A) for those ware and vessel part combinations.

[b] MNV = Minimum number of vessels.

[c] Two red wares have folded-over rim coils.

Table 7.22. Location of slip on historic red ware and Papago Red pottery from the San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

	Red Ware						Papago Red		
	Vessel Part						Vessel Part		
			Rim Sherds and Reconstructible Vessels						
Slip Location	Body Sherds	Neck Sherds	Bowl	Jar	Indeterminate Flare-rim form	Indeterminate Bowl or Scoop	Body Sherds	Neck Sherds	Row Total
Fully slipped on all visible interior and exterior surfaces	162	2	42	0	11	1	1	0	219
Interior only	36	1	2	0	0	0	0	0	39
Exterior only	28	3	0	0	0	0	1	1	33
Interior and rim	0	0	1	0	1	0	0	0	2
Exterior, rim, and interior band below rim	0	0	0	1	1	0	0	0	2
Lip only	0	0	1	0	0	0	0	0	1
Indeterminate slip location	37	4	5	0	3	0	1	0	50
Column total	263	10	51	1	16	1	3	1	346

mission times (circa 1771-1821), because fired adobe and/or plaster was recovered from five of the features—Features 166, 177, 178, 193, and 203. Additional information regarding characteristics of the red-slipped pottery types recovered from those deposits is provided in Table 7.22. Unfortunately, these mission features exhibit some temporal mixing, with prehistoric painted pottery comprising 2.8 percent of the sherds, or 15.2 percent of the vessels. Those values suggest some of the plain ware pottery is also likely to be prehistoric; however, as discussed above, it is essentially impossible to separate a prehistoric sand-tempered plain ware sherd from a historic sand-tempered plain ware.

Temper Attributes

Temper Type. The temper type data are summarized in Table 7.23. Two compositions dominate the collection: a mixture of sand and crushed sherd temper (49.7 percent of examined sherds) and sand temper (35.9 percent). This provides a confident way to identify early historic-era pottery (Ravesloot and Whittlesey 1987:94). Nine additional temper types were observed. They fall into two major groups: tempers containing fiber (presumably manure) and those containing metamorphic rocks and/or minerals (gneiss/schist, muscovite mica, and phyllite [with or without sand]). Nearly all examples of mixed sand and fiber temper occur in the "Papago" ceramic types (that is, Papago Red, possible Papago Red, Papago Plain, and possible Papago plain). Most of the gneiss/schist- and muscovite mica-tempered sherds may represent mixing of earlier, prehistoric sherds into the deposits, as those temper types are known to have been commonly used from approximately A.D. 850 to 1100 (Deaver 1984:397-398, Figure 4.69; Kelly 1978:72-76; Wallace et al. 1995:607, Figure 6). However, two vessels exhibiting a late ceramic trait—the folded rim—also contain metamorphic tempers (greater than 25 percent gneiss/schist and muscovite mica and greater than 25 percent phyllite), indicating the use of those types of temper continued into the Historic era (see also Fontana et al. 1962:57, 135).

Temper Provenance. The temper provenance data are summarized in Table 7.24. Approximately 3.5 percent of the characterized vessels contain sand temper from the volcanic Twin Hills Petrofacies. The Clearwater site is located within the Twin Hills Petrofacies, indicating little of the pottery was locally produced. At least three, and possibly four, additional source areas were identified: the volcanic Beehive Petrofacies (43.2 percent), the granitic and mixed lithic Airport Petrofacies (24.1 percent), and a granitic source representing the Black Mountain and/or Sierrita petrofacies (1.0 percent). The Beehive Petrofacies is located south of the site, while the Black Mountain and Sierrita petrofacies are located south of that resource area. The Airport Petrofacies is located immediately east of the site, on the other side of the Santa Cruz River.

The remaining sherds could not be assigned to a specific source using only the binocular microscope. Two sherds contained very little temper (which made it difficult to make a provenance determination), while another sherd contained sand from either a

Table 7.23. Three-way classification of historic ceramic types from the San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM), by vessel part and temper type. (The "rim" category includes rim sherds and reconstructible vessels; the "body" category includes body and neck sherds.)

	Plain Ware		Sobaipuri Plain (folded-over rim coil)	Red Ware		Papago Red		Possible Papago Red	Papago Plain		Possible Papago Plain	Papago Black-on-red	Papago Red-on-brown	Possible Papago Red-on-brown	Indeterminate Papago Red-on-buff or White-on-buff	Row
Temper Type	Rim	Body	Rim	Rim	Body	Rim	Body	Body	Rim	Body	Body	Body	Rim	Body	Body	Total
Sand and crushed sherd	50	1,412	12	19	105	0	0	0	0	0	0	1	0	1	0	1,599
Sand	30	916	8	45	153	0	0	0	0	0	0	0	1	0	0	1,155
Sand and fiber	0	0	1	0	2	1	4	1	3	28	1	0	0	2	0	41
>25% gneiss/schist	0	31	0	0	0	0	0	0	0	0	0	0	0	0	0	31
>25% muscovite mica	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	20
Mixed sand and 1-7% gneiss/schist	1	16	0	0	0	0	0	0	0	0	0	0	0	0	0	17
Mixed sand and 1-25% muscovite mica	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0	16
Mixed sand and 7-25% gneiss/schist	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	10
>25% gneiss/schist and muscovite mica	0	6	1	0	0	0	0	0	0	0	0	0	0	0	0	7
>25% phyllite	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
Indeterminate	14	285	3	5	13	0	0	0	0	0	0	0	0	0	1	321
Column total	95	2,713	26	69	273	1	4	1	3	28	1	1	1	0	1	3,219

Table 7.24. Three-way classification of historic ceramic types from the San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM), by vessel part and temper source. (The "rim" category includes rim sherds and reconstructible vessels; the "body" category includes body and neck sherds.)

	Plain Ware	Sobaipuri Plain (folded-over rim coil)	Red Ware	Papago Red	Papago Plain	Papago Black-on-red	Papago Red-on-brown	Possible Papago Red-on-brown	Indeterminate Papago Red-on-buff or White-on-buff	
Temper Source	Rim	Rim	Rim	Rim	Rim	Body	Rim	Body	Body	Row Total
Beehive Petrofacies (volcanic)	50	12	22	0	0	1	1	1	0	86
Airport Petrofacies (granitic and mixed lithic)	10	4	32	0	0	0	0	2	0	48
Twin Hills Petrofacies (volcanic)	5	0	2	0	0	0	0	0	0	7
Black Mountain or Sierrita petrofacies (granitic)	1	0	1	0	0	0	0	0	0	2
Indeterminate source (low temper percent)	1	0	1	0	0	0	0	0	0	2
Indeterminate granitic or metamorphic source	1	0	0	0	0	0	0	0	0	1
Indeterminate source	27	10	11	1	3	0	0	0	1	53
Column total	95	26	69	1	3	1	1	2	1	199

Table 7.25. Frequency of rim sherds and reconstructible vessels from the San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM), in each vessel form class, reported by ceramic type.

	Historic Native American Ceramic Type						
Vessel Form	Red Ware	Plain Ware	Sobaipuri Plain (folded-over rim coil)	Papago Red	Papago Red-on-brown	Papago Plain	Row Total
Bowl Forms							
Plate/Platter	2	6	0	0	0	0	8
Outcurved	6	0	0	0	0	0	6
Hemispherical	3	0	0	0	0	0	3
Incurved	1	2	0	0	0	0	3
Semi-flare-rim, incurved	0	2	0	0	0	0	2
Semi-flare-rim, hemispherical	0	0	1	0	0	0	1
Straight-walled or vertical-sided	1	0	0	0	0	0	1
Indeterminate bowl form	38	32	0	0	1	1	72
Jar Forms							
Tall flare-rim	0	0	2	0	0	0	2
Indeterminate jar form	1	0	0	0	0	0	1
Indeterminate Forms							
Indeterminate flare-rim form	16	46	23	0	0	1	86
Indeterminate bowl or seed jar	0	2	0	0	0	0	2
Indeterminate bowl or scoop	1	1	0	0	0	0	2
Indeterminate form	0	4	0	1	0	1	6
Column Total	69	95	26	1	1	3	195

granitic or a metamorphic source. The temper provenance of 53 sherds was recorded as indeterminate. Many of those sherds (62.3 percent) were small (less than 5 cm^2); sherds that small often lack a sufficient exposure of temper grains along their perimeter from which to make a provenance determination (Stark and Heidke 1992:140-141).

Pottery Function

Two different approaches were utilized to assess the likely uses O'odham pottery played in the lives of the inhabitants of the San Agustín Mission locus. The first approach was strictly typological and entailed the assignment of rim sherds and reconstructible vessels to vessel form categories originally created to classify prehistoric pottery from the region. The second approach examined a subset of the rim sherds and reconstructible vessels, placing them into functional categories determined by their overall morphology and size.

Typological Approach. The vessel forms of O'odham pottery recovered from the San Agustín Mission locus are reported in Table 7.25. Unfortunately, 86.7 percent of the rims could not be assigned to a vessel form, because most of the rim sherds recovered from the mission contexts are quite small (less than 5 cm^2). Even so, bowl vessel forms clearly must have been quite common, as 42.6 percent of the indeterminate forms represent bowls. Additionally, two of the bowl vessel forms have semi-flaring rims, suggesting some of the "indeterminate flare-rim forms" are probably also bowls.

Shepard-Braun Approach. The count of sherds in each vessel form class is summarized in Table 7.26, by ceramic type. The functional interpretation of each vessel form class follows the method shown above (see Table 7.5). If the plain ware, including Sobaipuri Plain, in vessel form classes C, M, and R is assumed to have been used for food preparation and cooking, and if the data set is representative, 42.9 percent of the O'odham pottery from the San Agustín Mission locus may have been used for cooking. Similarly, if all the pottery in vessel form classes B and H is assumed to have been used for storage, and if the data set is representative, 21.4 percent of the pottery may have been used for storage. Finally, 35.7 percent of the pottery may have been used for serving if the red ware in vessel form classes M and R was used for small group servings, if the red ware in vessel form classes N, O, and S was used for large group servings, and if the data set is representative.

Table 7.26. Frequency of rim sherds and reconstructible vessels from the San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM), in each functional category, reported by ceramic type.

	Historic Native American Ceramic Type			
Functional Category (Final Vessel Form Class)	Plain Ware	Sobaipuri Plain (folded-over rim coil)	Red Ware	Row Total
Independent Restricted Vessels				
B: Permanent, secure storage and/or water carrying (6.0-12.5 cm aperture diameter)	1	0	0	1
C: Cooking (small- to medium-sized groups), temporary storage, and/or water cooling (13.0-25.5 cm aperture diameter)	1	1	0	2
Simple and Dependent Restricted Vessels				
H: Specialized, temporary dry storage (13.0-25.5 cm orifice diameter)	1	0	1	2
Unrestricted Vessels (Deep)				
M: Food preparation and/or small group serving (13.0-25.5 cm orifice diameter)	0	1	1	2
N: Communal serving/eating (26.0-31.5 cm orifice diameter)	0	0	1	1
O: Communal serving/eating (32.0-38.5.5 cm orifice diameter)	0	0	1	1
Unrestricted Vessels (Shallow)				
R: Collecting, processing, and/or individual-to-large group serving (13.0-25.5 cm orifice diameter)	3	0	1	4
S: Collecting, processing, and/or communal serving (26.0-31.5 cm orifice diameter)	0	0	1	1
Column Total	6	2	6	14

Historic O'odham Pottery from the Tucson Presidio, AZ BB:13:13 (ASM), circa 1810s-1820s

A total of 340 pottery sherds—representing portions of at least 43 individual vessels—was recovered from presidio Feature 373 (Table 7.27). Additional information regarding characteristics of the red-slipped pottery recovered from that feature is provided in Table 7.28. Unfortunately, this presidio feature exhibits some temporal mixing, with prehistoric painted pottery comprising 1.8 percent of the sherds, or 9.3 percent of the vessels. Those values suggest some of the plain ware pottery is also likely to be prehistoric; however, as discussed above, it is essentially impossible to separate a prehistoric sand-tempered plain ware sherd from a sand-tempered plain ware made during the Historic era.

Temper Attributes

Temper Type. The temper type data are summarized in Table 7.29. Two compositions dominate the collection: sand temper (48.6 percent of examined sherds) and a mixture of sand and crushed sherd temper (43.4 percent). Six additional temper types were observed. They fall into two major groups: tempers containing fiber (presumably manure) and those containing metamorphic rocks and/or minerals (gneiss/schist and muscovite mica [with or without sand]). All examples of mixed sand and fiber temper occur in the ceramic type "Papago Plain." Many, or all, of the gneiss/schist- and muscovite mica-tempered sherds may represent mixing of earlier, prehistoric sherds into the deposit, as those temper types are known to have been commonly used from approximately A.D. 850 to 1100 (Deaver 1984:397-398, Figure 4.69; Kelly 1978:72-76; Wallace et al. 1995:607, Figure 6). However, as shown with the mission pottery from the Clearwater site (discussed above), some vessels exhibiting a late ceramic trait—the folded rim—also contain metamorphic tempers (greater than 25 percent gneiss/schist and muscovite mica), indicating the use of that temper type continued into the Historic era (see also Fontana et al. 1962:57, 135).

Temper Provenance. The temper provenance data are summarized in Table 7.30. Approximately 18.9 percent of the characterized vessels contain sand temper from the granitic and mixed lithic Airport Petrofacies. The Tucson Presidio is located in that petrofacies, indicating approximately one-fifth of the pottery recovered from Feature 373 was locally produced. Two or three additional source areas were identified: the volcanic Beehive Petrofacies

Table 7.27. Native American pottery types recovered from Feature 373, the Tucson Presidio, AZ BB:13:13 (ASM).

	Vessel Part[a]									
	Body Sherd		Rim Sherd		Reconstructible Vessel		Handle		Row Total	
Ceramic Type	Sherd Count	MNV[b]	Sherd Count	MNV	Sherd Count	MNV	Sherd Count	MNV	Sherd Count	MNV
Prehistoric Native American Types										
Indeterminate red-on-brown	4	2	0	0	0	0	0	0	4	2
Tanque Verde Red-on-brown	0	0	1	1	0	0	0	0	1	1
Indeterminate red-on-buff	1	1	0	0	0	0	0	0	1	1
Historic Native American Types										
Plain ware	176	N/A	13	9	0	0	0	0	189	9
Sobaipuri Plain (folded-over rim coil)	0	0	16	5	15	1	0	0	31	6
Red ware[c]	68	N/A	21	18	0	0	1	1	90	19
Papago Plain	5	N/A	0	0	0	0	0	0	5	N/A
Possible Papago Red	0	0	1	1	0	0	0	0	1	1
Papago Black-on-red[d]	1	1	0	0	15	1	0	0	16	2
Papago Red-on-buff	1	1	0	0	0	0	0	0	1	1
Indeterminate Native American Type										
Indeterminate	1	1	0	0	0	0	0	0	1	1
Column Total	257	6	52	34	30	2	1	1	340	43

[a] Historic plain ware and red-slipped body sherds were not inspected for conjoins; therefore, minimum number of vessel estimates are not available (N/A) for those wares.

[b] MNV = Minimum number of vessels.

[c] One red ware has a folded-over rim coil.

[d] The Papago Black-on-red reconstructible vessel has a strap handle.

Table 7.28. Location of slip on historic red ware from Feature 373, the Tucson Presidio, AZ BB:13:13 (ASM).

	Vessel Part			
		Rim Sherds and Reconstructible Vessels		
Slip Location	Body Sherds	Bowl	Indeterminate Flare-rim form	Row Total
Fully slipped on all visible interior and exterior surfaces	24	12	2	38
Interior only	29	0	0	29
Exterior only	15	0	0	15
Interior and rim	0	1	0	1
Interior, rim, and exterior band	0	1	0	1
Indeterminate slip location	0	1	1	2
Column total	68	15	3	86

(35.1 percent), the granitic Black Mountain Petrofacies (32.4 percent), and two sherds (5.4 percent) with sand that may have come from the Black Mountain and/or Sierrita petrofacies. The Beehive Petrofacies is located southwest of the presidio, west of the Santa Cruz River, while the Black Mountain and Sierrita petrofacies are located south of that resource area. The remaining three sherds (8.1 percent) could not be assigned to a specific source using only the binocular microscope.

Table 7.29. Three-way classification of historic ceramic types, vessel part, and temper type from Feature 373, the Tucson Presidio, AZ BB:13:13 (ASM). (The "rim" category includes rim sherds and reconstructible vessels.)

	Plain Ware		Sobaipuri Plain (folded-over rim coil)	Red Ware		Possible Papago Red	Papago Plain	Papago Black-on-red		Papago Red-on-buff	Row Total
Temper Type	Rim	Body	Rim	Rim	Body	Rim	Body	Rim	Body	Body	
Sand	6	61	4	13	52	1	0	0	1	1	139
Sand and crushed sherd	3	97	2	5	16	0	0	1	0	0	124
Mixed sand and 1-7 percent gneiss/schist	0	6	0	0	0	0	0	0	0	0	6
>25 percent gneiss/schist	0	5	0	0	0	0	0	0	0	0	5
Sand and fiber	0	0	0	0	0	0	5	0	0	0	5
>25 percent muscovite mica	0	2	0	0	0	0	0	0	0	0	2
Mixed sand and 7-25 percent gneiss/schist	0	3	0	0	0	0	0	0	0	0	3
>25 percent gneiss/schist and muscovite mica	0	2	0	0	0	0	0	0	0	0	2
Column total	9	176	6	18	68	1	5	1	1	1	286

Table 7.30. Three-way classification of historic ceramic types, vessel part, and temper source from Feature 373, the Tucson Presidio, AZ BB:13:13 (ASM). (The "rim" category includes rim sherds and reconstructible vessels.)

	Red Ware	Plain Ware	Sobaipuri Plain (folded-over rim coil)	Possible Papago Red	Papago Black-on-red		Papago Red-on-buff	Row Total
Temper Source	Rim	Rim	Rim	Rim	Rim	Body	Rim	
Beehive Petrofacies (volcanic)	5	3	4	0	1	0	0	13
Black Mountain Petrofacies (granitic)	7	4	0	1	0	0	0	12
Airport Petrofacies (granitic and mixed lithic)	4	1	1	0	0	0	1	7
Black Mountain or Sierrita petrofacies (granitic)	1	1	0	0	0	0	0	2
Indeterminate source	1	0	1	0	0	1	0	3
Column total	18	9	6	1	1	1	1	37

Table 7.31. Frequency of rim sherds and reconstructible vessels in each vessel form class recovered from Feature 373, the Tucson Presidio, AZ BB:13:13 (ASM), reported by ceramic type.

	Historic Native American Ceramic Type					
Vessel Form	Red Ware	Plain Ware	Sobaipuri Plain (folded-over rim coil)	Possible Papago Red	Papago Black-on-red	Row Total
Bowl Forms						
Outcurved	7	1	1	0	0	9
Semi-flare-rim, incurved	2	0	2	0	0	4
Plate/Platter	2	1	0	0	0	3
Hemispherical	1	1	0	0	0	2
Semi-flare-rim, hemispherical	0	0	2	0	0	2
Semi-flare-rim, outcurved	0	1	0	0	0	1
Indeterminate bowl form	3	1	1	1	0	6
Jar Forms						
Tall flare-rim	0	1	0	0	0	1
Cup	0	0	0	0	1	1
Indeterminate Forms						
Indeterminate flare-rim form	3	2	0	0	0	5
Indeterminate bowl or scoop	0	1	0	0	0	1
Column Total	18	9	6	1	1	35

Pottery Function

Two different approaches were used to assess the uses O'odham pottery likely played in the lives of the presidio inhabitants. The first approach was strictly typological and entailed the assignment of rim sherds and reconstructible vessels to vessel form categories originally created to classify prehistoric pottery from the region. The second approach examined a subset of the rim sherds and reconstructible vessels, placing them into functional categories determined by their overall morphology and size.

Typological Approach. The vessel forms of O'odham pottery recovered from presidio Feature 373 are reported in Table 7.31. Examination of Table 7.31 shows that more than three-quarters are bowl vessel forms, including numerous semi-flare-rim forms. A Papago Black-on-red cup recovered from Feature 373 is illustrated in Figure 7.10.

Shepard-Braun Approach. The count of sherds in each vessel form class is summarized in Table 7.32, by ceramic type. The functional interpretation of each vessel form class follows the method displayed in Table 7.5. If the plain ware, including Sobaipuri Plain, in vessel form classes C, M, and T is assumed to have been used for food preparation and cooking, and if the data set is representative, 15.0 percent of the O'odham pottery from presidio Feature 373 may have been used for cooking. Similarly, if all the pottery in vessel form class B and the red ware in class C is assumed to have been used for storage, and if the data set is representative, 15.0 percent of the pottery may have been used for storage. Finally, 70.0 percent of the pottery may have been used for serving if the Papago Black-on-red cup in vessel form class A was used for individual servings of a liquid, if the plain ware in vessel form class L was used for individual

Figure 7.10. Papago Black-on-red cup, recovered from Feature 373, the Tucson Presidio, AZ BB:13:13 (ASM).

Table 7.32. Frequency of rim sherds and reconstructible vessels in each functional category recovered from Feature 373, the Tucson Presidio, AZ BB:13:13 (ASM), reported by ceramic type.

	Historic Native American Ceramic Type				
Functional Category (Final Vessel Form Class)	Plain Ware	Sobaipuri Plain (folded-over rim coil)	Red Ware	Papago Black-on-red	Row Total
Independent Restricted Vessels					
A: Cup (<6.0 cm aperture diameter)	0	0	0	1	1
B: Permanent, secure storage and/or water carrying (6.0-12.5 cm aperture diameter)	1	1	0	0	2
C: Cooking (small- to medium-sized groups), temporary storage, and/or water cooling (13.0-25.5 cm aperture diameter)	0	1	1	0	2
Unrestricted Vessels (Deep)					
L: Individual serving (6.0-12.5 cm orifice diameter)	1	0	0	0	1
M: Food preparation and/or small group serving (13.0-25.5 cm orifice diameter)	1	0	8	0	9
N: Communal serving/eating (26.0-31.5 cm orifice diameter)	0	2	0	0	2
O: Communal serving/eating (32.0-38.5 cm orifice diameter)	0	1	0	0	1
Unrestricted Vessels (Shallow)					
R: Collecting, processing, and/or individual-to-large group serving (13.0-25.5 cm orifice diameter)	0	0	1	0	1
S: Collecting, processing, and/or communal serving (26.0-31.5 cm orifice diameter)	1	0	0	0	1
Column Total	4	5	10	1	20

servings, if the red ware in vessel form classes M and R was used for small group servings, if the Sobaipuri Plain ware in vessel form classes N and O was used for large group servings, and if the data set is representative.

Historic O'odham Pottery from the Tucson Presidio, AZ BB:13:13 (ASM), circa 1820s-1830s

A total of 1,106 pottery sherds—representing portions of at least 121 individual vessels—was recovered from presidio Features 409 and 441 (Table 7.33). Additional information regarding characteristics of the red-slipped pottery types recovered from those features is provided in Table 7.34. Unfortunately, these presidio features exhibit some temporal mixing, with prehistoric painted pottery comprising 0.9 percent of the sherds, or 8.3 percent of the vessels. Those values suggest some of the plain ware pottery is also likely to be prehistoric; however, as discussed above, it is nearly impossible to separate a prehistoric sand-tempered plain ware sherd from a historic sand-tempered plain ware.

Temper Attributes

Temper Type. The temper type data are summarized in Table 7.35. Three compositions dominate the collection: a mixture of sand and crushed sherd temper (41.5 percent of examined sherds), sand temper (31.6 percent), and sand and fiber (presumably horse manure, 20.3 percent). Seven additional temper types were observed; all seven contain metamorphic rocks and/or minerals (gneiss/schist and/or muscovite mica [with or without sand]). Most, if not all, of the gneiss/schist- and muscovite mica-tempered sherds may represent mixing of earlier, prehistoric sherds into the deposit, as those temper types are known to have been commonly used from approximately A.D. 850 to 1100 (Deaver 1984:397-398, Figure 4.69; Kelly 1978:72-76; Wallace et al. 1995:607, Figure 6). However, as shown with the mission pottery from the Clearwater site (discussed above), some vessels exhibiting a late ceramic trait—the folded rim—also contain metamorphic tempers (greater than 25 percent gneiss/schist and muscovite mica), indicating use of that temper type continued into the Historic era (see also Fontana et al. 1962:57, 135).

Table 7.33. Native American pottery types recovered from Features 409 and 441, the Tucson Presidio, AZ BB:13:13 (ASM).

Ceramic Type	Vessel Part[a]										Row Total	
	Body Sherd		Rim Sherd		Reconstructible Vessel		Neck		Handle			
	Sherd Count	MNV[b]	Sherd Count	MNV	Sherd Count	MNV	Sherd Count	MNV	Sherd Count	MNV	Sherd Count	MNV
Prehistoric Native American Types												
Indeterminate red-on-brown	2	2	0	0	0	0	0	0	0	0	2	2
Indeterminate pre-Classic red-on-brown type	1	1	0	0	0	0	0	0	0	0	1	1
Rillito or Early Rincon red-on-brown	3	3	0	0	0	0	0	0	0	0	3	3
Early or Middle Rincon red-on-brown	1	1	0	0	0	0	0	0	0	0	1	1
Middle Rincon Red-on-brown[c]	1	1	0	0	0	0	0	0	0	0	1	1
Sacaton Red-on-buff	0	0	1	1	0	0	0	0	0	0	1	1
Tanque Verde Red-on-brown	1	1	0	0	0	0	0	0	0	0	1	1
Historic Native American Types												
Plain ware	565	N/A	35	30	0	0	1	N/A	1	1	602	31
Sobaipuri Plain (folded-over rim coil)	0	0	34	23	24	3	0	0	0	0	58	26
Red ware	86	N/A	43	29	5	1	0	N/A	0	0	134	30
Papago Plain	138	N/A	2	2	44	1	0	N/A	0	0	184	3
Possible Papago Plain	0	N/A	2	1	0	0	0	N/A	0	0	2	1
Papago Red	40	N/A	11	8	0	0	0	N/A	0	0	51	8
Possible Papago Red	0	N/A	4	3	0	0	0	N/A	0	0	4	3
Papago Black-on-red[d, e]	0	0	1	1	30	2	0	0	0	0	31	3
Papago Red-on-brown[f]	1	1	0	0	18	1	0	0	0	0	19	2
Possible Papago Red-on-brown	0	0	1	1	0	0	0	0	0	0	1	1
Indeterminate Papago Red-on-buff or White-on-buff	0	0	8	1	0	0	0	0	0	0	8	1
Indeterminate Native American Type												
Indeterminate plain or red ware	0	0	2	2	0	0	0	0	0	0	2	2
Column Total	839	10	144	102	121	8	1	0	1	1	1,106	121

[a] Historic plain ware and red-slipped body and neck sherds were not inspected for conjoins; therefore, minimum number of vessel (MNV) estimates are not available (N/A) for those ware and vessel part combinations.

[b] MNV = Minimum number of vessels.

[c] The Middle Rincon Red-on-brown body sherd is a sharp shoulder.

[d] The Papago Black-on-red rim sherd has a folded-over rim coil.

[e] The Papago Black-on-red reconstructible vessel is a handled pitcher.

[f] The Papago Red-on-brown reconstructible vessel has a folded-over rim coil.

Table 7.34. Location of slip on historic red ware and Papago Red pottery recovered from Features 409 and 441, the Tucson Presidio, AZ BB:13:13 (ASM).

	Red Ware		Papago Red		
	Vessel Part		Vessel Part		
Slip Location	Body Sherds	Bowl Rims	Body Sherds	Bowl Rims	Row Total
Fully slipped on all visible interior and exterior surfaces	32	27	2	7	68
Interior only	26	0	8	0	34
Exterior only	28	0	30	0	58
Interior and rim	0	1	0	0	1
Exterior and rim	0	0	0	1	1
Indeterminate slip location	0	2	0	0	2
Column total	86	30	40	8	164

Temper Provenance. The temper provenance data are summarized in Table 7.36. Approximately 16.7 percent of the characterized vessels contain sand temper from the granitic and mixed lithic Airport Petrofacies. The Tucson Presidio is located in that petrofacies, indicating one-sixth of the pottery recovered from Features 409 and 441 was produced locally. Three or four additional source areas were identified: the volcanic Beehive Petrofacies (31.5 percent), the granitic Black Mountain Petrofacies (23.1 percent), the granitic Black Mountain and/or Sierrita petrofacies (13.0 percent), and the volcanic Twin Hills Petrofacies (0.9 percent). The Twin Hills Petrofacies is located immediately west of the presidio, across the Santa Cruz River. The Beehive Petrofacies is located south of that resource area, while the Black Mountain and Sierrita petrofacies are located south of the Beehive Petrofacies. The remaining 16 sherds (14.8 percent) could not be assigned to a specific source using only the binocular microscope. One of them contains sand from either a granitic or metamorphic source; the temper provenance of the other 15 sherds was recorded as indeterminate.

Pottery Function

Two different approaches were used to assess the uses O'odham pottery likely played in the lives of the presidio inhabitants. The first approach was strictly typological and entailed the assignment of rim sherds and reconstructible vessels to vessel form categories originally created to classify prehistoric pottery from the region. The second approach examined a subset of the rim sherds and reconstructible vessels, placing them into functional categories determined by their overall morphology and size.

Typological Approach. The vessel forms of O'odham pottery recovered from presidio Features 409 and 441 are reported in Table 7.37. Examination of Table 7.37 shows that more than 64.5 percent are bowl vessel forms, including two semi-flare-rim forms. Figures 7.11 and 7.12 illustrate a Papago Black-on-red pitcher and outcurved bowl, respectively. An indeterminate Papago Red-on-buff or White-on-buff plate (Figure 7.13), a Papago Red-on-brown semi-flaring, angled long collar jar (Figure 7.14), and two Sobaipuri semi-flaring, angled long collar jars (Figures 7.15-7.16) recovered from Feature 409 are also illustrated.

Shepard-Braun Approach. The count of sherds in each vessel form class is summarized in Table 7.38, by ceramic type. The functional interpretation of each vessel form class follows the method shown in Table 7.5 (above). If the plain ware, including plain ware, Sobaipuri Plain, and Papago Plain, in vessel form classes C, D, M, R, S, T, and TT are assumed to have been used for food preparation and cooking, and if the data set is representative, 39.0 percent of the O'odham pottery from presidio Features 409 and 441 may have been used for cooking. Similarly, if all the pottery in vessel form classes B and G, the Papago Red-on-brown in class C, and the Papago Red in class D is assumed to have been used for storage, and if the data set is representative, 6.8 percent of the pottery may have been used for storage. Finally, 54.2 percent of the pottery may have been used for serving if the Papago Black-on-red pitcher in vessel form class B was used for serving a liquid, if the red-slipped types in vessel form classes M and R were used for small group servings, if all the pottery in vessel form classes N and O as well as the slipped types in vessel form classes S and T, were used for large group servings, and if the data set is representative.

Table 7.35. Three-way classification of historic ceramic types, vessel part, and temper type from Features 409 and 441, the Tucson Presidio, AZ BB:13:13 (ASM). (The "rim" category includes rim sherds and reconstructible vessels; the "body" category includes body and neck sherds.)

	Plain Ware		Sobaipuri Plain (folded-over rim coil)	Red Ware		Papago Red		Possible Papago Red	Papago Plain		Possible Papago Plain	Papago Black-on-red	Papago Red-on-brown		Possible Papago Red-on-brown	Indeterminate Papago Red-on-buff or White-on-buff	
Temper Type	Rim	Body	Rim	Rim	Body	Rim	Body	Rim	Rim	Body	Rim	Rim	Rim	Body	Rim	Rim	Row Total
Sand and crushed sherd	13	283	13	16	61	0	0	0	0	0	0	1	0	0	1	1	389
Sand	11	229	12	11	25	2	0	1	0	0	1	2	1	1	0	0	296
Sand and fiber	1	0	0	0	0	6	40	2	3	138	0	0	0	0	0	0	190
Mixed sand and 1-7% gneiss/schist	1	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32
>25% gneiss/schist	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12
Mixed sand and 7-25% gneiss/schist	3	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9
>25% muscovite mica	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Mixed sand and 1-25% gneiss/schist and muscovite mica	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
>25% gneiss/schist and muscovite mica	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Mixed sand and 1-25% muscovite mica	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Indeterminate	1	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	5
Column total	30	566	26	30	86	8	40	3	3	138	1	3	1	1	1	1	938

Table 7.36. Three-way classification of historic ceramic types, vessel part, and temper source from Features 409 and 441, the Tucson Presidio, AZ BB:13:13 (ASM). (The "rim" category includes rim sherds and reconstructible vessels.)

	Plain Ware	Sobaipuri Plain (folded-over rim coil)	Red Ware	Papago Red	Possible Papago Red	Papago Plain	Possible Papago Plain	Papago Black-on-red	Papago Red-on-brown		Possible Papago Red-on-brown	Indeterminate Papago Red-on-buff or White-on-buff	
Temper Source	Rim	Rim	Rim	Rim	Rim	Rim	Rim	Rim	Rim	Body	Rim	Rim	Row Total
Beehive Petrofacies (volcanic)	15	12	7	0	0	0	0	0	0	0	0	0	34
Black Mountain Petrofacies (granitic)	6	3	9	1	2	0	0	2	0	1	0	1	25
Airport Petrofacies (granitic and mixed lithic)	3	5	6	1	0	0	1	0	1	0	1	0	18
Black Mountain or Sierrita petrofacies (granitic)	1	1	3	6	0	3	0	0	0	0	0	0	14
Twin Hills Petrofacies (volcanic)	1	0	0	0	0	0	0	0	0	0	0	0	1
Indeterminate granitic or metamorphic source	1	0	0	0	0	0	0	0	0	0	0	0	1
Indeterminate source	3	5	5	0	1	0	0	1	0	0	0	0	15
Column total	30	26	30	8	3	3	1	3	1	1	1	1	108

Table 7.37. Frequency of rim sherds and reconstructible vessels in each vessel form class recovered from Features 409 and 441, the Tucson Presidio, AZ BB:13:13 (ASM), reported by ceramic type.

	Historic Native American Ceramic Type											
Vessel Form	Plain Ware	Sobaipuri Plain (folded-over rim coil)	Red Ware	Papago Red	Possible Papago Red	Papago Plain	Possible Papago Plain	Papago Black-on-red	Papago Red-on-brown	Possible Papago Red-on-brown	Indeterminate Papago Red-on-buff or White-on-buff	Row Total
Bowl Forms												
Outcurved	3	0	19	4	1	0	1	1	0	0	0	29
Plate/Platter	10	0	2	1	0	0	0	0	0	0	1	14
Semi-flare-rim, incurved	0	3	0	2	0	0	0	0	0	0	0	5
Hemispherical	0	0	3	1	0	0	0	0	0	0	0	4
Semi-flare-rim, outcurved	0	1	1	0	0	1	0	0	0	0	0	3
Indeterminate bowl form	6	0	5	0	1	0	0	1	0	1	0	14
Jar Forms												
Semi-flaring, angled long-collar	0	7	0	0	0	1	0	0	1	0	0	9
Tall flare-rim	4	0	0	0	0	0	0	0	0	0	0	4
Seed	1	0	0	0	0	0	0	0	0	0	0	1
Neckless	1	0	0	0	0	0	0	0	0	0	0	1
Pitcher	0	0	0	0	0	0	0	1	0	0	0	1
Indeterminate Forms												
Indeterminate flare-rim form	5	14	0	0	1	1	0	0	0	0	0	21
Indeterminate form	0	1	0	0	0	0	0	0	0	0	0	1
Column Total	30	26	30	8	3	3	1	3	1	1	1	107

Figure 7.11. Papago Black-on-red pitcher, recovered from Feature 409, the Tucson Presidio, AZ BB:13:13 (ASM).

Figure 7.12. Papago Black-on-red outcurved bowl, recovered from Feature 409, the Tucson Presidio, AZ BB:13:13 (ASM).

Historic O'odham Pottery from the Carrillo Household, circa 1860-1880

A total of 331 pottery sherds—representing portions of at least 44 individual vessels—was recovered from Carrillo household Feature 61 at the San Agustín Mission locus of the Clearwater site (Table 7.39). Additional information regarding characteristics of the red-slipped pottery types recovered from this feature is provided in Table 7.40. Unfortunately, this American Territorial period feature exhibits some temporal mixing, with prehistoric painted pottery comprising 2.7 percent of the sherds, or 18.2 percent of the vessels. Those values suggest some of the plain ware pottery is also likely to be prehistoric; however, as discussed above, it is essentially impossible to separate a prehistoric sand-tempered plain ware sherd from a sand-tempered plain ware made during the Historic era.

Temper Attributes

Temper Type. The temper type data are summarized in Table 7.41. Three compositions dominate the collection: sand temper (40.7 percent of examined sherds), sand and fiber (presumably horse manure, 40.7 percent), and a mixture of sand and crushed sherd temper (10.9 percent). Four additional temper types were observed; all four contain metamorphic rocks and/or minerals (gneiss/schist and/or muscovite mica [with or without sand]). Most, if not all, of the gneiss/schist- and muscovite mica-tempered sherds may represent mixing of earlier, prehistoric sherds into the deposit, as those temper types are known to have been commonly used from approximately A.D. 850 to 1100 (Deaver 1984:397-398, Figure 4.69; Kelly 1978:72-76; Wallace et al. 1995:607, Figure 6). However, as shown with the mission pottery from the Clearwater site (discussed above), some vessels exhibiting a late ceramic trait—the folded rim—also contain metamorphic tempers (greater than 25 percent gneiss/schist and muscovite mica), indicating use of that temper type continued into the Historic era (see also Fontana et al. 1962:57, 135).

Temper Provenance. The temper provenance data are summarized in Table 7.42. Two or three source areas were identified in the small collection from the Carrillo household: the granitic Black Mountain and/or Sierrita petrofacies (33.3 percent) and the volcanic Beehive Petrofacies (25.9 percent). The Beehive Petrofacies is located south of the site, while the Black Mountain and Sierrita petrofacies are located

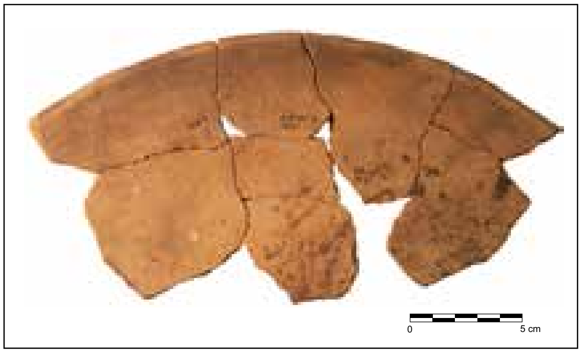

Figure 7.13. Papago Red-on-buff or White-on-buff plate, recovered from Feature 409, the Tucson Presidio, AZ BB:13:13 (ASM).

Figure 7.14. Papago Red-on-brown semi-flaring, angled long-collared jar, recovered from Feature 409, the Tucson Presidio, AZ BB:13:13 (ASM).

south of that resource area. The remaining 11 sherds could not be assigned to a specific source using only the binocular microscope; the temper provenance of those sherds was recorded as indeterminate.

Pottery Function

Two different approaches were utilized to assess the uses O'odham pottery likely played in the lives of the Carrillo household inhabitants. The first approach was strictly typological, whereas the second approach placed the only large rim sherd from the feature into a functional category determined by its overall morphology and size.

Typological Approach. The vessel forms of O'odham pottery recovered from the Carrillo household are reported in Table 7.43. Unfortunately, 88.9 percent of the rims could not be assigned to a vessel form because most of the rim sherds recovered from the Carrillo household are quite small (less than 5 cm^2). Even so, bowl vessel forms clearly must have been quite common, as half of the indeterminate forms represent bowls.

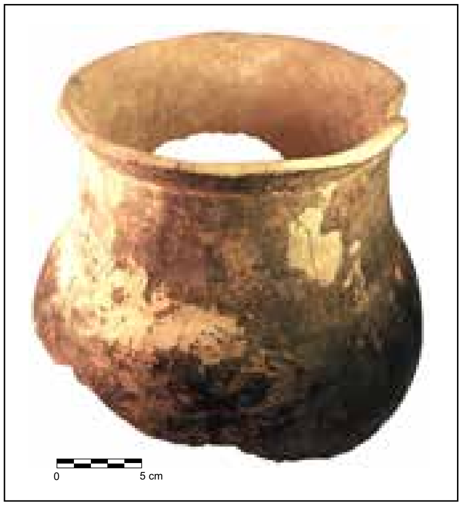

Figure 7.15. Sobaipuri semi-flaring, angled long-collared jar, recovered from Feature 409, the Tucson Presidio, AZ BB:13:13 (ASM).

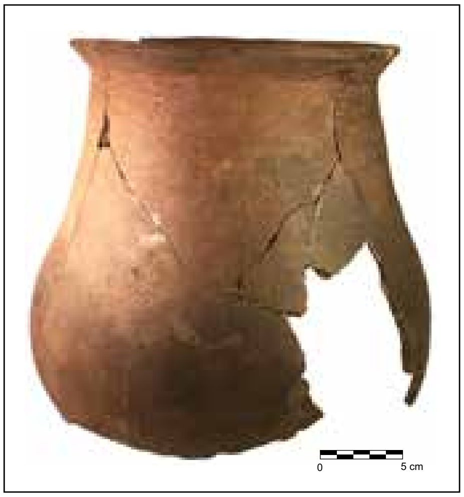

Figure 7.16. Sobaipuri semi-flaring, angled long-collared, jar, recovered from Feature 409, the Tucson Presidio, AZ BB:13:13 (ASM).

Shepard-Braun Approach. Only one of the three rim sherds assigned to a vessel form—the Papago Red cauldron—also had a measurable rim diameter. Following the method displayed in Table 7.5, it is classified as a small group serving vessel.

Historic O'odham Pottery from Block 181, Lot 1, circa Late 1870s-Early 1890s

A total of 1,319 pottery sherds—representing portions of at least 197 individual vessels—was recovered from Feature 376 at Block 181, Lot 1, the Tucson Presidio (Table 7.44). Additional information regarding

Table 7.38. Frequency of rim sherds and reconstructible vessels in each functional category recovered from Features 409 and 441, the Tucson Presidio, AZ BB:13:13 (ASM), reported by ceramic type.

	Historic Native American Ceramic Type										
Functional Category (Final Vessel Form Class)	Plain Ware	Sobaipuri Plain (folded-over rim coil)	Red Ware	Papago Red	Possible Papago Red	Papago Plain	Possible Papago Plain	Papago Black-on-red	Papago Red-on-brown	Indeterminate Papago Red-on-buff or White-on-buff	Row Total
Independent Restricted Vessels											
B: Permanent, secure storage and/or water carrying (6.0-12.5 cm aperture diameter)	0	1	0	0	0	0	0	1	0	0	2
C: Cooking (small- to medium-sized groups), temporary storage, and/or water cooling (13.0-25.5 cm aperture diameter)	1	6	0	0	0	1	0	0	1	0	9
D: Cooking (large group) and/or temporary storage (26.0-31.5 cm aperture diameter)	1	2	0	1	0	0	0	0	0	0	4
Simple and Dependent Restricted Vessels											
G: Specialized, temporary dry storage (6.0-12.5 cm orifice diameter)	1	0	0	0	0	0	0	0	0	0	1
Unrestricted Vessels (Deep)											
M: Food preparation and/or small group serving (13.0-25.5 cm orifice diameter)	2	1	17	4	1	0	0	0	0	0	25
N: Communal serving/eating (26.0-31.5 cm orifice diameter)	0	0	1	0	0	1	0	0	0	0	2
O: Communal serving/eating (32.0-38.5 cm orifice diameter)	1	0	0	0	0	0	1	1	0	0	3
Unrestricted Vessels (Shallow)											
R: Collecting, processing, and/or individual-to-large group serving (13.0-25.5 cm orifice diameter)	2	0	1	1	0	0	0	0	0	0	4
S: Collecting, processing, and/or communal serving (26.0-31.5 cm orifice diameter)	1	0	1	0	0	0	0	0	0	0	2
T: Collecting, processing, and/or communal serving (32.0-38.5 cm orifice diameter)	5	0	0	0	0	0	0	0	0	1	6
TT: Collecting, processing, and/or communal serving (>38.5 cm orifice diameter)	1	0	0	0	0	0	0	0	0	0	1
Column Total	15	10	20	6	1	2	1	2	1	1	59

Table 7.39. Native American pottery types recovered from Feature 61, the Carrillo household, at the San Agustín Mission locus, Clearwater site, AZ BB:13:6 (ASM).

	Vessel Part[a]						Row Total	
	Body Sherd		Rim Sherd		Neck			
Ceramic Type	Sherd Count	MNV[b]	Sherd Count	MNV	Sherd Count	MNV	Sherd Count	MNV
Prehistoric Native American Types								
Indeterminate red-on-brown	2	2	0	0	2	1	4	3
Indeterminate pre-Classic red-on-brown	1	1	0	0	0	0	1	1
Early Rincon, Middle Rincon, Late Rincon, or Tanque Verde red-on-brown	0	0	1	1	0	0	1	1
Tanque Verde Red-on-brown	2	2	0	0	0	0	2	2
Indeterminate red-on-buff	1	1	0	0	0	0	1	1
Historic Native American Types								
Plain ware	149	N/A	5	5	4	N/A	158	5
Sobaipuri Plain (folded-over rim coil)	0	0	2	1	0	0	2	1
Red ware	9	9	5	5	0	0	14	14
Papago Plain	79	N/A	10	10	7	N/A	96	10
Papago Red[c]	34	N/A	11	6	4	N/A	49	6
Possible Papago Red	3	N/A	0	0	0	N/A	3	0
Column Total	280	15	34	28	17	1	331	44

[a] Historic plain ware and Papago Red body and neck sherds were not inspected for conjoins; therefore, minimum number of vessel estimates are not available (N/A) for those ware and vessel part combinations.

[b] MNV = Minimum number of vessels.

[c] Two Papago Red have folded-over rim coils.

Table 7.40. Location of slip on historic red ware and Papago Red pottery recovered from Feature 61, the Carrillo household, at the San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

	Papago Red				Red Ware			
	Vessel Part				Vessel Part			
			Rim Sherds and Reconstructible Vessels			Rim Sherds and Reconstructible Vessels		
Slip Location	Body Sherds	Neck Sherds	Bowl	Indeterminate Flare-rim form	Body Sherds	Bowl	Indeterminate Flare-rim form	Row Total
Fully slipped on all visible interior and exterior surfaces	10	1	2	2	6	2	2	25
Exterior only	9	3	0	0	0	0	0	12
Interior only	0	0	0	0	2	0	0	2
Exterior, rim, and interior band below rim	0	0	1	0	0	0	0	1
Indeterminate slip location	1	0	0	1	1	1	0	4
Column total	20	4	3	3	9	3	2	44

Table 7.41. Three-way classification of historic ceramic types, vessel part, and temper type from Feature 61, the Carrillo household, at the San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM). (The "body" category includes body and neck sherds.)

Temper Type	Plain Ware		Sobaipuri Plain (folded-over rim coil)	Red Ware		Papago Red		Possible Papago Red	Papago Plain		Row Total
	Rim	Body	Rim	Rim	Body	Rim	Body	Body	Rim	Body	
Sand	1	109	1	2	7	0	1	2	0	0	123
Sand and fiber	0	0	0	0	0	6	22	1	9	85	123
Sand and crushed sherd	2	25	0	3	2	0	0	0	1	0	33
>25% gneiss/schist	1	5	0	0	0	0	0	0	0	0	6
Mixed sand and 1-25% muscovite mica	0	2	0	0	0	0	0	0	0	0	2
>25% muscovite mica	0	1	0	0	0	0	0	0	0	0	1
>25% gneiss/schist and muscovite mica	0	1	0	0	0	0	0	0	0	0	1
Indeterminate	1	10	0	0	0	0	1	0	0	1	13
Column total	5	153	1	5	9	6	24	3	10	86	302

Table 7.42. Three-way classification of historic ceramic types, vessel part, and temper source from Feature 61, the Carrillo household, at the San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM). (The "body" category includes body and neck sherds.)

Temper Source	Papago Red	Papago Plain	Plain Ware	Sobaipuri Plain (folded-over rim coil)	Red Ware	Row Total
	Rim	Rim	Rim	Rim	Rim	
Black Mountain or Sierrita petrofacies (granitic)	3	6	0	0	0	9
Beehive Petrofacies (volcanic)	0	1	3	1	2	7
Indeterminate	3	3	2	0	3	11
Column total	6	10	5	1	5	27

Table 7.43. Frequency of rim sherds and reconstructible vessels in each vessel form class recovered from Feature 61, the Carrillo household, at the San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM), reported by ceramic type.

	Historic Native American Ceramic Type					
Vessel Form	Red Ware	Plain Ware	Sobaipuri Plain (folded-over rim coil)	Papago Red	Papago Plain	Row Total
Bowl Forms						
Plate/Platter	1	0	0	0	1	2
Cauldron	0	0	0	1	0	1
Indeterminate bowl form	2	4	0	2	4	12
Indeterminate Forms						
Indeterminate flare-rim form	2	1	1	3	5	12
Column Total	5	5	1	6	10	27

Table 7.44. Native American pottery types recovered from Feature 376 at Block 181, Lot 1, the Tucson Presidio, AZ BB:13:13 (ASM).

	Vessel Part[a]											
	Body Sherd		Rim Sherd		Reconstructible Vessel		Neck		Handle		Row Total	
Ceramic Type	Sherd Count	MNV[b]	Sherd Count	MNV	Sherd Count	MNV	Sherd Count	MNV	Sherd Count	MNV	Sherd Count	MNV
Prehistoric Native American Types												
Indeterminate red-on-brown	1	1	0	0	0	0	0	0	0	0	1	1
Indeterminate pre-Classic red-on-brown	3	3	0	0	0	0	0	0	0	0	3	3
Rillito Red-on-brown	2	2	1	1	0	0	0	0	0	0	3	3
Rillito or Early Rincon red-on-brown	6	5	0	0	0	0	0	0	0	0	6	5
Early Rincon Red-on-brown	1	1	0	0	0	0	0	0	0	0	1	1
Early or Middle Rincon red-on-brown	3	2	2	2	0	0	0	0	0	0	5	4
Middle Rincon Red-on-brown	6	4	2	2	0	0	0	0	0	0	8	6
Tortolita Red	1	1	0	0	0	0	0	0	0	0	1	1
Indeterminate red-on-buff	1	1	0	0	0	0	0	0	0	0	1	1
Historic Native American Types												
Plain ware	229	N/A	12	12	0	0	7	N/A	0	0	248	12
Sobaipuri Plain (folded-over rim coil)	0	0	1	1	0	0	0	0	0	0	1	1
Red ware	4	N/A	2	1	0	0	0	N/A	0	0	6	1
Papago Plain[b=c]	509	N/A	111	87	41	4	0	N/A	1	1	662	92
Possible Papago Plain	2	N/A	0	0	0	0	0	N/A	0	0	2	0
Papago Red[d]	282	N/A	72	54	3	1	0	N/A	0	0	357	55
Possible Papago Red	0	0	3	3	0	0	0	0	0	0	3	3
Papago Black-on-red	1	1	1	1	0	0	2	1	0	0	4	3
Papago White-on-red	1	1	0	0	0	0	0	0	0	0	1	1
Indeterminate Papago Buff	4	2	0	0	0	0	0	0	0	0	4	2
Zuni Polychrome	1	1	1	1	0	0	0	0	0	0	2	2
Column Total	1,057	25	208	165	44	5	9	1	1	1	1,319	197

[a] Historic plain ware and red-slipped body and neck sherds were not inspected for conjoins; therefore, minimum number of vessel estimates are not available (N/A) for those ware and vessel part combinations.

[b] MNV = Minimum number of vessels.

[c] One Papago Plain ware has a folded rim.

[d] One Papago Red ware has a folded rim.

Table 7.45. Location of slip on historic red ware and Papago Red pottery recovered from Feature 376 at Block 181, Lot 1, the Tucson Presidio, AZ BB:13:13 (ASM).

	Papago Red				Red Ware		
	Vessel Part				Vessel Part		
		Rim Sherds and Reconstructible Vessels			Rim Sherd		
Slip Location	Body Sherds	Bowl	Jar	Indeterminate Flare-rim form	Indeterminate Flare-rim form	Body Sherds	Row Total
Exterior only	243	0	0	0	0	1	244
Fully slipped on all visible interior and exterior surfaces	31	10	1	23	0	1	66
Exterior, rim, and interior band	0	0	9	1	0	0	10
Interior only	7	0	0	0	0	1	8
Exterior and interior band	1	0	0	0	0	0	1
Indeterminate slip location	0	1	1	9	1	0	12
Column total	282	11	11	33	1	3	341

characteristics of the red-slipped pottery types recovered from the feature is provided in Table 7.45. Unfortunately, this American Territorial period feature exhibits some temporal mixing, with prehistoric painted pottery comprising 2.2 percent of the sherds, or 12.7 percent of the vessels. Those values suggest some of the plain ware pottery recovered from this feature is also likely to be prehistoric; however, as discussed above, it is essentially impossible to separate a prehistoric sand-tempered plain ware sherd from a historic sand-tempered plain ware.

Temper Attributes

Temper Type. The temper type data are summarized in Table 7.46. One composition dominates the collection: sand and fiber (presumably manure, 78.4 percent of examined sherds). Eight additional temper types were observed. These fall into to three major groups: tempers containing a mixture of sand and crushed sherd, sand alone, and those containing metamorphic rocks and/or minerals (gneiss/schist and/or muscovite mica [with or without sand]). Most of the gneiss/schist- and muscovite mica-tempered sherds may represent mixing of earlier, prehistoric sherds into the deposits, as those temper types are known to have been commonly used from approximately A.D. 850 to 1100 (Deaver 1984:397-398, Figure 4.69; Kelly 1978:72-76; Wallace et al. 1995:607, Figure 6).

Temper Provenance. The temper provenance data are summarized in Table 7.47. A very large percentage (87.5 percent) contains nonlocal sands from the granitic Black Mountain and/or Sierrita petrofacies. Three additional source areas were identified: the volcanic Beehive Petrofacies (5.4 percent), the volcanic Twin Hills Petrofacies (1.2 percent), and the granitic Black Mountain Petrofacies (0.6 percent). The Twin Hills Petrofacies is located immediately west of the Block 181, across the Santa Cruz River. The Beehive Petrofacies is located south of that resource area, while the Black Mountain and Sierrita petrofacies are located south of the Beehive Petrofacies. The remaining eight sherds (4.8 percent) could not be assigned to a specific source using only the binocular microscope; their temper provenance was recorded as indeterminate.

Pottery Function

Two different approaches were utilized to assess the uses O'odham pottery likely played in the lives of Block 181 inhabitants. The first approach was strictly typological and entailed the assignment of rim sherds and reconstructible vessels to vessel form categories originally created to classify prehistoric pottery from the region. The second approach examined a subset of the rim sherds and reconstructible vessels, placing them into functional categories determined by their overall morphology and size.

Typological Approach. The vessel forms of American Territorial period O'odham pottery recovered from Feature 376 are reported in Table 7.48.

Shepard-Braun Approach. The count of sherds in each vessel form class is summarized in Table 7.49, by ceramic type. The functional interpretation of each vessel form class follows the method shown in Table 7.5. If all the plain ware types (i.e., plain ware and Papago Plain) in vessel form classes C, M, and R are assumed to have been used for food preparation and cooking, and if the data set is representative, 40.9 percent of the pottery may have been used

Table 7.46. Three-way classification of historic ceramic types, vessel part, and temper type from Feature 376 at Block 181, Lot 1, the Tucson Presidio, AZ BB:13:13 (ASM). (The "rim" category includes rim sherds and reconstructible vessels; the "body" category includes body and neck sherds.)

	Papago Plain		Papago Red		Possible Papago Red	Possible Papago Plain	Papago Black-on-red		Papago White-on-red	Indeterminate Papago Buff Type	Zuni Glaze		Plain Ware		Sobaipuri Plain (folded-over rim coil)	Red Ware		
Temper Type	Rim	Body	Rim	Body	Rim	Body	Rim	Body	Body	Body	Rim	Body	Rim	Body	Rim	Rim	Body	Row Total
Sand and fiber	88	509	55	282	3	1	1	2	1	0	0	0	0	0	0	0	0	942
Mixed sand and 1-7% gneiss/schist	0	0	0	0	0	0	0	0	0	0	0	0	1	72	0	0	0	73
Sand and crushed sherd	0	0	0	0	0	1	0	0	0	0	0	0	9	46	1	1	2	60
Sand	1	0	0	0	0	0	0	0	0	1	0	0	0	50	0	0	1	53
>25% gneiss/schist	0	0	0	0	0	0	0	0	0	0	0	0	1	43	0	0	0	44
Mixed sand and 7-25% gneiss/schist	0	0	0	0	0	0	0	0	0	0	0	0	0	22	0	0	0	22
Mixed sand and 1-25% muscovite mica	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	2
Mixed sand and 1-25% gneiss/schist and muscovite mica	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2
Crushed sherd	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Indeterminate	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	3
Column total	91	509	55	282	3	2	1	2	1	1	1	1	12	236	1	1	3	1,202

Table 7.47. Three-way classification of historic ceramic types, vessel part, and temper source from Feature 376 at Block 181, Lot 1, the Tucson Presidio, AZ BB:13:13 (ASM). (The "rim" category includes rim sherds and reconstructible vessels; the "body" category includes body and neck sherds.)

	Papago Plain	Papago Red	Possible Papago Red	Papago Black-on-red		Papago White-on-red	Indeterminate Papago Buff Type	Plain Ware	Sobaipuri Plain (folded-over rim coil)	Red Ware	
Temper Source	Rim	Rim	Rim	Rim	Body	Body	Body	Rim	Rim	Rim	Row Total
Black Mountain or Sierrita petrofacies (granitic)	86	54	3	1	2	1	0	0	0	0	147
Beehive Petrofacies (volcanic)	0	0	0	0	0	0	0	9	0	0	9
Twin Hills Petrofacies (volcanic)	0	0	0	0	0	0	0	2	0	0	2
Black Mountain Petrofacies (granitic)	1	0	0	0	0	0	0	0	0	0	1
Indeterminate granitic or metamorphic source	1	0	0	0	0	0	0	0	0	0	1
Indeterminate source	3	1	0	0	0	0	1	1	1	1	8
Column total	91	55	3	1	2	1	1	12	1	1	168

Table 7.48. Frequency of rim sherds and reconstructible vessels in each vessel form class recovered from Feature 376 at Block 181, Lot 1, the Tucson Presidio, AZ BB:13:13 (ASM), reported by ceramic type.

	Historic Native American Ceramic Type							
Vessel Form	Papago Plain	Papago Red	Possible Papago Red	Papago Black-on-red	Plain Ware	Sobaipuri Plain (folded-over rim coil)	Red Ware	Row Total
Bowl Forms								
Semi-flare-rim, outcurved	12	3	0	0	1	0	0	16
Semi-flare-rim, hemispherical	5	1	0	0	0	0	0	6
Outcurved	3	2	0	0	0	0	0	5
Semi-flare-rim, incurved	3	1	0	0	0	0	0	4
Plate/Platter	2	0	0	0	1	0	0	3
Flare-rim	1	0	0	0	0	0	0	1
Hemispherical	0	1	0	0	0	0	0	1
Incurved	1	0	0	0	0	0	0	1
Straight-walled or vertical-sided	0	0	0	0	1	0	0	1
Indeterminate bowl form	4	3	0	0	3	0	0	10
Jar Forms								
Tall flare-rim	7	9	0	0	0	0	0	16
Semi-flare-rim angled long-collar	1	2	0	0	0	0	0	3
Neckless	0	0	0	0	1	0	0	1
Indeterminate jar form	1	0	0	0	1	0	0	2
Indeterminate Forms								
Indeterminate flare-rim form	51	33	3	1	4	1	1	94
Column Total	91	55	3	1	12	1	1	164

for cooking. Similarly, if all the pottery in vessel form classes B and H and all of the Papago Red pottery in class C are assumed to have been used for storage, and if the data set is representative, 20.5 percent of the pottery may have been used for storage. Finally, 38.6 percent of the pottery may have been used for serving if the Papago Red in vessel form class M was used for small group servings, if all the pottery in vessel form classes N, O, and OO was used for large group servings, and if the data set is representative.

Review of Vessel Function

The findings reported above can be compared with similar data drawn from ethnographic studies. Rice (1987:Table 9.5) reports the percentage of cooking, storage, and serving vessels in 10 different cultures. The average percentage of cooking vessels in those 10 cultures is 53 (range = 26-87 percent; standard deviation = 19 percent), the average percentage of storage vessels is 16 (range = 2-31 percent; standard deviation = 11 percent), and the average percentage of serving vessels is 23 (range = 8-41 percent; standard deviation = 14 percent). By those measures, the inferred percentage of cooking vessels recovered from presidio Feature 373 falls below that documented ethnographically, while the percentage of serving vessels recovered from Feature 373, as well as presidio Features 409 and 441, exceeds the documented range. The inferred percentages of cooking, storage, and serving vessels recovered from the San Agustín Mission deposits and the Tucson Presidio's American Territorial period Feature 376 fall within the ethnographic ranges.

Papago Red vessels assigned to categories C and D were probably used for storing and cooling water (Hand 1994:15, 41, 44, 83, 105, 135, 154, 172, 175; Hosmer et al. 1991:56-57; Naranjo 2002), although that practice probably ended as the municipal water supply became available throughout the project area. Also, the high percentage of deep, unrestricted vessels is consistent with a cuisine that featured soups and stews. Indeed, the ubiquitous semi-flaring bowl forms recovered from the Historic era contexts closely resemble the flanged plates and bowls produced by contemporary Hispanic potters in New Mexico for

Table 7.49. Frequency of rim sherds and reconstructible vessels in each functional category recovered from Feature 376 at Block 181, Lot 1, the Tucson Presidio, AZ BB:13:13 (ASM), reported by ceramic type.

	Historic Native American Ceramic Type			
Functional Category (Final Vessel Form Class)	Papago Red	Papago Plain	Plain Ware	Row Total
Independent Restricted Vessels				
B: Permanent, secure storage and/or water carrying (6.0-12.5 cm aperture diameter)	1	1	0	2
C: Cooking (small- to medium-sized groups), temporary storage, and/or water cooling (13.0-25.5 cm aperture diameter)	6	9	1	16
Simple and Dependent Restricted Vessels				
H: Specialized, temporary dry storage (13.0-25.5 cm orifice diameter)	0	1	0	1
Unrestricted Vessels (Deep)				
M: Food preparation and/or small group serving (13.0-25.5 cm orifice diameter)	1	5	1	7
N: Communal serving/eating (26.0-31.5 cm orifice diameter)	2	7	0	9
O: Communal serving/eating (32.0-38.5 cm orifice diameter)	2	3	0	5
OO: Communal serving/eating (>38.5 cm orifice diameter)	0	2	0	2
Unrestricted Vessels (Shallow)				
R: Collecting, processing, and/or individual-to-large group serving (13.0-25.5 cm orifice diameter)	0	1	1	2
Column Total	12	29	3	44

their own use and for sale within their communities (Carrillo 1997:11, 103, 221). Finally, the large, shallow, unrestricted plain ware vessels in categories R, S, T, and TT may well have been used as griddles, or *comales*, for cooking tortillas—based on the dimensions of 176 *comales* reported by Arnold (1978:Appendices 2A-2C).

O'odham Pottery Systematics: A Review of Technological Attributes Exhibited by Material Recovered from Well-dated, Tucson-area Historic Era Deposits

Fontana et al.'s (1962:101-116) discussion of "Papago" pottery types is generally considered the classic work on the subject. However, although they drew upon ceramic collections from an expansive area ". . . all of this material is flawed by a frustrating lack of chronological control" (Fontana et al. 1962:102). Five recent archaeological projects at six sites located in the central Tucson area have yielded a number of well-dated deposits containing historic Native American pottery (Heidke 2002, 2003a, 2003b, 2005b). That material provides the type of chronological control that Fontana et al. (1962) thought they lacked, although the samples themselves are drawn from a much smaller area. Additionally, variability related to social and economic factors needs to be explored further (Whittlesey 1997:439). Therefore, it would be inappropriate to extend the findings reported here at this time. More well-dated samples, covering a broader range of social and economic statuses, need to be recovered from deposits located within and, especially, outside the Tucson area before that can happen.

Tables 7.50 and 7.51 summarize information recorded from pottery recovered from well-dated deposits at the sites that reflect decisions made by the potters—temper source and type, occurrence of folded rim coils, location of red slips, and decorated type color schemes—as well as those that reflect consumer preference (type frequency). All of these are characteristics of "Papago" pottery that contributed to the Fontana et al. (1962) typology. The temper type, folded rim, slip location, and ware frequency data are based on sherd counts, whereas the temper source data are based on minimum number of vessel counts. Figure 7.17 shows the date ranges of the contexts included in the summary; examination of that figure makes it clear where the date ranges overlap *and* where there are gaps in the dating. The two, dashed, vertical lines indicate changes in administration between the Spanish and Mexican governments

Table 7.50. Summary of temporal changes in select technological attributes of Native American pottery from Spanish and Mexican period deposits.

	Period			
Contexts and Technological Attributes	Spanish		Mexican	American Territorial
Date Range	1694-1821		1821-1856	1856-1912
Site Name	San Agustín Mission	Tucson Presidio	Tucson Presidio	León Farmstead
AZ ASM Site Number	BB:13:6	BB:13:13	BB:13:13	BB:13:505
Feature Number(s)	64, 161, 166, 177, 178, 193, 203	373	409, 441	4 (Stratum 50.03), 14, 25, 28
Feature Date Range	1771-1821	1810s-1820s	1820s-1830s	1840-1869
Maximum Sample Sizes: Sherd Count (MNV)[a]	3,396 (476)	333 (38)	1,094 (109)	831 (123)
Temper Source				
Percentage volcanic production locale[b]	64.6	38.2	37.6	29.5
Percentage granitic and mixed lithic production locale[b]	33.3	20.6	19.3	6.3
Percentage granitic production locale[b]	1.4	41.2	41.9	64.2
Temper Type				
Percentage sand-tempered[c]	39.8	48.6	31.7	34.7
Percentage sand and crushed sherd-tempered[c]	55.2	43.4	41.7	16.0
Percentage sand and fiber-tempered[c]	1.4	1.7	20.4	47.6
Folded Rims				
Percentage folded rim coils[d]	14.4	20.0	26.2	14.5
Type Frequency				
Percentage plain ware pottery[e]	85.2	66.1	60.3	34.3
Percentage red ware pottery[f]	13.2	27.0	12.2	2.6
Percentage Papago Plain pottery[g]	1.0	1.5	17.0	41.9
Percentage Papago Red pottery[h]	0.2	0.3	5.0	18.9
Percentage decorated pottery	0.4	5.1	5.4	2.3
Slip Location				
Percentage interior-slipped[i]	87.8	82.1	63.6	44.5
Percentage exterior-slipped[j]	11.8	17.9	36.4	55.5

Table 7.50. Continued.

Contexts and Technological Attributes	Period			
	Spanish		Mexican	American Territorial
Date Range	1694-1821		1821-1856	1856-1912
Site Name	San Agustín Mission	Tucson Presidio	Tucson Presidio	León Farmstead
AZ ASM Site Number	BB:13:6	BB:13:13	BB:13:13	BB:13:505
Decorated Types Present ("P")				
Papago Black-on-red	P	P	P	P
Papago Red-on-brown	P	–	P	P
Papago Red-on-buff	P	P	?	–
Papago Black-on-buff	–	–	–	–
Papago White-on-red	–	–	–	–

[a] Prehistoric types and indeterminate wares not included in sherd and MNV counts (MNV = Minimum number of vessels).

[b] Volcanic production locales include Beehive and/or Twin Hills petrofacies observations; granitic and mixed lithic production locale includes Airport Petrofacies observations; granitic production locales include Black Mountain and/or Sierrita petrofacies observations; indeterminate temper source observations were deleted before percentage values were calculated.

[c] Indeterminate temper type observations were deleted before percentage values were calculated.

[d] Calculation based on the MNV count of all historic Native American rim sherds and reconstructible vessels; percentage figures include Sobaipuri Plain and any other cases of folded-over rim coils noted in other types.

[e] Calculation based on the sherd count of all historic Native American types. The "plain ware" category includes plain ware and Sobaipuri Plain observations.

[f] Calculation based on the sherd count of all historic Native American types.

[g] Calculation based on the sherd count of all historic Native American types; the "Papago Plain" category includes Papago Plain and possible Papago Plain observations.

[h] Calculation based on the sherd count of all historic Native American types; the "Papago Red" category includes Papago Red and possible Papago Red observations.

[i] Percentage based on all sherds slipped on their: (1) interior surface; (2) interior and rim; (3) interior, rim, and exterior band; and (4) fully slipped on all interior and exterior surfaces; indeterminate observations were deleted before percentage values were calculated.

[j] Percentage based on all sherds slipped on their exterior surface and those slipped on their exterior, rim, and a band below the rim; indeterminate observations were deleted before percentage values were calculated.

Table 7.51. Summary of temporal changes in select technological attributes of historic Native American pottery from the American periods deposits.

Contexts and Technological Attributes	Period							
	American Territorial							American Statehood
Date Range	1856-1912							1912-present
Site Name	Carrillo Household	León Farmstead	Block 181	León Farmstead	Block 139	Block 172	Block 136	Block 136
AZ ASM Site Number	BB:13:6	BB:13:505	BB:13:13	BB:13:505	BB:13:644	BB:13:668	BB:13:513	BB:13:513
Feature Number(s)	61	4 (Stratum 50.02)	376	4 (Stratum 50.01)	19	46, 54	60	7, 41
Feature Date Range	1860-1880	1870-1880	Late 1870s-early 1890s	1880-1890	1890-1895	1891/1892-1900	1898-1911	1916-1929
Arrival of City Water	1940s	1930s	1883	1930s	1910s-1920s	1901	Early 1900s	Early 1900s
Maximum Sample Sizes: Sherd Count (MNV)[a]	322 (36)	116 (16)	1,288 (170)	1,054 (150)	1,098 (44)	1,131 (36)	188 (16)	139 (6)
Temper Source								
Percentage volcanic production locale[b]	43.7	15.4	6.9	4.8	0.0	0.0	0.0	16.7
Percentage granitic and mixed lithic production locale[b]	0.0	0.0	0.0	0.0	15.6	0.0	0.0	0.0
Percentage granitic production locale[b]	56.2	84.6	92.5	95.2	84.4	100.0	100.0	83.3
Temper Type								
Percentage sand-tempered[c]	42.6	20.5	4.4	11.2	2.3	0.0	1.7	11.7
Percentage sand and crushed sherd-tempered[c]	11.4	3.6	5.0	2.3	0.0	0.0	0.0	0.0
Percentage sand and fiber-tempered[c]	42.6	72.3	78.6	85.5	97.7	100.0	98.3	88.3
Folded Rims								
Percentage folded rim coils[d]	11.1	0.0	1.8	2.8	0.0	0.0	0.0	0.0
Type Frequency								
Percentage plain ware pottery[e]	49.7	7.8	19.3	8.5	0.4	1.3	0.5	0.7
Percentage red ware pottery[f]	4.3	0.0	0.5	0.2	0.0	0.0	0.0	0.0
Percentage Papago Plain pottery[g]	29.8	75.0	51.5	58.3	46.5	14.9	15.4	47.5
Percentage Papago Red pottery[h]	16.1	17.2	27.9	19.6	38.5	82.8	84.0	51.8
Percentage decorated pottery	0.0	0.0	0.7	13.3	14.6	0.9	0.0	0.0

Table 7.51. Continued.

	Period							
Contexts and Technological Attributes	American Territorial							American Statehood
Date Range	1856-1912							1912-present
Site Name	Carrillo Household	León Farmstead	Block 181	León Farmstead	Block 139	Block 172	Block 136	Block 136
AZ ASM Site Number	BB:13:6	BB:13:505	BB:13:13	BB:13:505	BB:13:644	BB:13:668	BB:13:513	BB:13:513
Slip Location								
Percentage interior-slipped[i]	67.5	56.2	22.5	20.8	11.0	8.5	14.1	47.1
Percentage exterior-slipped[j]	32.5	43.8	77.5	79.2	89.0	91.5	85.9	52.9
Decorated Types Present ("P")								
Papago Black-on-red	–	–	P	P	P	P	–	–
Papago Red-on-brown	–	–	–	P	–	–	–	–
Papago Red-on-buff	–	–	?	P	–	–	–	–
Papago Black-on-buff	–	–	?	P	–	–	–	–
Papago White-on-red	–	–	P	–	–	–	–	–

[a] Prehistoric types and indeterminate wares not included in sherd and MNV counts (MNV = Minimum number of vessels).

[b] Volcanic production locales include Beehive and/or Twin Hills petrofacies observations; granitic and mixed lithic production locale includes Airport Petrofacies observations; granitic production locales include Black Mountain and/or Sierrita petrofacies observations; indeterminate temper source observations were deleted before percentage values were calculated.

[c] Indeterminate temper type observations were deleted before percentage values were calculated.

[d] Calculation based on the MNV count of all historic Native American rim sherds and reconstructible vessels; percentage figures include Sobaipuri Plain and any other cases of folded-over rim coils noted in other types.

[e] Calculation based on the sherd count of all historic Native American types; the "plain ware" category includes plain ware and Sobaipuri Plain observations.

[f] Calculation based on the sherd count of all historic Native American types.

[g] Calculation based on the sherd count of all historic Native American types; the "Papago Plain" category includes Papago Plain and possible Papago Plain observations.

[h] Calculation based on the sherd count of all historic Native American types; the "Papago Red" category includes Papago Red and possible Papago Red observations.

[i] Percentage based on all sherds slipped on their: (1) interior surface; (2) interior and rim; (3) interior, rim, and exterior band; and (4) fully slipped on all interior and exterior surfaces; indeterminate observations were deleted before percentage values were calculated.

[j] Percentage based on all sherds slipped on their exterior surface and those slipped on their exterior, rim, and a band below the rim; indeterminate observations were deleted before percentage values were calculated.

in 1821 and the Mexican and American governments in 1856.

Examination of the temper source data indicates three important temporal trends (Figure 7.18): (1) a decrease over time in the amount of pottery tempered with volcanic sands; (2) a decrease over time in the amount of pottery tempered with granitic and mixed lithic sands; and (3) a concomitant increase in the amount of pottery tempered with granitic sands. The highest percentage of Historic era pottery tempered with volcanic sand occurs in the deposits recovered from the San Agustín Mission locus of the Clearwater site. Examination of the temper source data indicates a small amount of the volcanic sand-tempered pottery may have been made at the site, because some sherds contain the locally available Twin Hills Petrofacies sand. However, nearly half the pots are tempered with Beehive Petrofacies sand, the closest source of which is located approximately 3.2 km south of the site. Almost one-quarter of the pots contain sand temper from the Airport Petrofacies, located east of the mission on the other side of the Santa Cruz River. The Tucson Presidio was located in the Airport Petrofacies, and the presidio era contexts there also contain appreciable amounts of pottery tempered with that local sand composition.

A marked decrease in the amount of pottery tempered with volcanic sand occurs around 1870. After 1870, pots tempered with granitic Black Mountain and/or Sierrita petrofacies sands comprise anywhere from 83 percent to 100 percent of a site's collection; however, after 1890, the average number of vessels represented per feature declines rapidly from 44 (1890-1895) to three (1916-1929). The San Xavier District of the Tohono O'odham Reservation was established in 1874, and much of it lies within the Black Mountain and Sierrita petrofacies. Those facts suggest potters residing somewhere within that district made the vessels commonly recovered from American Territorial period deposits—a suggestion supported by historic accounts (Hand 1994:15, 134). Indeed, two O'odham villages shown on Chillson's 1888 map of the area lie within easy reach of sand and clay resources located in the Black Mountain and Sierrita petrofacies (Figure 7.19).

Some aspects of the temper type data follow the trends discussed above (Figure 7.20). The percentage of pottery tempered with a mixture of sand and crushed potsherd (grog) declined over time, while the percentage tempered with sandy pedogenic clay and manure increased. The transition between those two approaches to tempering appears to have occurred largely between 1820 and 1880, with marked increases in the amount of pottery tempered with manure noted at about 1820, between 1830 and 1840, and again between 1860 and 1870. Vessels tempered

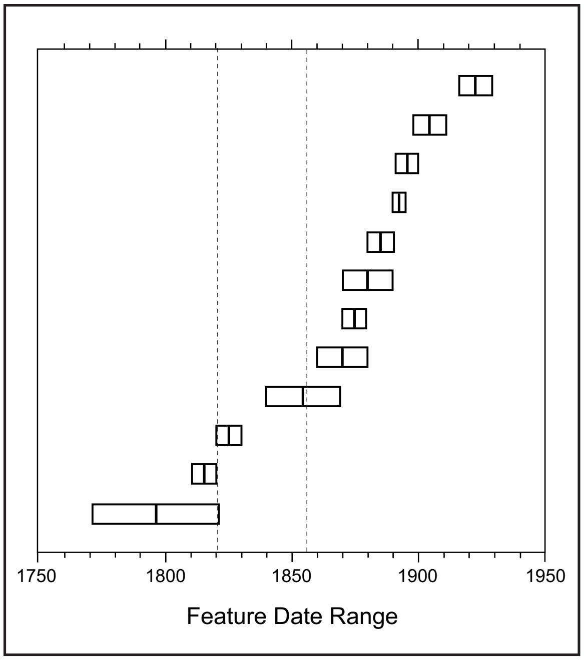

Figure 7.17. Date ranges of features summarized in Tables 7.50 and 7.51.

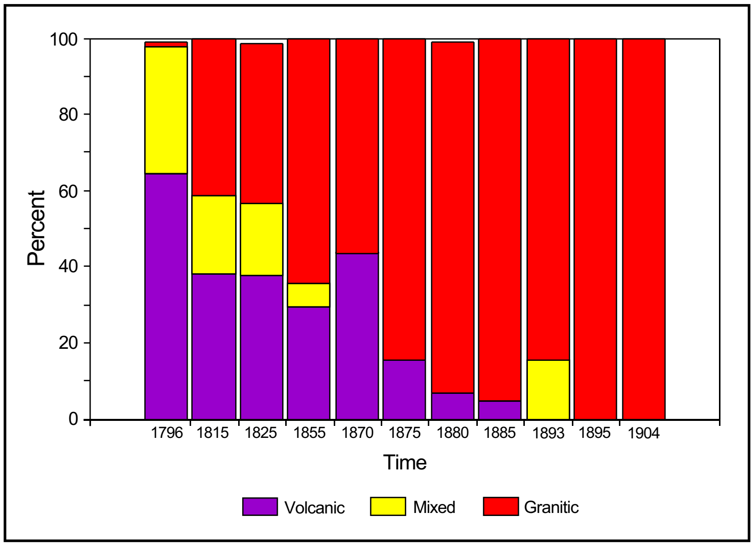

Figure 7.18. Temporal trends in Historic Native American pottery temper provenance. (Data batches are ordered by the midpoints of the feature date ranges reported in Tables 7.50 and 7.51.)

with sand and grog become increasingly rare after the 1830s. Cross-tabulation of the temper source and type data indicates a relationship between the two attributes. While some potters working in both areas used only sand temper, most of the vessels tempered with grog contain volcanic sand, and most vessels tempered with manure contain granitic sand.

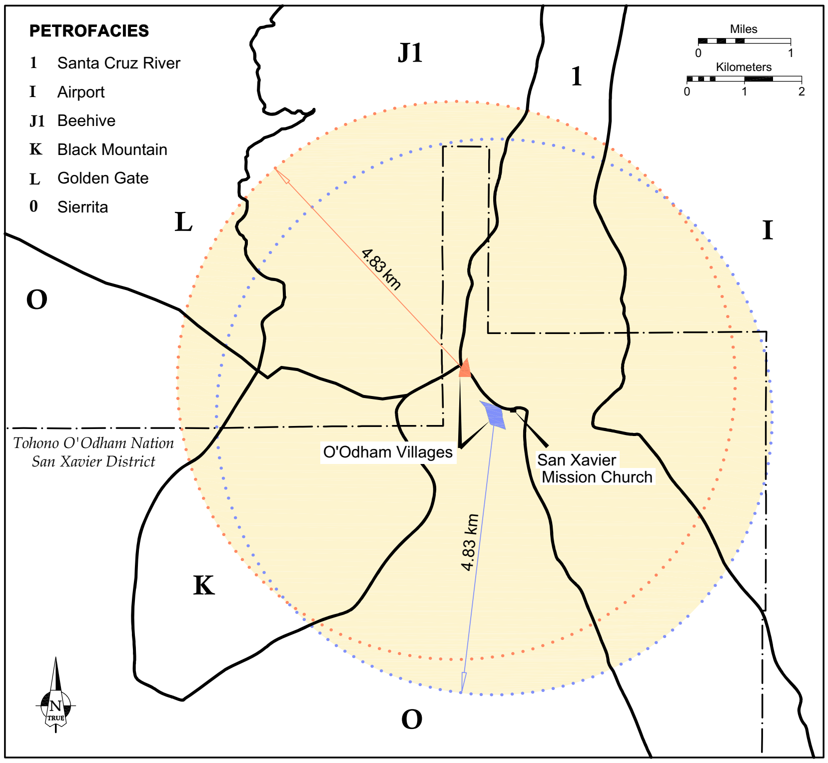

Figure 7.19. Detail of Tucson area petrofacies map showing the location of two Tohono O'odham villages in relation to the Black Mountain and Sierrita temper sources (after Chillson 1888). (The 4.83-km-radius circles depict the likely maximum distances that potters in both villages would travel by foot to collect clays containing natural nonplastics or clays to be mixed with sand temper [after Arnold 1985; Heidke et al. 2006]).

The folded rim coil attribute also follows the temper source and type trends discussed above (Figure 7.21). Vessels with folded rim coils are relatively common through about 1870, and, in the well-dated deposits summarized in Tables 7.50 and 7.51, are absent after 1890 (although they likely continued to be produced even later in time). The latest examples known to the author were recovered from Block 172, AZ BB:13:668 (ASM), Feature 23; the fill of that feature is dated 1891-1911 (Thiel et al. 2003). Six Sobaipuri Plain and two Papago Red sherds with rim coils were present among the 228 rims recovered from Feature 23. Fontana et al. (1962:109) thought that red wares with rim coils were not produced after 1860; the evidence from Feature 23 suggest at least one potter continued to make red-slipped vessels with a folded rim after that time.

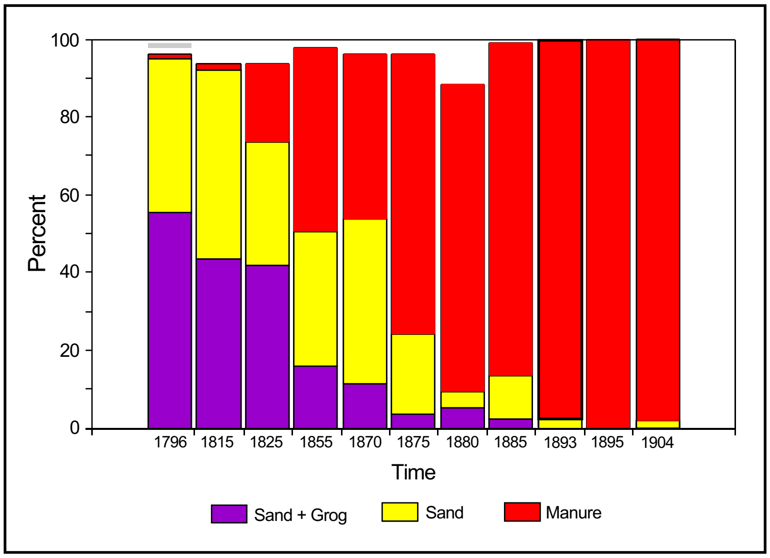

Figure 7.20. Temporal trends in Historic Native American pottery temper type. (Data batches are ordered by the midpoints of the feature date ranges reported in Tables 7.50 and 7.51.)

Table 7.52 summarizes the production locale and tempering technology used to produce the folded rim coil vessels recovered from the sites, including a number of sherds that were not recovered from well-dated deposits. Examination of Table 7.52 shows that half the plain ware vessels with folded rim coils were produced in either the volcanic Beehive or Twin Hills petrofacies, and almost three-quarters of them contain grog temper. Approximately 20 percent were made in either the granitic Black Mountain or Sierrita petrofacies, and two-thirds of those pots

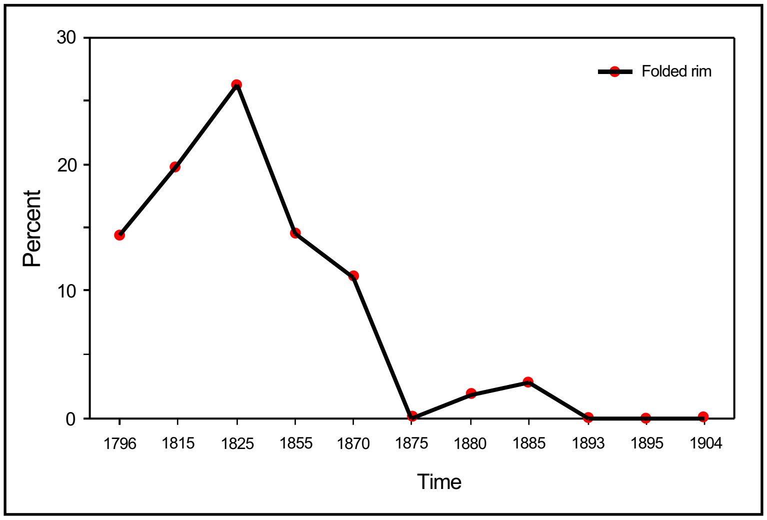

Figure 7.21. Temporal trends in the folded rim coil attribute. (Data batches are ordered by the midpoints of the feature date ranges reported in Tables 7.50 and 7.51.)

contain manure temper. Finally, about 8.5 percent of the plain ware vessels exhibiting a folded rim coil contain Airport Petrofacies sand temper.

Four red ware, 8 Papago Red, 3 Papago Plain, 1 Papago Black-on-red, 1 Papago Red-on-brown, and 1 Papago Red-on-buff also display the folded rim coil feature. Nine of those vessels are tempered with fiber and sand from either the Black Mountain or the Sierrita petrofacies, two just contain sand from those sources, and three are tempered with sand from the Airport Petrofacies. The production locale of the remaining folded rim vessels is unknown. However, based on the temper descriptions of Fontana et al. (1962), it is possible that the pots containing metamorphic tempers (that is, gneiss/schist, muscovite mica, and phyllite) were manufactured somewhere west of Tucson in the Papaguería.

Through the 1880s, unslipped pottery comprises approximately 75 percent of each Historic era archaeological collection; after that time, the percentage of red-slipped pottery increased markedly (Figure 7.22). The typical surface that was slipped also changed at about this time: before 1880, the interior surface was usually red-slipped, but after 1880 the exterior surface was usually the one slipped red (Figure 7.23). Together, the abundance and slip location data suggest red-slipped vessels were used rather differently before and after the 1880s. Prior to 1880, red-slipped vessels make up 13-27 percent of the Historic era collections, and most vessels were interior slipped bowls; however, after 1890, red-slipped vessels comprise anywhere from 39 percent to 84 percent of each collection, and most pots were exterior slipped jars.

Five decorated types—consisting of designs painted on plain brown, red-slipped, and cream- or buff-slipped backgrounds—were recovered. They are generally uncommon in the collections summarized in Tables 7.50 and 7.51, except two deposits spanning 1880-1895. The most common type—Papago Black-on-red—occurs in deposits dating from 1771 through the 1830s, 1840-1869, and the late 1870s through 1900, suggesting that, at a minimum, it was manufactured from the 1810s-1892 and, at a maximum, from 1771-1900.

The early ends of the date ranges (1771/1810s) modify Fontana et al.'s (1962:106-109) opinion about when this type was first made. They thought Papago Black-on-red was not produced before 1860. Further, the 1892/1900 end date suggested by these Tucson area deposits may be too early, as Doelle (1983:93) provides evidence that Papago Black-on-red manufacture continued in the Papaguería until the 1920s. Fontana et al. (1962:106) also indicate that most Papago Black-on-red vessel forms were eccentric and beyond the range of traditional Tohono O'odham forms. However, the vessel forms of Papago Black-on-red vessels recovered from the sites listed in Tables 7.50 and 7.51, summarized in Table 7.53, does not support their position: nearly all of the forms fall within the range of serving and storage vessels that they illustrate (Fontana et al. 1962). Doelle (1983:93-95) came to a similar conclusion with regard to the Papago Black-on-red vessels recovered from the Nolic site, AZ AA:13:19 (ASM). However, it should be noted that during the Tucson Presidio occupation, O'odham potters utilized traditional pottery manufacturing techniques to make some nontraditional, black-on-red vessel forms—such as cups and pitchers—which likely met the needs and expectations of the soldiers (and their families) stationed there.

The second-most common decorated type—Papago Red-on-brown—occurs in deposits dating from 1771-1821, 1820s-1830s, 1840-1869, and 1880-1890, suggesting that, at a minimum, it was made from 1821-1880 and, at a maximum, from 1771-1890. Those ranges fall within that proposed by Fontana et al. (1962:103-105, 109): 1700-1930. Papago Red-on-buff, Papago Black-on-buff, and Papago White-on-red occur less frequently. Papago Red-on-buff was documented in deposits dating from 1771-1821 and 1880-1890, Papago Black-on-buff was documented in a deposit dated 1880-1890, and Papago White-

Table 7.52. Temper source and type of Historic Native American pottery exhibiting a folded rim recovered from the sites shown in Tables 7.50 and 7.51.

		Ceramic Type with Folded-over Rim Coil							
Temper Source	Temper Type	Plain Ware	Red Ware	Papago Red	Papago Plain	Papago Black-on-red	Papago Red-on-brown	Papago Red-on-buff	Row Total
Beehive Petrofacies	Sand and grog	43	0	0	0	0	0	0	43
Beehive Petrofacies	Sand	13	0	0	0	0	0	0	13
Beehive Petrofacies	Indeterminate	1	0	0	0	0	0	0	1
Twin Hills Petrofacies	Sand	1	0	0	0	0	0	0	1
Black Mountain or Sierrita petrofacies	Sand and fiber	16	0	7	1	0	0	0	24
Black Mountain or Sierrita petrofacies	Sand	4	0	0	2	0	0	0	6
Black Mountain or Sierrita petrofacies	Sand and grog	1	0	0	0	0	0	0	1
Black Mountain Petrofacies	Sand	3	1	0	0	0	0	0	4
Airport Petrofacies	Sand	10	2	0	0	0	1	0	13
Indeterminate	Sand and grog	10	0	0	0	0	0	0	10
Indeterminate	Sand	4	0	1	0	1	0	1	7
Indeterminate	Sand and fiber	2	0	0	0	0	0	0	2
Indeterminate	>25 percent gneiss/schist and muscovite mica	1	0	0	0	0	0	0	1
Indeterminate	>25 percent phyllite	1	0	0	0	0	0	0	1
Indeterminate	Indeterminate	7	1	0	0	0	0	0	8
Column total		117	4	8	3	1	1	1	135

on-red was documented in a deposit that accumulated from the late 1870s through the early 1890s.

Discussion: Spatial and Temporal Variability in Historic Era Native American Ceramics

Temper Type. Spatial and temporal variability in the temper type of Tohono O'odham pottery is easily summarized from published reports, because nearly every author discusses that aspect of ceramic production. As mentioned above, except the Agua Caliente phase, prehistoric pottery made in the Tucson Basin was rarely tempered with sand and crushed potsherds. This fact leads one to wonder how and why so much of the Historic era pottery came to contain that type of temper. Late prehistoric sherds recovered from sites located in the Phoenix area and Protohistoric period sherds recovered from two sites located in the San Pedro River Valley provide tantalizing clues that suggest one possible answer to this mystery.

Henderson (1995:107) has noted that crushed sherd temper is a distinctly Classic period trait among the Phoenix area Hohokam. Heidke (2005d:Table 7.13) summarized the percentage of sand- and crushed sherd-tempered plain and red ware pottery in the ceramic collections recovered from 11 Phoenix area sites with Classic period components. Three of the sites—Grand Canals, AZ T:12:14 (ASU) and AZ T:12:16 (ASU); Pueblo Blanco, AZ U:9:95 (ASM); and AZ U:9:97 (ASM)—have collections that are temporally mixed with pre-Classic material and were not addressed further. The ceramic collections from the other sites are well-dated and lack evidence of temporal mixing. The median percentage of sand- and sherd-tempered plain ware in those collections is 10.2 (range = 2.0-23.1), while the median percentage of sand- and sherd-tempered red ware in those collections is 29.1 (range = 11.4-73.2). Further, the collection from Pueblo Grande displays monotonic increases over time, from the early Soho phase through the Polvorón phase, in the amount of plain and red ware pottery tempered with sand and crushed sherds.

Heidke (2005d) also examined the temper type of some Whetstone Plain rim sherds recovered from the Alder Wash Ruin, AZ BB:6:9 (ASM). In the sample of 28 Whetstone Plain sherds examined, 28.6 percent were found to be tempered with a mixture of sand and crushed potsherds. Masse (1980) did not mention that type of temper. However, as with Historic era sherds from the Tucson area, it would have been nearly impossible to identify grog temper in these Whetstone Plain sherds without the aid of a

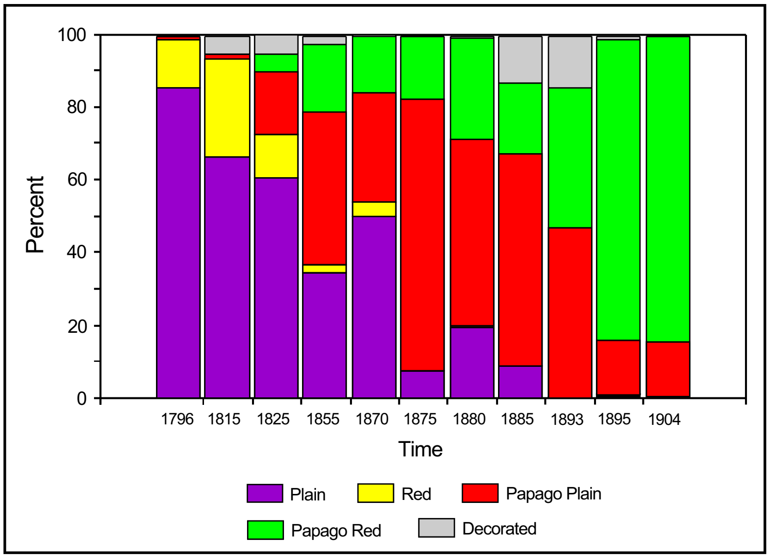

Figure 7.22. Temporal trends in Historic Native American pottery ware abundance. (Data batches are ordered by the midpoints of the feature date ranges reported in Tables 7.50 and 7.51.)

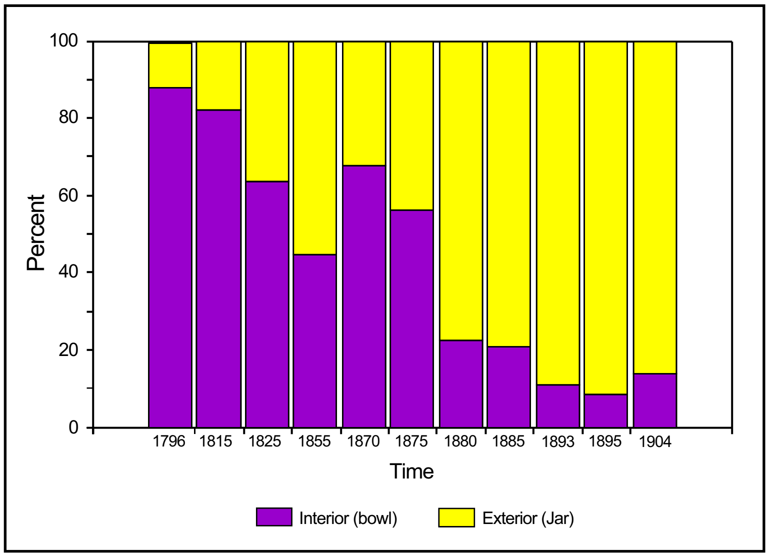

Figure 7.23. Temporal trends in the location of red-slipped surfaces on Historic Native American pottery. (Data batches are ordered by the midpoints of the feature date ranges reported in Tables 7.50 and 7.51.)

Table 7.53. Frequency of Papago Black-on-red vessel forms identified in rim sherds and reconstructible vessels recovered from the sites shown in Tables 7.50 and 7.51.

Vessel Form	Quantity
Bowl Forms	
Semi-flare-rim, outcurved	6
Outcurved	4
Semi-flare-rim, hemispherical	2
Incurved	1
Cauldron	1
Indeterminate bowl form	5
Jar Forms	
Tall flare-rim	6
Short flare-rim	1
Pitcher	1
Cup	1
Indeterminate jar form	3
Indeterminate Forms	
Indeterminate flare-rim form	11
Indeterminate form	1
Column Total	43

microscope. The temper type of some Whetstone Plain and Sobaipuri Plain rim sherds recovered from the Presidio de Santa Cruz de Terrenate was also examined at 15x magnification. In the sample of 18 Whetstone Plain sherds examined, 16.6 percent were found to be tempered with a mixture of sand and crushed potsherds. Like Masse, Di Peso (1953) did not mention that type of temper. The presence of sand and crushed sherd temper in Classic period plain and red ware pottery, two collections of Protohistoric period plain ware, and Historic era plain and red ware suggests continuity in this aspect of a technological style (Gosselain 1992) over hundreds of years. In 1762, some 250 Sobaipuris were relocated from the San Pedro River Valley to Tucson (Dobyns 1976:20, 189; Officer 1987:40, 340). Assuming that potters were among them, the local introduction of grog-tempering technology may have occurred at this time, as the earliest San Agustín Mission deposits postdate 1762.

The reason why manure temper was adopted and supplanted the use of sand tempers, or mixtures of sand and grog, is another interesting question. The earliest well-dated deposits containing that temper type were recovered from the Presidio de Santa Cruz de Terrenate, which was occupied from 1775 to 1780 (O'Conor 1952:64-65, cited in Gerald 1968:18). Di Peso (1953:148) reported that 94 percent of the plain ware recovered from the site was Sobaipuri Plain tempered with sand and "some vegetable matter" (Di Peso 1953:149). Waugh (1995:23) reported that 72 percent of the plain ware recovered from excavation units placed in the site's eastern midden were tempered with "a mixture of sand and organic inclusions." Those percentage values are much higher than either the roughly contemporary San Agustín Mission deposits (1.4 percent; see Table 7.50), or the earliest Tucson Presidio, León farmstead, and Carrillo household deposits. Interestingly, the actual abundance of organic temper in the paste of Sobaipuri Plain rim sherds from the Presidio de Santa Cruz de Terrenate seemed to be less than that usually observed in nineteenth century Papago Plain and Papago Red specimens from the Tucson Basin.

Whittlesey (1997) examined a small sample of pottery recovered from the Tohono O'odham village of Batki, AZ Z:16:6 (ASM), located in the Papaguería. Haury (1975) thought that village was destroyed by Apache raiders around 1850; none of the 11 vessels Whittlesey (1997:459) examined displayed organic temper casts. Rancho Punta de Agua, AZ BB:13:18 (ASM), located on the San Xavier District of the Tohono O'odham Reservation, was occupied only a few years later, between 1857 and 1877, by a German immigrant and his Mexican wife, and later, by a Mexican family (McGuire 1979). Nearly all the Tohono O'odham pottery recovered from that site—92.8 percent—contained casts of organic temper in the fired paste (McGuire 1979:Table 1).

Compared with contemporary deposits recovered from sites located in the Tucson area, the percentage of sand and fiber-tempered pottery in the Batki collection is low, while the percentage in the Rancho Punta de Agua collection is high. Whittlesey (1997:462) summarized the evidence regarding the first occurrence and adoption of fibrous, organic (manure) temper in this way: its first use was likely a Spanish-inspired innovation, the practice was most common in acculturated Tohono O'odham settlements, and the custom did not become widespread until the late nineteenth century. All the evidence reviewed here supports her conclusions.

Folded Rim Coils. The origins of the rim coil attribute are even less clear than those of crushed sherd temper. Masse (1977:22, Figure 9b) reports the presence of a plain ware jar with a rim coil in a late Classic period Hohokam context at Las Colinas, AZ T:12:10 (ASM). Further, numerous late Classic period sites located along the San Pedro River—such as Curtis, AZ BB:11:100 (ASM); Reeve, AZ BB:11:26 (ASM); Elliott, AZ BB:11:27 (ASM); and Davis Ranch, AZ BB:11:36 (ASM)—have yielded plain ware pottery with folded rim coils in association with Gila Polychrome ceramics (Patrick Lyons, personal communication 2003). Some Protohistoric Whetstone Plain sherds recovered from sites located in the same general area display the narrower folded bead rim (Di Peso 1953; Masse 1980), and three vessels with wider, folded rim coils were observed by the author during an inspection of 28 rim sherds recovered from the Alder Wash Ruin. Later still, folded rim coils are common on Sobaipuri Plain vessels recovered from the Presidio de Santa Cruz de Terrenate (circa 1775-1780).

The presence of folded rim coils in late Classic period plain ware, Protohistoric period Whetstone Plain ware, and Historic era pottery suggests this may also be an aspect of technological style that continued from late prehistory into the Historic era. However, other archaeologists think that folded rims were introduced into southern Arizona twice: once during the Classic period (by immigrants from the north) and again during the Historic era via the Spanish and/or Yumans (Patrick Lyons, personal communication 2003). Regardless of how or when this morphological characteristic originally came to be adopted, it is clear that after 1880, it is relatively rare throughout the region (Haury 1975:351; McGuire 1979:24).

SUMMARY

Analysis of the Native American pottery recovered from six archaeological sites revealed that Tucson's eighteenth and nineteenth century Spanish, Mexican, and American residents made extensive use of storage, cooking, and serving vessels produced by O'odham potters. A change over time in production locale—from predominantly volcanic sand temper resource areas to predominantly granitic ones—was documented, which likely reflects the establishment of the San Xavier District of the Tohono O'odham Reservation in 1874 (see also Thiel and Faught 1995:202, 212). The arrival of the railroad in 1880 is also reflected in the data. The average number of Native American vessels recovered per archaeological deposit declines rapidly after that time, as Euro-American pottery replaced locally made O'odham vessels. Further, vessel form and slip location data suggest that most O'odham pots sold after 1880 were water storage jars. From 1883 through the 1940s, the need for water storage jars declined markedly as the municipal water supply became available throughout the study area.

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CHAPTER 8

HUMAN FIGURINES

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Figurines in the forms of people, animals, and other objects are recovered from archaeological sites throughout the world. They were constructed from a wide range of materials, including clay, stone, wood, and other perishable items such as split twigs. Stylistically simple and with little decoration, researchers often link these figures with fertility or cult rituals that may have been based in the household, or on a larger community-wide scale (Marcus 1998; Voigt 1983, 1991). Other possible functions included use as charms in healing rituals, use in rituals honoring family ancestors, and as toys. In the Greater Southwest, figurines such as these are recovered from various contexts that encompass an extensive time range.

Some of the earliest known ceramic figurines in human form were discovered at the Las Capas site, AZ AA:12:111 (ASM), in the Tucson Basin (Stinson 2005). All the figurines from this site are strikingly similar and came from deposits and features dated from 1200 B.C. to 800 B.C. These figurines consist of three separate pieces of clay joined together to form a large, rounded base with a narrow torso, and a head extending upward. Facial features include small, circular punctures for the eyes and, in some cases, a mouth. Hair, specifically braided hair, is the only other noticeable ornamentation. Nearly all figurine fragments from Las Capas had appliquéd clay strips formed into braids present on either side of the head. In cases where these braids are missing, there is evidence that the braids were once attached and broke off at some point during the thousands of years since their manufacture and use.

The Rio Nuevo sites yielded a total of 49 fired-clay objects, including 44 artifacts that could be identified as portions of fired clay human figurines (Tables 8.1-8.3). These artifacts were recovered from both an early site, Clearwater, AZ BB:13:6 (ASM), and a site occupied later in time, the Tucson Presidio site, AZ BB:13:13 (ASM). The majority, however, were found at the Clearwater site. Many of these fragments consist of leg segments or the end of an appendage. No complete figurines or heads were recovered. The fragments were primarily unburned, although obviously broken. They were overwhelmingly found in pit structures, with a few recovered from pits or other features.

Ceramic figures continued to be manufactured in the Tucson area for thousands of years after this. Slight changes in form occurred over this long period, although the basic shape and decoration remained the same. After the San Pedro phase (1200-800 B.C.), figurines were more common during the Cienega phase (800 B.C.-A.D. 50), with examples coming from the Santa Cruz Bend, AZ AA:12:746 (ASM); Coffee Camp, AZ AA:6:9 (ASM); and Wetlands, AZ AA:12:90 (ASM), sites. At Coffee Camp, the torso of a seated male figure was found with coffee bean eyes and an appliquéd necklace and hair (Ferg 1998). The origin and function of these early figurines is difficult to determine. However, the artifacts (phyllite wand, bone tube, shell, a piece of malachite, unworked pebbles, and two deer antler racks) found associated with the Coffee Camp figurine indicate a possible ritual function.

In the general Hohokam region, most studies of ritual concentrate on ballcourts and other forms of communal architecture such as platform mounds (Wilcox 1991). Figurines have been analyzed, but primarily from a descriptive basis only (Haury 1976; Morss 1954). To determine the function of figurines in the Tucson Basin, a number of characteristics can be compiled and analyzed. These attributes include intentional breakage, intentional burning, context in which they were discarded, use-wear, and sex characteristics. The figurines can then be placed into a functional category based on these attributes.

Prior to A.D. 900, the figurines appear to have been frequently utilized as representatives of deceased relatives in ancestor worship. Ancestor ritual is common in Africa, Asia, and North and South America, and it can be practiced on several different levels. However, certain attributes of ancestor worship seem universal throughout the world (Fortes 1976). Death does not end a person's participation in the lives of his or her family community. Instead, this participation simply takes a different form than if they were still living, and the contributions this person made while living are still recognized and valued. It is important for the ancestors to be reincorporated into the community in a different spiritual capacity after death, and this is frequently made real in specific material ways with the use of altars, shrines, memorial tablets, and figurines.

Table 8.1. Context of Rio Nuevo fired clay objects, by site.

Context	Clearwater, AZ BB:13:6 (ASM)	Canal Feature 144, AZ BB:13:481 (ASM)	Tucson Presidio, AZ BB:13:13 (ASM)
Stratum 504, pit structure	1	–	–
Stratum 504, nonfeature	2	–	–
Stratum 503, nonfeature	1	–	–
Cienega phase pit structure	23	–	–
Hohokam pit structure or pit	4	–	1
Hohokam canal	–	1	–
Territorial/Modern adobe structure	1	–	–
Territorial large pit	–	–	4
Spanish, large pit	–	–	1
Naturally deposited overburden	1	–	–
Sheet trash	1	–	8
Total	34	1	14

Table 8.2. Figurine and other fired-clay object types from the Rio Nuevo project, by site.

Object Type	Clearwater, AZ BB:13:6 (ASM)	Canal Feature 144, AZ BB:13:481 (ASM)	Tucson Presidio, AZ BB:13:13 (ASM)
Fired clay fragment	2	–	2
Individual human figurine fragment	3	–	–
Torso	1	–	1
Cylindrical segment	14	–	6
Pointed extremity	4	–	1
Rounded extremity	4	1	1
Blunted extremity	1	–	1
Spatulate extremity	–	–	1
Torso and extremities	–	–	1
Plain bead	3	–	–
Squeeze	2	–	–
Total	34	1	14

Table 8.3. Figurine characteristics from the Rio Nuevo project.

ASM Site	Unburned Figurines	Partially Burned Figurines	Heavily Burned Figurines	Broken Figurines	Decoration
Clearwater, AZ BB:13:6	20	7	2	29	1
Canal Feature 144, AZ B:13:481	1	–	–	1	–
Tucson Presidio, AZ BB:13:13	6	3	5	14	2
Total	27	10	7	44	3

Ancestors can also be used to mark a familial tie to certain places or rights (McAnany 1995). In this sense, ancestors are venerated by name so that their descendants can inherit certain places and resource rights, and ancestors were often buried within residential compounds to strengthen these ties. The interesting point is that the practice of ancestor worship is not about the actual dead; instead, in some instances, it is about how the living relatives used the dead.

A second possible usage of these figurines is in ceremonies intended to cure, heal, insure future health and fertility, and to ward off evil power. Magic is defined as a realm of power in which people can directly affect nature or other individuals, as exemplified by the practices of curing and witchcraft. Malicious behaviors are believed in many societies to cause illness, and witchcraft is thought to be a manifestation of this power (Crawford 1967; Simmons 1974). Therefore, figurines can be used to produce, prevent, or counteract a negative situation. These figures, along with other kinds of medicine or personal charms worn on the body, are safeguards, and they may even represent good spirits that are able to remove evil or perpetuate good. They may be used as part of a healing ritual strongly associated with fertility and pregnancy (Barbour 1975). They may also be used for everything from curing specific diseases to preventing illness and misfortune in all segments of the population (Bruce 1973; Follensbee 2000).

After A.D. 900 in the Hohokam area, the use of figurines appears to change; at that time, figures were most commonly buried with cremated individuals. They were also constructed from different clays, and they were formed in new ways that incorporated perishable material such as wood for the body. Further study will help explain these changes and allow a more clear definition of the functional uses of these figurines.

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CHAPTER 9

GROUND STONE ARTIFACTS

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The City of Tucson's downtown revitalization project, known as the Rio Nuevo Archaeology project, provided a unique opportunity to recapture long-lost knowledge about life in the shadow of A-Mountain and within the historic Tucson Presidio, now located under downtown Tucson. Some of the locations near A-Mountain were occupied by unnamed groups as early as 2100 B.C., and as late as the 1820s, by Pima Indians. Between these temporal extremes is evidence from several other periods of occupation (Table 9.1). These are collectively designated as site AZ BB:13:6 (ASM), with four loci: Congress Street, Brickyard, Mission, and Mission Gardens, located west of the Santa Cruz River and south of modern-day Congress Street. The Tucson Presidio was a historic Spanish and Mexican period occupation, dating from 1775 to the 1850s, with deeply buried evidence of prehistoric occupations. This location is referred to as AZ BB:13:13 (ASM). Desert Archaeology, Inc., conducted a series of archaeological recovery projects at Clearwater and the Tucson Presidio in preparation for the Rio Nuevo project. The purpose of this chapter is to describe the analyzed ground stone assemblage from these locations in a manner that facilitates reconstruction of lifestyles during the represented time periods.

Rio Nuevo is a particularly appropriate project for Desert Archaeology, due to numerous other projects conducted by the company throughout the Santa Cruz River basin. For the current analysis of ground stone artifacts, the data most applicable are from Santa Cruz Bend, AZ AA:12:746 (ASM); Stone Pipe, AZ BB:13:425 (ASM); Square Hearth, AZ AA:12:745 (ASM) (Adams 1998a); Las Capas, AZ AA:12:111 (ASM); Los Pozos, AZ AA:12:91 (ASM) (Adams 2005); Wetlands, AZ AA:12:90 (ASM) (Adams 1998b); Valencia Vieja, AZ BB:13:15 (ASM) (Adams 2003); Julian Wash, AZ BB:13:17 (ASM) (Adams 2006); and Sunset Mesa, AZ AA:12:10 (ASM) (Adams 2000). The ground stone assemblages from these sites have all been analyzed with the same approach as that used for the Rio Nuevo project and provide a temporally deep context against which the Rio Nuevo research can be compared, assessed, and broadened (Tables 9.2 and 9.3).

ANALYSIS APPROACH

The artifact analysis approach is technological, using classification techniques and artifact types defined elsewhere (Adams 1996, 2002). Attributes that relate to artifact design, primary and secondary uses, wear amounts, and use-wear were quantified. Based on these attributes, inferences were made about the activities in which the artifacts were used. Interpretations of how artifacts were used are modeled from ethnographic, ethnoarchaeological, archaeological, and experimental sources (Adams 2002:9-16).

The stone items considered in this chapter include traditional tools such as manos, metates, and axes, as well as the raw materials selected for tool manufacture, pigments, and minerals collected for pigment production or ornament manufacture—that is, anything that has been shaped through impaction or grinding, and anything that has been used to impact or grind, essentially any stone item not considered flaked (Adams 2002:1). A total of 1,206 items thought to fit this definition were recovered in the field and were inventoried in the Desert Archaeology laboratory in Tucson (Table 9.4). Artifacts and supporting documentation are curated at the Arizona State Museum (ASM).

Time and budget constraints precluded the ability to analyze every recovered item; therefore, certain contexts were prioritized for analysis. Enough ground stone artifacts were selected from historic-era extramural pits to evaluate whether they were filled with period-appropriate artifacts. Floor artifacts, artifacts recovered from floor pits, and those within 5 cm of the floor (floor fill) were analyzed from selected prehistoric pithouses. Ground stone items found in the floor fill were usually interpreted as associated with the occupation of the structure. Artifacts on extramural occupation surfaces and from selected prehistoric extramural pits were also analyzed. These contexts provide an opportunity to assess artifacts from activities that occurred both within and outside of structures. A total of 260 (22 percent) items were chosen to examine the nature of the activities that occurred at Clearwater and the Tucson Presidio (Table 9.5; see also Tables 9.1 and 9.4).

Table 9.1. Temporal and spatial designations of features with analyzed ground stone from the Clearwater site, AZ BB:13:6 (ASM), and the Tucson Presidio, AZ BB:13:13 (ASM).

Age/Stratum	AZ (ASM) Site Number	Locus	Feature	Feature Type	Number of Artifacts
Spanish/Mexican	BB:13:13	Presidio	373	Exterior pit	4
			409	Exterior pit	1
			422	Exterior pit	1
Spanish/O'odham	BB:13:6	Mission	64	Sheet trash	10
			166	Trash	14
			177	Exterior pit	2
			178	Exterior pit	1
			193	Exterior pit	1
			203	Exterior pit	2
Hohokam	BB:13:6	Mission Gardens	3005	Pithouse	7
			3019	Burial	1
			3025	Burial	1
			3058	Exterior pit	41
	BB:13:6	Congress Street	308	Pithouse	6
	BB:13:13	Presidio	417	Pithouse	1
Early Ceramic	BB:13:6	Mission Gardens	3014	Pithouse	11
			3038	Pithouse	11
Cienega	BB:13:6	Brickyard	3220	Pithouse	1
			3245	Interior pit	1
			3262	Pithouse	4
			3264	Pithouse	5
			3270	Pithouse	9
			3273	Pithouse	3
			3294	Pithouse	1
			3296	Pithouse	2
			3300	Interior pit	1
			3312	Pithouse	2
			3323	Pithouse	1
			3327	Pithouse	3
			3357	Burial	2
			9357	Pithouse	5
		Mission	7	Pithouse	5
			15	Pithouse	20
			28	Pithouse	1
			29	Pithouse	2
			32	Pithouse	1
			57	Pithouse	1
			65	Pithouse	4
			69	Exterior pit	1
			97	Pithouse	7
			100	Pithouse	2
			112	Pithouse	7
			121	Pithouse	5

Table 9.1. Continued.

Age/Stratum	AZ (ASM) Site Number	Locus	Feature	Feature Type	Number of Artifacts
			126	Pithouse	5
			128	Pithouse	1
			151	Pithouse	5
			191	Pithouse	1
Early Agricultural	BB:13:6	Congress Street	603	Burial	6
		Mission	190	Burial	1
Stratum 503	BB:13:6	–	0	Extramural pit	1
Stratum 504	BB:13:6	Congress Street	3374	Nonfeature	14
			581	Pithouse	1
			592	Exterior pit	1
			3359	Pithouse	1
			3370	Exterior pit	1
			3371	Pithouse	2
			3414	Extramural surface	2
Undated	BB:13:6	Mission	31	Exterior pit	1
			160	Burial	1
		?	0	Disturbed	4
			3344	Exterior pit	1
Total					260

Carlos Lavayen, under the direction of Elizabeth Miksa, identified the stone material of a smaller sample ($n = 169$, 65 percent of the analyzed sample) (Table 9.6). Stone selection was an important part of the design process, perhaps more so for some tool types than for other artifacts (Adams 2002:19-20). For example, a polisher was selected from among smooth rocks because a rough texture abrades rather than polishes. If a smooth stone was not available, a smooth surface was manufactured. Similarly, if a new mano required coarser material than what was available, manufacturing and maintenance strategies compensated for rock texture. Surfaces were pecked or scored to roughen their otherwise smooth texture. Raw material requirements might have spurred a trip to, or trade for, material from a source located at some distance from the settlement. For example, if rocks of appropriate size for metates were not available in the nearby riverbed, a trip was required to obtain larger rocks.

Material availability was classified for each artifact in terms of the relative proximity to the sites. Geologic maps of the Tucson area (Dickinson 1991; Lipman 1993) and specific field sampling helped the geologists to identify potential source locations, recognizing that streams carry rocks considerable distances from their originating outcrops (Miksa and Tompkins 1998). Local sources include river-worn cobbles and pebbles from the Santa Cruz riverbed and other smaller streams, or outcrops that occur within 1 km of the settlements. Sources in the site vicinity are outcrops and streambeds more than 1 km from the settlement but within a day's walk, or about an 18-km round trip (see Drennan 1984 and Lightfoot 1979 for discussions about transportation costs or resource trade and procurement). Distant sources are located beyond the Tucson Basin that required either trade or a trip of more than one day to procure. Some rocks may have been procured from outcrops or streambeds immediately around the settlement, or from sources that are more than 1 km away. A distinction is not possible, however, given the scale of this analysis. Other rocks may have been procured from sources more than 1 km away, either in or beyond the Tucson Basin. The overlap and ambiguity in categorizing these sources can only be reconciled by intense field research, which is beyond the scope of this analysis.

Table 9.2. Temporal comparisons of ground stone artifact types from various Santa Cruz River basin sites.

	San Pedro[a]		Cienega[b]		Agua Caliente[c]		Tortolita[d]		Snaketown-Cañada del Oro[e]		Rincon[f]		Total	
Artifact	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Abraders	10	4	18	3	–	–	2	1	–	–	3	–	33	2
Axes	–	–	–	–	–	–	3	1	1	9	4	1	8	1
Balls	–	–	–	–	–	–	1	–	–	–	1	–	2	1
Choppers	–	–	–	–	–	–	–	–	–	–	5	1	5	1
Containers	1	1	10	1	–	–	–	–	–	–	2	–	13	1
Debris	–	–	–	–	–	–	–	–	–	–	3	–	3	1
Donut stones/ Rings	–	–	5	1	1	1	5	2	–	–	5	1	16	1
Figurines	–	–	–	–	–	–	–	–	–	–	5	1	5	1
Handstones	81	33	204	28	12	–	65	24	2	18	50	8	414	22
Lapstones	21	9	144	20	7	15	19	7	–	–	34	6	225	12
Manos	43	18	140	20	9	19	77	29	4	36	76	12	349	18
Metates	4	2	6	1	2	4	17	6	–	–	14	2	43	2
Mortars	–	–	15	2	2	4	5	2	–	–	7	1	29	2
Netherstones	37	15	69	10	8	17	16	6	1	9	25	4	156	8
Ornaments	–	–	–	–	–	–	26	10	–	–	38	6	64	3
Palettes	–	–	–	–	–	–	1	–	–	–	6	1	7	1
Pecking stones	3	1	12	2	1	2	–	–	–	–	10	2	26	1
Pestles	2	1	41	6	3	6	13	5	1	9	22	4	82	4
Pigment	–	–	–	–	–	–	–	–	–	–	54	9	54	3
Pipes	7	3	1	–	–	–	–	–	–	–	–	–	8	1
Planes	–	–	–	–	–	–	–	–	–	–	1	–	1	1
Polishers	15	6	24	3	2	4	11	4	1	9	89	15	142	7
Pottery anvils	–	–	–	–	–	–	–	–	–	–	3	–	3	1
Reamers	–	–	–	–	–	–	–	–	–	–	1	–	1	1
Shaped	12	5	26	4	–	–	9	3	–	–	12	2	59	3
Spindle bases	–	–	–	–	–	–	–	–	–	–	1	–	1	1
Tablets	–	–	–	–	–	–	–	–	–	–	3	–	3	1
Tabular tools	–	–	2	–	–	–	–	–	1	9	23	4	26	1
Temper	–	–	–	–	–	–	–	–	–	–	116	19	116	6
Trays	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Whorls	6	2	–	–	–	–	–	–	–	–	–	–	6	1
Subtotal	242	100	717	101	47	72	270	100	11	99	613	99	1,900	110

Note: Unidentified fragments, and indeterminate and not applicable variables not included. Date not available: pigment at Sunset Mesa, Valencia Vieja, ornaments, temper at Sunset Mesa.

[a] Las Capas, AZ AA:12:111 (ASM).

[b] Las Capas, AZ AA:12:111 (ASM); Wetlands, AZ AA:12:90 (ASM); Stone Pipe, AZ BB:13:425 (ASM); Clearwater, AZ BB:13:6 (ASM) pre-Rio Nuevo; Santa Cruz Bend, AZ AA:12:746 (ASM); Los Pozos, AZ AA:12:91 (ASM).

[c] Square Hearth, AZ AA:12:745 (ASM); Stone Pipe, AZ BB:13:425 (ASM).

[d] Valencia Vieja, AZ BB:13:15 (ASM).

[e] Julian Wash, AZ BB:13:17 (ASM).

[f] Julian Wash, AZ BB:13:17 (ASM); Sunset Mesa, AZ AA:12:10 (ASM).

Table 9.3. Temporal comparisons of ground stone variables from various Santa Cruz River basin sites.

	San Pedro[a]		Cienega[b]		Agua Caliente[c]		Tortolita[d]		Snaketown-Cañada del Oro[e]		Rincon[f]		Total	
Variable	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Design														
Expedient	60	52	381	68	24	65	115	58	6	46	230	55	816	61
Strategic	56	48	182	32	13	35	84	42	7	54	190	45	532	39
Subtotal	116	100	563	100	37	100	199	100	13	100	420	100	1,348	100
Wear														
Light	27	27	114	20	3	13	53	28	2	15	75	15	274	43
Moderate	61	60	380	66	20	87	117	63	7	54	207	42	792	70
Heavy	5	5	78	14	0	0	16	9	1	8	69	14	169	59
Unused	8	8	1	0	0	0	0	0	3	23	139	28	151	11
Subtotal	101	100	573	100	23	100	186	100	13	100	490	99	1,386	183
Use														
Single	49	22	377	60	29	71	135	63	11	73	274	47	875	51
Reused	9	4	30	5	0	0	8	4	0	0	2	0	49	3
Multiple	25	11	102	16	8	20	26	12	1	7	54	9	216	13
Redesigned	5	2	17	3	0	0	13	6	0	0	20	3	55	3
Recycled	125	56	94	15	4	10	27	13	0	0	104	18	354	21
Unused	6	3	7	1	0	0	7	3	3	20	129	22	152	9
Destroyed	5	2	1	1	0	0	0	0	0	0	2	0	8	0
Subtotal	224	100	628	101	41	101	216	101	15	100	585	99	1,709	100
Activities														
Food processing	47	20	148	21	11	23	44	34	4	31	76	15	330	20
General processing	84	35	314	45	33	70	24	19	2	15	67	13	524	32
Manufacture	28	12	106	15	3	6	12	9	4	31	88	17	241	15
Pottery manufacture	0	0	0	0	0	0	5	4	0	0	163	32	168	10
Pigment processing	67	28	98	14	0	0	33	26	2	15	63	13	263	16
Paraphernalia	14	6	27	4	0	0	10	8	1	8	46	9	98	6
Subtotal	240	101	693	99	47	99	128	100	13	100	503	99	1,624	99

Note: Unidentified fragments, and indeterminate and not applicable variables not included.

[a] Las Capas, AZ AA:12:111 (ASM).

[b] Las Capas, AZ AA:12:111 (ASM); Wetlands, AZ AA:12:90 (ASM); Stone Pipe, AZ BB:13:425 (ASM); Clearwater, AZ BB:13:6 (ASM) pre-Rio Nuevo; Santa Cruz Bend, AZ AA:12:746 (ASM); Los Pozos, AZ AA:12:91 (ASM).

[c] Square Hearth, AZ AA:12:745 (ASM); Stone Pipe, AZ BB:13:425 (ASM).

[d] Valencia Vieja, AZ BB:13:15 (ASM).

[e] Julian Wash, AZ BB:13:17 (ASM).

[f] Julian Wash, AZ BB:13:17 (ASM); Sunset Mesa, AZ AA:12:10 (ASM).

Table 9.4. Accounting of inventoried and analyzed ground stone artifacts from the Clearwater site, AZ BB:13:6 (ASM), and the Tucson Presidio, AZ BB:13:13 (ASM).

Site	Feature	Inventoried	Analyzed	Percent of Analyzed
AZ BB:13:6 (ASM)				
	0	153	18	12
	1	5	0	0
	2	2	0	0
	4	16	0	0
	7	12	4	33
	10	1	0	0
	15	56	20	36
	20	10	0	0
	28	1	1	100
	29	6	2	33
	31	4	1	25
	32	3	1	33
	32.01	2	0	0
	57	1	1	100
	63	4	0	0
	64	36	10	28
	65	11	3	27
	65.01	2	1	50
	69	7	1	14
	71	1	0	0
	76	4	0	0
	78	3	0	0
	80	5	0	0
	97	11	7	64
	100	4	2	50
	112	11	7	64
	121	13	5	38
	121.03	4	0	0
	122	1	0	0
	126	4	4	100
	126.04	1	1	100
	128	4	1	25
	151	17	9	53
	160	1	1	100
	166	68	14	21
	177	2	2	100
	178	1	1	100
	190	1	1	100
	191.01	1	1	100
	193	1	1	100
AZ BB:13:6 (ASM), continued				
	203	4	2	50
	308	6	3	50
	308.02	2	2	100
	308.04	1	1	100
	506	1	0	0
	510	5	0	0
	516	3	0	0
	542	4	0	0
	544	2	0	0
	545	1	0	0
	547	1	0	0
	581	2	1	50
	592	1	1	100
	598	1	0	0
	599	4	0	0
	603	6	6	100
	3000	4	0	0
	3001	4	0	0
	3005	21	7	33
	3006	9	0	0
	3012	1	0	0
	3014	21	11	52
	3019	1	1	100
	3021	1	0	0
	3025	1	1	100
	3026	4	0	0
	3038	44	11	25
	3050	1	0	0
	3058	61	41	67
	3067	20	0	0
	3083	3	0	0
	3104	1	0	0
	3105	1	0	0
	3214	3	0	0
	3220	16	1	6
	3220.01	5	0	0
	3221	1	0	0
	3225	2	0	0
	3237	5	0	0
	3238	1	0	0

Table 9.4. Continued.

Site	Feature	Inventoried	Analyzed	Percent of Analyzed
AZ BB:13:6 (ASM), continued				
	3245.06	1	1	100
	3260	1	0	0
	3262	11	4	36
	3264	8	4	50
	3264.04	1	1	100
	3270	15	5	33
	3270.02	9	4	44
	3272	5	0	0
	3273	6	3	50
	3273.02	1	1	100
	3274	1	0	0
	3294	5	1	20
	3295	1	0	0
	3296	8	2	25
	3300.02	2	1	50
	3312	2	2	100
	3317	1	0	0
	3323	3	1	33
	3323.01	1	0	0
	3325.01	1	0	0
	3327	13	3	23
	3336	1	0	0
	3344	2	1	50
	3357	2	2	100
	3358	1	0	0
	3359	1	1	100
	3362	1	0	0
	3363	1	0	0
	3370	1	1	100
	3371	2	2	100
	3374	1	1	100
	3413	5	0	0
	3414	2	2	100
	9218	1	0	0
AZ BB:13:6 (ASM), continued				
	9357	58	5	9
	9372	2	0	0
	9376	3	0	0
Subtotal		945	257	27
AZ BB:13:13 (ASM)				
	0	152	0	0
	305	1	0	0
	314	1	0	0
	317	1	0	0
	321	1	0	0
	327	2	0	0
	350.06	3	0	0
	358	1	0	0
	359	7	0	0
	360	7	0	0
	372	1	0	0
	373	4	4	100
	376	17	0	0
	380	6	0	0
	385	3	0	0
	407	1	0	0
	408	7	0	0
	409	20	1	5
	416	2	0	0
	417	8	1	13
	422	1	1	100
	437	4	0	0
	441	7	0	0
	450	1	0	0
	452	2	0	0
	454	1	0	0
Subtotal		261	7	3
Total		1,206	260	22

NATURE OF THE ASSEMBLAGE

The 260 sampled artifacts were sorted into 25 artifact types, a category of unidentified pieces, a single fire-cracked rock, and naturally formed items such as concretions and minerals that may have been brought to the settlements for personal reasons (Table 9.7). More than half of the analyzed artifacts are whole (Table 9.8). Sixty-eight percent of the broken artifacts became that way through recycling into roasting or heating activities. These ended up in exterior pits or in structure fill as secondary trash.

A considerable percentage of the analyzed artifacts (66 percent) have moderate-to-heavy wear. The rest are either unused (8 percent) or have light wear (27 percent). Among those that could be identified by the activity in which they were used, most were either used only in the activities for which they were designed or not used at all (see Table 9.8). The rest were secondarily used. Those not recycled into the roasting or heating activities just mentioned were used in multiple activities. For example, some food grinding manos were also used for processing pigments, as an abrader, or included as mortuary offerings. Metates were secondarily used as mortuary offerings. Three lapstones were also a scraper, a chopper, and a tabular tool. Food and general processing activities, pottery manufacturing, other manufacturing, and pigment processing are represented by ground stone artifacts (see Table 9.8).

The contexts from which the assemblages were recovered are quite distinct during different time periods (see Table 9.8). For example, most artifacts (62 percent) from the unnamed phase of the Early Agricultural period (2100 B.C.-1200 B.C.) were not associated with features. Ground stone artifacts were more commonly recovered from on or near pithouse floors that date to the Cienega phase, or to the Early Ceramic period. Most Hohokam artifacts were recovered from extramural pits, as were those from the Spanish and Mexican periods (see Table 9.8). These differences in recovery context may explain most of the variation between time periods. The technological aspects of the ground stone assemblage for each time period are discussed in the following sections. See Table 9.5 for a listing of all analyzed variables for each artifact.

Early Agricultural Period

The Early Agricultural period at the Clearwater site (Congress Street locus) is represented by contexts from several superimposed strata (see Table 9.1). Stratum 503 and Stratum 504 date to the unnamed phase of the Early Agricultural period. Only one ground stone artifact was analyzed from Stratum 503, and 21 were analyzed from Stratum 504. Later Early Agricultural period contexts were uncovered in stratigraphically higher deposits dated to the Cienega phase. The Cienega phase ground stone artifacts are discussed in a separate section.

The items recovered from Stratum 504, the earliest component within the Congress Street locus at Clearwater were manos, a handstone, a hammerstone, a polisher, a cone, and several pieces of raw and processed pigment—perhaps the earliest evidence of processed pigment to date in the Tucson Basin (circa 2100 B.C.) (see Table 9.7). Most of the pigments were recovered from contexts not associated with features, as were the hammerstone, a flat/concave mano, and a piece of rhyolite that had been fashioned into a cone. The pigments are earthy hematite in shades of red and earthy limonite in shades of yellow (Figure 9.1; Table 9.9). The handstone was recovered from an extramural pit. Three pithouses (Features 581, 3359, and 3371) had ground stone artifacts on or near their floors. A polisher that was also used as a pecking stone was found near the floor of Feature 581. This tool may have been used in two different activities, or in a two-step manufacturing task that involved both pecking and burnishing the surface. Flat/concave manos were on or near the floors of Features 3359 and 3371.

Two manos were on the floor of Feature 3371; both had been used against flat/concave metates, although one was also worked in a basin metate. Similarly, two manos associated with an extramural surface, Feature 3414, adjacent to Feature 3371, were flat/concave manos with one also used in a basin metate. All except the basin mano on the floor of Feature 3371 were made from dacite. The exception was manufactured from quartzite. No metates were recovered with which these manos could have been used, but it is not uncommon to find manos with no associated metates. Metates were probably removed by either the departing inhabitants or by subsequent scavengers.

The only piece of ground stone from Stratum 503 (circa 1500 B.C.) is a lapstone recovered from an extramural pit, Feature 3374, at Clearwater (see Table 9.5). The lapstone is an ovoid piece of schistic rock that was chipped to shape. A reddish-brown (see Table 9.9) pigment was ground into powder on one surface—perhaps the earliest evidence of pigment processing recovered, to date, in the Tucson Basin.

Two burials dating to the Early Agricultural period provide unique information about early mortuary rituals. In Feature 190, a large mortar was buried across the feet of a young adult (gender unknown). The mortar has a conical basin typical of those used historically with large pestles to crush mesquite pods. It is broken, and some of the pieces are missing. Although the burial pit was uncovered by the backhoe and the mortar may have broken upon discovery, none of the missing pieces were found in the disturbed back dirt, and the mortar is assumed to have been broken when placed with the body.

The second individual, a woman, was buried with a compatible basin mano and metate, a broken basin metate, and a mortar. The compatible mano and metate were manufactured from the same granitic type of stone, and their configuration must have resonated when in use. The metate is large enough (62 cm by 32 cm by 12 cm) and heavy enough that it may have taken two people to place it upside down over her body.

Table 9.5. Variables recorded for each analyzed artifact from the Clearwater site, AZ BB:13:6 (ASM), and the Tucson Presidio, AZ BB:13:13 (ASM).

AZ (ASM) Site No.	Age/ Stratum	Feature	Feature Type	Context	FN	Artifact	Subtype	Condition	Burned	Design	Use	Sequence	Wear	Designed Activity	Actual Activity	Length (cm)	Width (cm)	Thickness (cm)	Weight (gm)	Second Type	Rock Type	Availability	Residue	Color
BB:13:13	Spanish	373	Exterior pit	Fill	2363.01	Mano	Flat/ Concave	Broken	Fire-cracked	Strategic	Recycled	Sequential	Moderate	Food processing	Multiple	–	–	6.1	–	FCR[a]	–	–	–	–
BB:13:13	Spanish	373	Exterior pit	Fill	2364.01	Debris	Flake	Broken	No	Strategic	Unused	–	Unknown	Ornamentation	Stone manufacture	–	–	–	0.3	–	Muscovite	Unknown	–	–
BB:13:13	Spanish	373	Exterior pit	Fill	2364.02	Debris	Flake	Broken	No	Strategic	Unknown	–	Unknown	Ornamentation	Stone manufacture	–	–	–	0.3	–	Muscovite	Unknown	–	–
BB:13:13	Spanish	373	Exterior pit	Fill	2449.01	Mineral	Natural	Broken	No	–	Unused	–	–	Specimens	Unused	–	–	–	0.1	–	Muscovite	Unknown	–	–
BB:13:13	Spanish	409	Exterior pit	Fill	4371.01	Palette	Flat border	Broken	No	Strategic	Unknown	Unknown	Unknown	Paraphernalia	Unknown	–	–	0.5	–	–	–	–	–	–
BB:13:13	Spanish	422	Exterior pit	Fill	4048.01	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Spanish/ O'odham	64	Sheet trash	Sheet trash	5911.01	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Spanish/ O'odham	64	Sheet trash	Sheet trash	5911.02	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Spanish/ O'odham	64	Sheet trash	Sheet trash	5911.03	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Spanish/ O'odham	64	Sheet trash	Sheet trash	6245.01	Abrader	Pebble	Whole	No	Expedient	Single	Unknown	Light	Abrading	Manufacture	4.3	4.0	2.8	63.0	–	–	–	–	–
BB:13:6	Spanish/ O'odham	64	Sheet trash	Sheet trash	6251.01	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Spanish/ O'odham	64	Sheet trash	Sheet trash	6251.02	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Spanish/ O'odham	64	Sheet trash	Sheet trash	6251.03	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Spanish/ O'odham	64	Sheet trash	Sheet trash	6251.04	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Spanish/ O'odham	64	Sheet trash	Sheet trash	6251.05	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Spanish/ O'odham	64	Sheet trash	Sheet trash	6639.01	Abrader	Pebble	Whole	No	Expedient	Single	–	Light	Abrading	Manufacture	2.7	2.6	1.3	13.0	–	–	–	–	–
BB:13:6	Spanish/ O'odham	166	Trash	Fill	6642.01	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Spanish/ O'odham	166	Trash	Fill	6643.01	Handstone	Flat/ Concave	Whole	Yes	Expedient	Single	–	Light	General processing	General processing	11.0	9.1	3.9	543.0	–	–	–	–	–
BB:13:6	Spanish/ O'odham	166	Trash	Fill	6657.01	Mano	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Food processing	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Spanish/ O'odham	166	Trash	Fill	6694.01	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Spanish/ O'odham	166	Trash	Fill	6694.02	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Spanish/ O'odham	166	Trash	Fill	6694.03	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Spanish/ O'odham	166	Trash	Fill	6694.04	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Spanish/ O'odham	166	Trash	Fill	6709.01	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Spanish/ O'odham	166	Trash	Fill	6709.02	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Spanish/ O'odham	166	Trash	Fill	6709.03	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Spanish/ O'odham	166	Trash	Fill	6709.04	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Spanish/ O'odham	166	Trash	Fill	6709.05	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–

Table 9.5. Continued.

AZ (ASM) Site No.	Age/ Stratum	Feature	Feature Type	Context	FN	Artifact	Subtype	Condition	Burned	Design	Use	Sequence	Wear	Designed Activity	Actual Activity	Length (cm)	Width (cm)	Thickness (cm)	Weight (gm)	Second Type	Rock Type	Availability	Residue	Color
BB:13:6	Spanish/ O'odham	166	Trash	Fill	6709.06	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Spanish/ O'odham	166	Trash	Fill	6709.07	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Spanish/ O'odham	177	Exterior pit	Fill	6556.01	Abrader	Flat	Whole	No	Expedient	Single	–	Moderate	Abrading	Manufacture	10.5	6.5	3.2	335.0	–	–	–	–	–
BB:13:6	Spanish/ O'odham	177	Exterior pit	Fill	6558.01	Polisher	Pottery	Whole	No	Expedient	Single	–	Moderate	Polishing/ Smoothing	Pottery manufacture	5.4	2.7	2.2	46.0	–	–	–	–	–
BB:13:6	Spanish/ O'odham	178	Exterior pit	Fill	6503.01	Chopper	Expedient	Whole	Fire-cracked	Expedient	Recycled	Sequential	Unknown	Percussion	Multiple	12.1	7.3	4.4	–	FCR	–	–	–	–
BB:13:6	Spanish/ O'odham	193	Exterior pit	Fill	6630.01	Mano	Trough	Broken	Fire-cracked	Strategic	Recycled	Sequential	Moderate	Food processing	Multiple	–	11.2	6.2	–	FCR	–	–	–	–
BB:13:6	Spanish/ O'odham	203	Exterior pit	Fill	6607.01	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Spanish/ O'odham	203	Exterior pit	Fill	6607.02	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Prehistoric	31	Exterior pit	Fill	5792.01	Pestle	Cylindrical	Whole	No	Strategic	Single	–	Light	Food processing	Food processing	45.4	9.4	8.8	–	–	Basalt, vesicular	Local/ Vicinity	–	–
BB:13:6	Prehistoric	160	Burial	Fill	6741.01	Mano	Flat/ Concave	Whole	No	Strategic	Recycled	Sequential	Moderate	Food processing	Multiple	7.3	11.0	4.5	–	Offering	–	–	–	–
BB:13:13	Hohokam	417	Pithouse	Fill	3996.01	Palette	Flat border	Broken	Yes	Strategic	Unknown	Unknown	Unknown	Paraphernalia	Unknown	–	–	0.6	–	–	–	–	–	–
BB:13:6	Hohokam	308	Pithouse	Fill	6891.01	Debris	Flake	Whole	No	–	Unused	–	–	Ornamentation	Manufacture	–	–	–	0.3	–	Chrysocolla	Local/ Vicinity	–	–
BB:13:6	Hohokam	308	Pithouse	Floor	7082.01	Lapstone	Flat	Broken	Yes	Strategic	Redesigned	Unknown	Heavy	Polishing/ Smoothing	Multiple	–	–	0.7	–	Tabular tool	Shale	Vicinity/ Distant	–	–
BB:13:6	Hohokam	308	Pithouse	Floor fill	7001.01	Tablet	–	Whole	No	Strategic	Single	–	Unknown	Paraphernalia	Unknown	8.3	7.5	1.4	–	–	Schist	Local/ Vicinity	–	–
BB:13:6	Hohokam	308.02	Interior pit	Fill	7067.01	Polisher	Pottery	Whole	No	Expedient	Single	–	Heavy	Polishing/ Smoothing	Pottery manufacture	8.3	4.0	2.2	108.0	–	Diabase	Vicinity/ Distant	–	–
BB:13:6	Hohokam	308.02	Interior pit	Fill	7084.01	Polisher	Pottery	Whole	No	Expedient	Single	–	Heavy	Polishing/ Smoothing	Pottery manufacture	7.1	2.6	1.5	42.0	–	Volcanic, felsic	Unknown	–	–
BB:13:6	Hohokam	308.04	Posthole/ Post	Fill	7070.01	Mano	Flat/ Concave	Broken	No	Strategic	Multiple	Sequential	Moderate	Food processing	Multiple	–	–	3.3	–	Abrader	Quartzite	Local/ Vicinity	–	–
BB:13:6	Hohokam	3005	Pithouse	Fill	8047.01	Pecking stone	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Percussion	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Hohokam	3005	Pithouse	Fill	8057.01	Handstone	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	General processing	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Hohokam	3005	Pithouse	Fill	8057.02	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Hohokam	3005	Pithouse	Fill	8258.01	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Hohokam	3005	Pithouse	Fill	8258.02	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Hohokam	3005	Pithouse	Fill	8258.03	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Hohokam	3005	Pithouse	Fill	8258.04	Unidentified	Unknown	Broken	No	Unknown	Redesigned	Sequential	Unknown	Unknown	Multiple	–	–	–	–	Flake	–	–	–	–
BB:13:6	Hohokam	3019	Burial	Fill	7879.01	Mano	Basin	Broken	No	Expedient	Recycled	Sequential	Heavy	Food processing	Multiple	10.4	8.1	3.8	–	Pecking stone	–	–	–	–
BB:13:6	Hohokam	3025	Burial	Fill	7758.01	Mano	Flat/ Concave	Broken	No	Expedient	Recycled	Sequential	Heavy	Food processing	Multiple	–	8.4	4.8	–	–	–	–	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	7792.01	Tabular tool	Blank	Whole	No	–	Unused	–	–	Cutting/ Scraping	Unused	13.8	17.2	2.4	1,102.0	–	Andesite	Local/ Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	7793.01	Tabular tool	Blank	Broken	No	–	Unused	–	–	Cutting/ Scraping	Unused	16.7	12.3	2.4	726.0	–	Andesite	Local/ Vicinity	–	–

Table 9.5. Continued.

AZ (ASM) Site No.	Age/ Stratum	Feature	Feature Type	Context	FN	Artifact	Subtype	Condi-tion	Burned	Design	Use	Sequence	Wear	Designed Activity	Actual Activity	Length (cm)	Width (cm)	Thickness (cm)	Weight (gm)	Second Type	Rock Type	Availa-bility	Residue	Color
BB:13:6	Hohokam	3058	Exterior pit	Fill	7794.01	Tabular tool	Blank	Whole	No	Unknown	Unused	–	–	Cutting/ Scraping	Unused	26.2	12.3	2.2	916.0	–	Andesite	Local/ Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	7795.01	Tabular tool	Blank	Whole	No	–	Unused	–	–	Cutting/ Scraping	Unused	15.5	10.5	2.3	597.0	–	Andesite	Local/ Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	7796.01	Tabular tool	Blank	Whole	No	–	Unused	–	–	Cutting/ Scraping	Unused	11.4	11.6	2.3	368.0	–	Andesite	Local/ Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	7797.01	Tabular tool	Blank	Whole	No	Unknown	Unused	–	–	Polishing/ Smoothing	Unused	11.8	8.3	1.1	146.0	–	Andesite	Local/ Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	7797.02	Tabular tool	Blank	Whole	No	Unknown	Unused	–	–	Cutting/ Scraping	Unused	12.2	8.9	1.5	179.0	–	Andesite	Local/ Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	7797.03	Tabular tool	Debris	Broken	No	–	Unused	–	–	Cutting/ Scraping	Stone manufacture	8.2	7.1	1.7	–	–	Andesite	Local/ Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	7797.04	Tabular tool	Debris	Broken	No	Unknown	Unused	–	–	Cutting/ Scraping	Stone manufacture	11.5	6.5	2.1	–	–	Andesite	Local/ Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	7797.05	Tabular tool	Blank	Broken	No	Unknown	Unused	–	–	Cutting/ Scraping	Stone manufacture	6.0	8.5	1.7	–	–	Andesite	Local/ Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	7798.01	Tabular tool	Blank	Whole	No	Unknown	Unused	–	Unused	Cutting/ Scraping	Incomplete	16.4	12.0	2.1	441.0	–	Andesite	Local/ Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	9335.01	Mano	Flat/ Concave	Whole	No	Strategic	Single	–	Moderate	Food processing	Food processing	11.2	8.8	3.5	593.0	–	Rhyolite	Local/ Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	9340.01	Tabular tool	Blank	Whole	No	–	Unused	–	–	Unknown	Unknown	19.6	15.8	2.9	1,181.0	–	Andesite	Local/ Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	9341.01	Tabular tool	Blank	Whole	No	–	Unused	–	–	Cutting/ Scraping	Unused	14.2	11.7	2.1	416.0	–	Andesite	Local/ Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	9342.01	Tabular tool	Blank	Whole	No	–	Unused	–	–	Cutting/ Scraping	Unused	18.6	19.0	4.4	2,190.0	–	Andesite	Local/ Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	9343.01	Tabular tool	Blank	Whole	No	–	Unused	–	–	Cutting/ Scraping	Unused	–	–	–	723.0	–	Andesite	Local/ Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	9344.01	Tabular tool	Blank	Whole	No	–	Unused	–	–	Cutting/ Scraping	Unused	14.3	9.9	2.1	467.0	–	Andesite	Local/ Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	9345.01	Tabular tool	Blank	Whole	No	–	Unused	–	–	Cutting/ Scraping	Unused	21.9	13.4	3.1	861.0	–	Andesite	Local/ Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	9346.01	Tabular tool	Blank	Whole	No	–	Unused	–	–	Cutting/ Scraping	Unused	16.9	13.6	1.3	508.0	–	Andesite	Local/ Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	9347.01	Tabular tool	Blank	Whole	No	–	Unused	–	–	Cutting/ Scraping	Unused	18.0	1,407.0	208.0	977.0	–	Andesite	Local/ Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	9348.01	Tabular tool	1 concave edge	Whole	No	Expedient	Single	–	Light	Cutting/ Scraping	General processing	18.9	12.1	3.7	874.0	–	Andesite	Local/ Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	9349.01	Tabular tool	1 convex edge	Whole	No	Expedient	Single	–	Light	Cutting/ Scraping	General processing	16.8	13.4	2.3	627.0	–	Andesite	Local/ Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	9350.01	Pestle	Blank	Whole	No	–	Unused	–	–	Cutting/ Scraping	Unused	13.5	9.9	2.3	343.0	–	–	–	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	9351.01	Tabular tool	Blank	Whole	No	–	Unused	–	–	Cutting/ Scraping	Unused	11.9	12.0	2.7	482.0	–	Andesite	Local/ Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	9352.01	Tabular tool	Blank	Whole	No	–	Unused	–	–	Cutting/ Scraping	Unused	13.0	937.0	2.2	349.0	–	Andesite	Local/ Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	9353.01	Tabular tool	Blank	Whole	No	–	Unused	–	–	Cutting/ Scraping	Unused	14.4	9.7	2.4	596.0	–	Andesite	Local/ Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	9354.01	Tabular tool	Blank	Whole	No	–	Unused	–	–	Cutting/ Scraping	Unused	16.1	12.6	1.8	583.0	–	Andesite	Local/ Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	9355.01	Tabular tool	Blank	Whole	No	–	Unused	–	–	Cutting/ Scraping	Unused	18.4	13.6	2.5	847.0	–	Andesite	Local/ Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	9356.01	Tabular tool	Blank	Whole	No	–	Unused	–	–	Cutting/ Scraping	Unused	17.9	13.0	3.3	818.0	–	Andesite	Local/ Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	9357.01	Tabular tool	Blank	Whole	No	–	Unused	–	–	Cutting/ Scraping	Unused	17.6	10.5	1.8	372.0	–	Andesite	Local/ Vicinity	–	–

Table 9.5. Continued.

AZ (ASM) Site No.	Age/ Stratum	Feature	Feature Type	Context	FN	Artifact	Subtype	Condition	Burned	Design	Use	Sequence	Wear	Designed Activity	Actual Activity	Length (cm)	Width (cm)	Thickness (cm)	Weight (gm)	Second Type	Rock Type	Availability	Residue	Color
BB:13:6	Hohokam	3058	Exterior pit	Fill	9358.01	Tabular tool	Blank	Whole	No	–	Unused	–	–	Cutting/Scraping	Unused	20.5	10.5	2.6	960.0	–	Andesite	Local/Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	9359.01	Tabular tool	Blank	Whole	No	–	Unused	–	–	Cutting/Scraping	Unused	21.3	11.5	2.6	630.0	–	Andesite	Local/Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	9360.01	Tabular tool	Blank	Whole	No	–	Unused	–	–	Cutting/Scraping	Unused	15.0	10.2	2.4	393.0	–	Andesite	Local/Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	9361.01	Tabular tool	Blank	Whole	No	–	Unused	–	–	Cutting/Scraping	Unused	17.7	9.6	1.9	490.0	–	Andesite	Local/Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	9362.01	Tabular tool	Blank	Whole	No	–	Unused	–	–	Cutting/Scraping	Unused	17.6	8.5	1.8	410.0	–	Andesite	Local/Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	9363.01	Tabular tool	Straight	Whole	No	Expedient	Single	–	Light	Cutting/Scraping	General processing	13.4	11.6	2.7	492.0	–	Andesite	Local/Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	9364.01	Tabular tool	Blank	Whole	No	–	Unused	–	–	Cutting/Scraping	Unused	18.6	9.7	1.9	445.0	–	Andesite	Local/Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	9365.01	Chopper	Hand axe	Whole	No	Expedient	Single	–	Light	Percussion	General processing	29.3	11.8	2.7	1,208.0	–	–	–	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	9366.01	Tabular tool	Blank	Whole	No	–	Unused	–	–	Cutting/Scraping	Unused	26.2	14.8	2.3	921.0	–	Andesite	Local/Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	9367.01	Tabular tool	Blank	Whole	No	–	Unused	–	–	Cutting/Scraping	Unused	20.6	14.1	3.3	1,193.0	–	Andesite	Local/Vicinity	–	–
BB:13:6	Hohokam	3058	Exterior pit	Fill	9368.01	Tabular tool	Convex	Whole	No	Expedient	Single	–	Light	Cutting/Scraping	General processing	18.4	13.4	2.9	930.0	–	Andesite	Local/Vicinity	–	–
BB:13:6	Early Ceramic	3014	Pithouse	Fill	7836.01	Netherstone	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Early Ceramic	3014	Pithouse	Floor	8245.01	Mano	Flat/Concave	Whole	No	Strategic	Reused	Concomitant	Moderate	Food processing	Pigment processing	10.4	7.6	6.1	654.0	Handstone	–	–	Pigment	10R 4/8
BB:13:6	Early Ceramic	3014	Pithouse	Floor fill	8171.01	Netherstone	Flat	Broken	No	Unknown	Unknown	Unknown	Moderate	Unknown	Unknown	–	–	–	–	–	–	–	–	–
BB:13:6	Early Ceramic	3014	Pithouse	Floor fill	8173.01	Mineral	Natural	Whole	No	–	Unused	–	–	Specimens	Unused	–	–	–	0.2	–	Chalcedony	Unknown	–	–
BB:13:6	Early Ceramic	3014	Pithouse	Floor fill	8174.01	Pigment	Processed	Broken	No	Strategic	Single	–	–	Ornamentation	Decorative	–	–	–	2.5	–	Hematite, earthy	Local/Vicinity	Pigment	2.5YR 6/8
BB:13:6	Early Ceramic	3014	Pithouse	Floor fill	8178.01	Lapstone	Flat	Whole	Fire-cracked	Expedient	Single	–	Light	Polishing/Smoothing	Manufacture	9.4	5.0	1.7	121.0	–	–	–	–	–
BB:13:6	Early Ceramic	3014	Pithouse	Floor fill	8179.01	Ornament	Geometric	Whole	No	Strategic	Single	–	Moderate	Ornamentation	Decorative	1.0	0.7	0.3	0.4	–	–	–	–	–
BB:13:6	Early Ceramic	3014	Pithouse	Floor fill	8181.01	Debris	Flake	Broken	No	Strategic	Unused	–	–	Ornamentation	Stone manufacture	–	–	–	0.2	–	Muscovite	Unknown	–	–
BB:13:6	Early Ceramic	3014	Pithouse	Floor fill	8186.01	Netherstone	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Early Ceramic	3014	Pithouse	Floor fill	8186.02	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Early Ceramic	3014	Pithouse	Roof/Wall fall	7847.01	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Early Ceramic	3038	Pithouse	Floor	8225.01	Mano	Flat/Concave	Whole	No	Strategic	Unused	–	Unused	Food processing	Unused	9.5	8.1	3.3	384.0	–	–	–	–	–
BB:13:6	Early Ceramic	3038	Pithouse	Floor fill	8130.01	Pigment	Processed	Broken	No	Strategic	Single	–	–	Ornamentation	Decorative	–	–	–	2.5	–	Limonite, earthy	Local/Vicinity	Pigment	2.5YR 5/8
BB:13:6	Early Ceramic	3038	Pithouse	Floor fill	8191.01	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Early Ceramic	3038	Pithouse	Floor fill	8191.02	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Early Ceramic	3038	Pithouse	Floor fill	8191.03	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Early Ceramic	3038	Pithouse	Floor fill	8191.04	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–

Table 9.5. Continued.

AZ (ASM) Site No.	Age/ Stratum	Feature	Feature Type	Context	FN	Artifact	Subtype	Condition	Burned	Design	Use	Sequence	Wear	Designed Activity	Actual Activity	Length (cm)	Width (cm)	Thickness (cm)	Weight (gm)	Second Type	Rock Type	Availability	Residue	Color
BB:13:6	Early Ceramic	3038	Pithouse	Floor fill	8195.01	Pigment	Processed	Whole	Unknown	Strategic	Single	–	Unknown	Ornamentation	Decorative	–	–	–	0.3	–	Hematite, earthy	Local/ Vicinity	Pigment	10R 3/4
BB:13:6	Early Ceramic	3038	Pithouse	Roof/ Wall fall	8140.01	Netherstone	Flat	Broken	Yes	Expedient	Unknown	Unknown	Moderate	General processing	Pigment processing	–	–	1.9	–	–	–	–	Pigment	10R 5/6
BB:13:6	Early Ceramic	3038	Pithouse	Roof/ Wall fall	8142.01	FCR	–	Broken	Fire-cracked	Expedient	Single	–	Light	Food processing	Food processing	–	–	–	–	–	–	–	–	–
BB:13:6	Early Ceramic	3038	Pithouse	Roof/ Wall fall	8143.01	Polisher	Pebble	Whole	No	Expedient	Single	–	Moderate	Polishing/ Smoothing	Manufacture	5.4	3.5	2.6	67.0	–	–	–	–	–
BB:13:6	Early Ceramic	3038	Pithouse	Roof/ Wall fall	8144.01	Mano	Trough	Broken	Yes	Unknown	Unknown	Unknown	Unknown	Food processing	Unknown	–	–	4.4	–	–	–	–	–	–
BB:13:6	Cienega	7	Pithouse	Floor	5960.01	Mano	Flat/ Concave	Whole	No	Strategic	Reused	Concomitant	Moderate	Food processing	Multiple	10.2	9.4	4.2	586.0	Handstone	Granite	Vicinity/ Distant	Pigment	10R 4/8
BB:13:6	Cienega	7	Pithouse	Floor fill	5946.01	Polisher	Pottery	Whole	No	Expedient	Single	–	Moderate	Polishing	Pottery manufacture	4.9	3.1	1.4	32.0	–	Basalt, vesicular	Local/ Vicinity	–	–
BB:13:6	Cienega	7	Pithouse	Floor fill	5955.01	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	Dacite	Local/ Vicinity	–	–
BB:13:6	Cienega	7	Pithouse	Floor fill	5956.01	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	Andesite	Local/ Vicinity	–	–
BB:13:6	Cienega	15	Pithouse	Floor	6147.01	Handstone	Flat/ Concave	Whole	No	Expedient	Single	–	Light	General processing	General processing	9.2	6.7	5.4	459.0	–	Quartzite	Local/ Vicinity	–	–
BB:13:6	Cienega	15	Pithouse	Floor	6149.01	Donut stone	Blank	Whole	No	Strategic	Unused	–	Unused	Paraphernalia	Unused	9.0	9.2	4.3	638.0	–	Basaltic andesite, vesicular	Local/ Vicinity	–	–
BB:13:6	Cienega	15	Pithouse	Floor	6153.01	Handstone	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	Dacite	Local/ Vicinity	–	–
BB:13:6	Cienega	15	Pithouse	Floor	6153.02	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	Granite	Local/ Vicinity	–	–
BB:13:6	Cienega	15	Pithouse	Floor fill	5851.01	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	Latite	Local/ Vicinity	–	–
BB:13:6	Cienega	15	Pithouse	Floor fill	5851.02	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	Basalt/ Andesite, vesicular	Local/ Vicinity	–	–
BB:13:6	Cienega	15	Pithouse	Floor fill	5851.03	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	Andesite	Local/ Vicinity	–	–
BB:13:6	Cienega	15	Pithouse	Floor fill	5851.04	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	Basalt/ Andesite, vesicular	Local/ Vicinity	–	–
BB:13:6	Cienega	15	Pithouse	Floor fill	5851.05	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	Basalt/ Andesite, vesicular	Local/ Vicinity	–	–
BB:13:6	Cienega	15	Pithouse	Floor fill	6008.01	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	Dacite	Local/ Vicinity	–	–
BB:13:6	Cienega	15	Pithouse	Floor fill	6008.02	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	Rhyolite	Local/ Vicinity	–	–
BB:13:6	Cienega	15	Pithouse	Floor fill	6073.01	Polisher	Blank	Whole	No	Expedient	Unused	–	Unused	Polishing	Unused	2.6	2.3	1.1	9.0	–	Rhyolite	Local/ Vicinity	–	–
BB:13:6	Cienega	15	Pithouse	Roof/ Wall fall	5766.01	Pigment	Processed	Whole	No	Strategic	Single	–	–	Ornamentation	Decorative	–	–	–	2.3	–	Hematite, earthy	Local/ Vicinity	Pigment	10R 5/6
BB:13:6	Cienega	15	Pithouse	Roof/ Wall fall	5766.02	Pigment	Processed	Whole	No	Strategic	Single	–	–	Ornamentation	Decorative	–	–	–	0.7	–	Hematite, earthy	Local/ Vicinity	Pigment	10R 5/6
BB:13:6	Cienega	15	Pithouse	Roof/ Wall fall	5766.03	Pigment	Processed	Whole	Yes	Strategic	Single	–	–	Ornamentation	Decorative	–	–	–	0.8	–	Iron oxide	–	Pigment	10R 3/6
BB:13:6	Cienega	15	Pithouse	Roof/ Wall fall	5766.04	Pigment	Processed	Whole	Yes	Strategic	Single	–	–	Ornamentation	Decorative	–	–	–	0.4	–	Iron oxide	Local/ Vicinity	Pigment	10R 4/6
BB:13:6	Cienega	15	Pithouse	Floor fill	5852.01	Polisher	Pebble-surface	Whole	No	Expedient	Single	–	Light	Polishing/ Smoothing	Manufacture	2.9	2.7	2.0	22.0	–	Quartzite	Unknown	–	–

Table 9.5. Continued.

AZ (ASM) Site No.	Age/ Stratum	Feature	Feature Type	Context	FN	Artifact	Subtype	Condition	Burned	Design	Use	Sequence	Wear	Designed Activity	Actual Activity	Length (cm)	Width (cm)	Thickness (cm)	Weight (gm)	Second Type	Rock Type	Availability	Residue	Color
BB:13:6	Cienega	15	Pithouse	Roof/ Wall fall	5984.01	Pigment	Natural	Whole	No	–	Unused	–	–	Ornamentation	Unused	–	–	–	1.5	–	Hematite, earthy	Local/ Vicinity	Pigment	10R 3/2
BB:13:6	Cienega	15	Pithouse	Roof/ Wall fall	5984.02	Pigment	Processed	Whole	Yes	Strategic	Single	–	–	Ornamentation	Decorative	–	–	–	0.8	–	Hematite, earthy	Local/ Vicinity	Pigment	10R 3/6
BB:13:6	Cienega	15	Pithouse	Roof/ Wall fall	5987.01	Polisher	Pebble	Whole	No	Expedient	Single	–	Moderate	Polishing	Manufacture	2.7	2.3	0.8	8.0	–	Volcanic, felsic	Unknown	–	–
BB:13:6	Cienega	28	Pithouse	Floor fill	6687.01	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	Quartzite	Local/ Vicinity	–	–
BB:13:6	Cienega	29	Pithouse	Floor	5700.01	Lapstone	Flat	Whole	No	Expedient	Single	–	Moderate	General processing	Pigment processing	13.4	10.2	2.2	531.0	–	Andesite	Local/ Vicinity	Pigment	10R 4/6
BB:13:6	Cienega	29	Pithouse	Floor	5701.01	Lapstone	Flat	Broken	No	Expedient	Redesigned	Concomitant	Moderate	General processing	Multiple	–	12.3	1.9	–	Chopper	Andesite	Local/ Vicinity	–	–
BB:13:6	Cienega	32	Pithouse	Floor	5833.01	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	Rhyolite	Local/ Vicinity	–	–
BB:13:6	Cienega	57	Pithouse	Fill	6042.01	Ornament	Pendant	Broken	No	Strategic	Unused	–	Unused	Ornamentation	Unused	–	1.1	0.3	–	–	Turquoise	Vicinity/ Distant	–	–
BB:13:6	Cienega	65	Pithouse	Floor	6236.01	Lapstone	Unknown	Broken	Fire-cracked	Expedient	Multiple	Both	Light	Polishing/ Smoothing	Multiple	–	–	2.2	–	Scraper	Volcanic, felsic	Local/ Vicinity	–	–
BB:13:6	Cienega	65	Pithouse	Floor fill	6112.01	Pigment	Processed	Whole	No	Strategic	Single	–	–	Ornamentation	Decorative	–	–	–	0.3	–	Hematite, earthy	Local/ Vicinity	Pigment	10R 4/6
BB:13:6	Cienega	65	Pithouse	Floor fill	6231.01	Pigment	Processed	Whole	No	Strategic	Single	–	Unknown	Ornamentation	Decorative	–	–	–	1.4	Mano	Iron oxide	Local/ Vicinity	Pigment	10R 5/4
BB:13:6	Cienega	65.01	Interior pit	Fill	6265.01	Handstone	Flat	Whole	No	Expedient	Single	–	Light	General processing	General processing	4.0	303.0	2.4	42.0	–	Granodiorite	Unknown	–	–
BB:13:6	Cienega	69	Exterior pit	Fill	6195.01	Mano	Flat/ Concave	Whole	No	Strategic	Single	–	Moderate	Food processing	Food processing	17.0	17.3	5.8	–	–	Basalt, vesicular	Local/ Vicinity	–	–
BB:13:6	Cienega	97	Pithouse	Fill	6057.01	Donut stone	Flat	Broken	No	Strategic	Unknown	–	Unknown	Paraphernalia	Unknown	–	–	3.4	–	–	Basaltic andesite, vesicular	Local/ Vicinity	–	–
BB:13:6	Cienega	97	Pithouse	Fill	6543.01	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	Quartzite	Local/ Vicinity	–	–
BB:13:6	Cienega	97	Pithouse	Floor fill	6284.01	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	Basaltic andesite, vesicular	Local/ Vicinity	–	–
BB:13:6	Cienega	97	Pithouse	Floor fill	6285.01	Lapstone	Flat	Whole	No	Expedient	Single	–	Moderate	Polishing/ Smoothing	Stone manufacture	11.1	7.9	1.6	240.0	–	Andesite	Local/ Vicinity	–	–
BB:13:6	Cienega	97	Pithouse	Floor fill	6286.01	Polisher	Pebble	Whole	No	Expedient	Single	–	Moderate	Polishing/ Smoothing	Manufacture	2.7	2.4	1.2	8.0	–	Sandstone	Unknown	–	–
BB:13:6	Cienega	97	Pithouse	Floor fill	6339.01	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	Rhyolite	Local/ Vicinity	–	–
BB:13:6	Cienega	97	Pithouse	Floor fill	6345.01	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	Basalt, vesicular	Local/ Vicinity	–	–
BB:13:6	Cienega	100	Pithouse	Floor fill	6134.01	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	Rhyolite	Local/ Vicinity	–	–
BB:13:6	Cienega	100	Pithouse	Floor fill	6134.02	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	Netherstone	Granodiorite	Local/ Vicinity	–	–
BB:13:6	Cienega	112	Pithouse	Floor	6067.01	Pigment	Processed	Broken	No	Strategic	Single	–	–	Ornamentation	Decorative	–	–	–	0.7	–	Hematite, earthy	Local/ Vicinity	Pigment	2.5YR 4/8
BB:13:6	Cienega	112	Pithouse	Floor	6207.01	Handstone	Flat/ Concave	Whole	Yes	Expedient	Single	–	Light	General processing	General processing	12.0	11.5	7.4	1,462.0	–	Granite	Local/ Vicinity	Carbon	–
BB:13:6	Cienega	112	Pithouse	Floor	6208.01	Handstone	Flat/ Concave	Whole	Yes	Expedient	Single	–	Moderate	General processing	General processing	10.4	7.6	4.3	381.0	–	Basalt, vesicular	Local/ Vicinity	–	–
BB:13:6	Cienega	112	Pithouse	Floor	6209.01	Netherstone	Unknown	Broken	Fire-cracked	Unknown	Unknown	Unknown	Unknown	Unknown	Multiple	–	–	–	–	–	Basalt/ Andesite, vesicular	Local/ Vicinity	–	–

Table 9.5. Continued.

AZ (ASM) Site No.	Age/ Stratum	Feature	Feature Type	Context	FN	Artifact	Subtype	Condition	Burned	Design	Use	Sequence	Wear	Designed Activity	Actual Activity	Length (cm)	Width (cm)	Thickness (cm)	Weight (gm)	Second Type	Rock Type	Availability	Residue	Color
BB:13:6	Cienega	112	Pithouse	Floor	6213.01	Lapstone	Flat	Whole	Yes	Expedient	Single	–	Light	Polishing/ Smoothing	Manufacture	13.8	11.0	3.9	–	–	Basalt, vesicular	Local/ Vicinity	–	–
BB:13:6	Cienega	112	Pithouse	Floor fill	6122.01	Pigment	Processed	Broken	No	Strategic	Single	–	Unknown	Ornamentation	Decorative	–	–	–	1.1	–	Hematite, earthy	Local/ Vicinity	Pigment	10R 5/8
BB:13:6	Cienega	112	Pithouse	Floor fill	6123.01	Mineral	Natural	Whole	No	–	Unused	–	–	Specimens	Unused	–	–	–	0.4	–	Chalcedony	Unknown	–	–
BB:13:6	Cienega	121	Pithouse	Floor	6452.01	Handstone	Unknown	Broken	Fire-cracked	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	–	–	–	–	–	Dacite	Local/ Vicinity	–	–
BB:13:6	Cienega	121	Pithouse	Floor	6775.01	Chopper	Hand axe	Whole	No	Strategic	Single	–	Moderate	Percussion	Procurement	17.7	10.6	4.6	1,626.0	–	Andesite	Local/ Vicinity	–	–
BB:13:6	Cienega	121	Pithouse	Floor fill	6401.01	Shaped	–	Whole	Yes	Strategic	Single	–	–	Paraphernalia	Unknown	12.3	7.2	3.2	–	–	Basalt, vesicular	Local/ Vicinity	–	–
BB:13:6	Cienega	121	Pithouse	Floor fill	6405.01	Polisher	Disk	Broken	No	Expedient	Single	–	Heavy	Polishing/ Smoothing	Manufacture	–	4.8	1.0	–	–	Andesite	Local/ Vicinity	–	–
BB:13:6	Cienega	121	Pithouse	Floor fill	6405.02	Polisher	Unknown	Broken	No	Unknown	Unknown	Unknown	Unknown	Polishing/ Smoothing	Unknown	–	4.8	–	–	–	Diabase	Vicinity/ Distant	–	–
BB:13:6	Cienega	126	Pithouse	Floor	6438.01	Pestle	Shaped	Whole	No	Strategic	Single	–	Moderate	Food processing	Food processing	19.1	9.4	8.7	2,371.0	–	Rhyolite	Local/ Vicinity	–	–
BB:13:6	Cienega	126	Pithouse	Floor	6439.01	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Cienega	126	Pithouse	Floor	6454.01	Mortar	Knobbed	Whole	Yes	Strategic	Single	–	Moderate	General processing	General processing	18.7	15.4	5.3	–	–	Volcanic, intermediate	Local/ Vicinity	–	–
BB:13:6	Cienega	126	Pithouse	Floor	6455.01	Mortar	Knobbed	Whole	No	Strategic	Single	–	Moderate	General processing	General processing	20.2	16.4	4.3	–	–	Basalt, vesicular	Local/ Vicinity	–	–
BB:13:6	Cienega	126.04	Interior pit	Fill	6379.01	Mano	Flat/ Concave	Whole	No	Strategic	Reused	Concomitant	Moderate	Food processing	Multiple	16.0	13.1	7.0	2,380.0	Handstone	Quartzite	Local/ Vicinity	Pigment	10R 6/6
BB:13:6	Cienega	128	Pithouse	Fill	6587.01	Pigment	Natural	Whole	No	–	Unused	–	–	Ornamentation	Unused	1.5	1.3	0.6	–	–	Azurite	Vicinity/ Distant	Pigment	Blue
BB:13:6	Cienega	151	Pithouse	Floor fill	6475.01	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Cienega	151	Pithouse	Floor fill	6475.02	Unidentified	Unknown	Broken	Yes	Unknown	Recycled	Sequential	Unknown	Unknown	Unknown	–	–	–	–	FCR	–	–	–	–
BB:13:6	Cienega	151	Pithouse	Floor fill	6475.03	Unidentified	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	–	–	–	–
BB:13:6	Cienega	151	Pithouse	Floor fill	6475.04	Handstone	Unknown	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	Basalt/ Andesite, vesicular	Local/ Vicinity	–	–
BB:13:6	Cienega	151	Pithouse	Floor fill	6474.01	Mano	Flat/ Concave	Whole	Yes	Strategic	Single	–	Heavy	Food processing	Food processing	10.5	9.2	4.2	636.0	–	Granodiorite	Local/ Vicinity	–	–
BB:13:6	Cienega	191.01	Interior pit	Fill	6577.01	Donut stone	Flat	Broken	No	Strategic	Unknown	Unknown	Unknown	Paraphernalia	Unknown	–	–	5.6	–	–	Basalt, vesicular	Local/ Vicinity	–	–
BB:13:6	Cienega	3220	Pithouse	Floor fill	8383.01	Mineral	Natural	Whole	No	–	Unknown	–	–	Specimens	Unknown	1.2	0.9	0.3	–	–	Muscovite	Local/ Vicinity	–	–
BB:13:6	Cienega	3245.06	Interior pit	Fill	8529.01	Mano	Flat/ Concave	Whole	No	Strategic	Single	–	Heavy	Food process	Food process	12.2	10.7	4.1	815.0	–	Quartzite	Local/ Vicinity	–	–
BB:13:6	Cienega	3262	Pithouse	Floor	8577.01	Spindle base	–	Whole	No	Strategic	Single	–	Light	General processing	Manufacture	4.6	4.4	3.8	103.0	–	–	–	–	–
BB:13:6	Cienega	3262	Pithouse	Floor	8578.01	Whorl	Spherical	Whole	No	Strategic	Single	Unknown	Unknown	General processing	Manufacture	4.0	3.7	3.3	70.0	–	–	–	–	–
BB:13:6	Cienega	3262	Pithouse	Floor	8581.01	Pestle	Cobble	Whole	No	Strategic	Single	–	Moderate	Food processing	Food processing	30.0	11.5	9.5	4,318.0	–	Granite	Local/ Vicinity	–	–
BB:13:6	Cienega	3262	Pithouse	Floor fill	8570.01	Donut stone	Flat	Broken	No	Strategic	Unknown	–	–	Paraphernalia	Unknown	–	–	2.3	–	–	Basalt, vesicular	Local/ Vicinity	–	–
BB:13:6	Cienega	3264	Pithouse	Fill	8560.01	Pigment	Processed	Broken	Unknown	Strategic	Single	–	Unknown	Ornamentation	Decorative	–	–	–	2.5	–	Hematite, earthy	Local/ Vicinity	Pigment	10R 3/6
BB:13:6	Cienega	3264	Pithouse	Floor fill	8680.01	Mano	Flat/ Concave	Whole	No	Strategic	Single	–	Moderate	Food processing	Food processing	12.3	9.7	4.9	815.0	–	Granite	Local/ Vicinity	–	–

Table 9.5. Continued.

AZ (ASM) Site No.	Age/ Stratum	Feature	Feature Type	Context	FN	Artifact	Subtype	Condition	Burned	Design	Use	Sequence	Wear	Designed Activity	Actual Activity	Length (cm)	Width (cm)	Thickness (cm)	Weight (gm)	Second Type	Rock Type	Availability	Residue	Color
BB:13:6	Cienega	3264	Pithouse	Floor	8684.01	Pestle	Cobble	Whole	No	Strategic	Reused	Concomitant	Moderate	General processing	Multiple	7.5	5.8	5.5	354.0	Handstone	–	–	–	–
BB:13:6	Cienega	3264	Pithouse	Floor fill	8679.01	Pigment	–	Whole	No	Unknown	Unknown	–	Unknown	Ornamentation	Unknown	–	–	–	0.2	–	Rhyolite	Local/ Vicinity	Pigment	10R 4/2
BB:13:6	Cienega	3264.04	Posthole	Fill	8694.01	Chopper	Hand axe	Whole	No	Expedient	Single	–	Moderate	Percussion	Procurement	12.2	7.4	2.2	310.0	–	Slate	Unknown	–	–
BB:13:6	Cienega	3270	Pithouse	Floor	8784.01	Concretion	Round	Whole	No	–	Unknown	–	Unknown	Paraphernalia	Unknown	2.6	2.6	2.6	–	–	Granodiorite	Unknown	–	–
BB:13:6	Cienega	3270	Pithouse	Floor	8785.01	Polisher	Disk	Whole	Yes	Expedient	Single	–	Heavy	Polishing/ Smoothing	Wood/Bone manufacture	5.9	5.6	0.9	49.0	–	Diorite	Vicinity/ Distant	–	–
BB:13:6	Cienega	3270	Pithouse	Floor	8789.01	Pestle	Shaped	Whole	No	Strategic	Single	–	Moderate	General processing	General processing	5.2	5.8	6.1	209.0	–	–	–	–	–
BB:13:6	Cienega	3270	Pithouse	Floor	8790.01	Pestle	Cobble	Whole	No	Strategic	Single	–	Light	Food processing	Food processing	34.0	10.8	7.4	3,896.0	–	Basalt/ Andesite, vesicular	Local/ Vicinity	–	–
BB:13:6	Cienega	3270	Pithouse	Floor	8791.01	Netherstone	Flat	Whole	No	Expedient	Single	–	Moderate	General processing	General processing	28.0	17.0	6.0	4,098.0	–	Basalt/ Andesite, vesicular	Local/ Vicinity	–	–
BB:13:6	Cienega	3270.02	Bell pit	Fill	8890.01	Mano	Flat/ Concave	Broken	Yes	Strategic	Unknown	Unknown	Moderate	Food processing	Unknown	–	9.2	3.0	–	–	Quartzite	Local/ Vicinity	–	–
BB:13:6	Cienega	3270.02	Interior pit	Fill	8893.01	Pigment	Natural	Whole	No	–	Unused	–	–	Ornamentation	Unused	–	–	–	0.5	–	Hematite, earthy	Unknown	Pigment	10R 4/8
BB:13:6	Cienega	3270.02	Interior pit	Fill	8901.01	Pigment	Natural	Whole	No	–	Unused	–	–	Ornamentation	Unused	–	–	–	0.3	–	Turquoise	–	Pigment	Green
BB:13:6	Cienega	3270.02	Interior pit	Fill	8902.01	Pigment	Processed	Broken	No	Strategic	Single	–	–	Ornamentation	Decorative	–	–	–	2.0	–	Hematite, earthy	Local/ Vicinity	Pigment	10R 4/6
BB:13:6	Cienega	3273	Pithouse	Floor	8803.01	Netherstone	Flat	Broken	Yes	Expedient	Reused	Concomitant	Moderate	General processing	Pigment processing	33.0	–	3.5	–	Netherstone	Basalt/ Andesite, vesicular	Local/ Vicinity	Pigment	10R 5/8
BB:13:6	Cienega	3273	Pithouse	Floor	8804.01	Metate	Blank	Whole	No	Strategic	Unused	–	Unused	Food processing	Stone manufacture	40.0	39.0	17.0	–	–	Dacite	Vicinity/ Distant	–	–
BB:13:6	Cienega	3273	Pithouse	Floor fill	8815.01	Pigment	Ground	Whole	No	Expedient	Single	–	Moderate	Ornamentation	Decorative	–	–	–	11.3	–	Hematite, rock	Local/ Vicinity	Pigment	10R 3/6
BB:13:6	Cienega	3273.02	Floor groove	Fill	8869.01	Abrader	Grooved	Whole	No	Strategic	Unused	–	Unused	Abrading	Wood/Bone manufacture	6.5	3.8	3.5	132.0	–	Volcanic, intermediate	Local/ Vicinity	–	–
BB:13:6	Cienega	3294	Pithouse	Fill	8772.01	Debris	Flake	Whole	No	–	Unused	–	–	Ornamentation	Unused	–	–	–	0.4	–	Chalcedony	Unknown	–	–
BB:13:6	Cienega	3296	Pithouse	Floor	9023.01	Abrader	Flat	Whole	No	Strategic	Single	–	Moderate	Abrading	Manufacture	11.3	3.8	1.7	143.0	–	Schist	Local/ Vicinity	–	–
BB:13:6	Cienega	3296	Pithouse	Floor	9025.01	Handstone	Flat	Whole	No	Expedient	Single	–	Light	General processing	General processing	6.7	5.6	5.0	255.0	–	Felsic volcanic	Local/ Vicinity	–	–
BB:13:6	Cienega	3300.02	Interior pit	Fill	9036.01	Tray	Unknown	Broken	No	Strategic	Unknown	Unknown	Unknown	Paraphernalia	Unknown	–	–	–	–	–	Basalt, vesicular	Local/ Vicinity	Unknown	–
BB:13:6	Cienega	3312	Pithouse	Floor	8963.01	Ball	Spherical	Broken	No	Strategic	Unknown	Unknown	Unknown	Paraphernalia	Unknown	–	3.0	–	–	–	Tuff	Local/ Vicinity	–	–
BB:13:6	Cienega	3312	Pithouse	Floor	8964.01	Handstone	Unknown	Whole	No	Expedient	Single	–	Light	General processing	General processing	7.7	7.4	3.8	297.0	–	Basalt, vesicular	Local/ Vicinity	–	–
BB:13:6	Cienega	3323	Pithouse	Floor	9251.01	Metate	Flat/ Concave	Whole	No	Expedient	Single	–	Moderate	Food processing	Food processing	55.0	50.0	14.0	–	–	Basalt/ Andesite, vesicular	Local/ Vicinity	–	–
BB:13:6	Cienega	3327	Pithouse	Floor	9140.01	Mano	Flat/ Concave	Whole	Yes	Strategic	Multiple	Concomitant	Moderate	Food processing	Multiple	14.0	13.1	4.7	1,382.0	Lapstone	Granite	Local/ Vicinity	Pigment	10R 6/6
BB:13:6	Cienega	3327	Pithouse	Floor	9143.01	Metate	Basin	Whole	No	Expedient	Single	–	Light	Food processing	Food processing	54.0	27.0	19.0	–	–	Dacite	Vicinity/ Distant	–	–
BB:13:6	Cienega	3327	Pithouse	Floor	9144.01	Netherstone	Flat	Whole	No	Expedient	Single	–	Light	General processing	General processing	34.0	33.0	3.0	–	–	Basalt/ Andesite, vesicular	Local/ Vicinity	–	–

Table 9.5. Continued.

AZ (ASM) Site No.	Age/ Stratum	Feature	Feature Type	Context	FN	Artifact	Subtype	Condition	Burned	Design	Use	Sequence	Wear	Designed Activity	Actual Activity	Length (cm)	Width (cm)	Thickness (cm)	Weight (gm)	Second Type	Rock Type	Availability	Residue	Color
BB:13:6	Cienega	3357	Burial	Fill	9330.01	Unidentified	–	Broken	Fire-cracked	Unknown	Unknown	Unknown	Unknown	Unknown	Multiple	–	–	–	–	–	–	–	–	–
BB:13:6	Cienega	3357	Burial	Fill	9331.01	Concretion	Round	Whole	No	Expedient	Single	–	Unknown	Paraphernalia	Ritual	1.9	1.7	1.3	–	–	–	–	–	–
BB:13:6	Cienega	9357	Pithouse	Fill	8345.01	Mano	Flat/Concave	Broken	Yes	Unknown	Recycled	Sequential	Moderate	Food processing	Multiple	–	–	3.5	–	FCR	Quartzite	Local/Vicinity	Carbon	–
BB:13:6	Cienega	9357	Pithouse	Fill	8454.01	Handstone	Flat	Whole	No	Expedient	Single	–	Moderate	General processing	General processing	8.0	7.2	2.1	196.0	–	Quartzite	Local/Vicinity	–	–
BB:13:6	Cienega	9357	Pithouse	Fill	8479.01	Mano	Flat/Concave	Whole	No	Strategic	Single	–	Moderate	Food processing	Food processing	10.2	10.4	4.0	692.0	–	Granite	Local/Vicinity	–	–
BB:13:6	Cienega	9357	Pithouse	Floor fill	8472.01	Lapstone	Flat	Whole	Yes	Expedient	Multiple	Concomitant	Moderate	General processing	Pigment processing	16.2	11.6	3.7	1,031.0	Lapstone	Volcanic, felsic	Local/Vicinity	Pigment	10R 5/8
BB:13:6	Cienega	9357	Pithouse	Roof/Wall fall	8458.01	Mano	Flat/Concave	Whole	Yes	Strategic	Reused	Concomitant	Moderate	Food processing	Multiple	14.1	7.6	4.4	775.0	Handstone	Latite	Local/Vicinity	Pigment	10R 4/8
BB:13:6	Early Agricultural	190	Burial	Fill	6745.01	Mortar	Rock	Broken	No	Expedient	Recycled	Sequential	Heavy	Food processing	Multiple	25.5	–	24.3	–	Offering	–	–	–	–
BB:13:6	Early Agricultural	603	Burial	Fill	7570.01	Metate	Basin	Whole	Yes	Strategic	Recycled	Sequential	Heavy	Food processing	Multiple	62.0	32.0	12.4	–	Offering	–	–	–	–
BB:13:6	Early Agricultural	603	Burial	Fill	7571.01	Mano	Basin	Whole	No	Strategic	Recycled	Sequential	Heavy	Food processing	Multiple	12.7	12.0	6.5	–	Offering	–	–	–	–
BB:13:6	Early Agricultural	603	Burial	Fill	7572.01	Metate	Basin	Broken	No	Strategic	Recycled	Sequential	Heavy	Food processing	Multiple	–	22.0	5.9	–	Offering	–	–	Carbon	–
BB:13:6	Early Agricultural	603	Burial	Fill	7573.01	Handstone	Other	Whole	No	Strategic	Recycled	Sequential	Heavy	Unknown	Multiple	9.4	5.6	5.1	–	Offering	–	–	–	–
BB:13:6	Early Agricultural	603	Burial	Fill	7586.01	Tray	Plain	Whole	No	Strategic	Recycled	Sequential	Light	General processing	Multiple	14.8	11.0	5.2	–	Offering	–	–	Pigment	Multiple
BB:13:6	Early Agricultural	603	Burial	Fill	7593.01	Unidentified	–	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	Offering	–	–	–	–
BB:13:6	Stratum 503	3374	Exterior pit	Fill	9290.01	Lapstone	Flat	Whole	No	Strategic	Multiple	Concomitant	Heavy	General processing	Multiple	21.2	15.0	2.9	1,311.0	Lapstone	–	–	Pigment	2.5YR 4/4
BB:13:6	Stratum 504	0		Stratum	7180.01	Pigment	Processed	Whole	No	Strategic	Single	–	–	Ornamentation	Decorative	–	–	–	0.9	–	Limonite, earthy	Local/Vicinity	Pigment	10YR 7/8
BB:13:6	Stratum 504	0		Stratum	7210.01	Mineral	Natural	Whole	No	–	Unused	–	–	Specimens	Unused	–	–	–	0.1	–	Copper minerals	Local/Vicinity	–	–
BB:13:6	Stratum 504	0		Stratum	7211.01	Unidentified	–	Broken	Fire-cracked	Unknown	Recycled	Sequential	Unknown	Unknown	Multiple	–	–	–	–	FCR	Andesite	Local/Vicinity	–	–
BB:13:6	Stratum 504	0		Stratum	7218.01	Hammerstone	Natural	Whole	Yes	Expedient	Single	–	Light	Percussion	Stone manufacture	9.6	4.4	2.6	151.0	–	Basalt/Andesite, vesicular	Local/Vicinity	–	–
BB:13:6	Stratum 504	0		Stratum	7225.01	Shaped	–	Whole	No	Strategic	Unknown	Unknown	Unknown	Paraphernalia	Unknown	5.1	4.9	3.3	92.0	–	Rhyolite	Local/Vicinity	–	–
BB:13:6	Stratum 504	0		Stratum	7236.01	Pigment	Natural	Broken	No	–	Unused	–	–	Ornamentation	Unused	–	–	–	–	–	Hematite, earthy	Local/Vicinity	Pigment	Too minute
BB:13:6	Stratum 504	0		Stratum	7327.01	Pigment	Processed	Whole	No	Strategic	Single	–	–	Ornamentation	Decorative	–	–	–	9.3	–	Hematite, earthy	Local/Vicinity	Pigment	10R 6/8
BB:13:6	Stratum 504	0		Stratum	7327.02	Pigment	Processed	Broken	No	Strategic	Single	–	–	Ornamentation	Decorative	–	–	–	11.0	–	Hematite, earthy	Local/Vicinity	Pigment	10R 6/6
BB:13:6	Stratum 504	0		Stratum	7354.01	Pigment	Processed	Broken	No	Strategic	Single	–	–	Ornamentation	Decorative	–	–	–	1.3	–	Limonite, earthy	Local/Vicinity	Pigment	10YR 7/8
BB:13:6	Stratum 504	0		Stratum	7414.01	Pigment	Natural	Whole	No	–	Unused	–	–	Ornamentation	Unused	–	–	–	2.8	–	Hematite, earthy	Local/Vicinity	Pigment	10R 4/8
BB:13:6	Stratum 504	0		Stratum	7455.01	Pigment	Ground	Whole	No	Expedient	Single	–	Heavy	Ornamentation	Decorative	3.3	3.1	2.6	32.0	–	Rhyolite	Local/Vicinity	Pigment	10YR 6/6
BB:13:6	Stratum 504	0		Stratum	7457.01	Mano	Flat/Concave	Whole	No	Expedient	Single	–	Moderate	Food processing	Food processing	9.6	8.5	5.7	648.0	–	–	–	–	–

Table 9.5. Continued.

AZ (ASM) Site No.	Age/ Stratum	Feature	Feature Type	Context	FN	Artifact	Subtype	Condition	Burned	Design	Use	Sequence	Wear	Designed Activity	Actual Activity	Length (cm)	Width (cm)	Thickness (cm)	Weight (gm)	Second Type	Rock Type	Availability	Residue	Color
BB:13:6	Stratum 504	0		Stratum	7492.01	Pigment	Processed	Broken	No	Strategic	Single	–	Unknown	Ornamentation	Decorative	–	–	–	0.6	–	Limonite, earthy	Local/ Vicinity	Pigment	10YR 7/8
BB:13:6	Stratum 504	581	Pithouse	Floor fill	7474.01	Polisher	Multiple	Whole	Yes	Expedient	Multiple	Concomitant	Light	Polishing/ Smoothing	Multiple	5.3	5.3	3.9	131.0	Pecking stone	Volcanic, felsic	Vicinity/ Distant	–	–
BB:13:6	Stratum 504	592	Exterior pit	Fill	7545.01	Handstone	Flat	Whole	Yes	Expedient	Recycled	Sequential	Light	Food processing	Multiple	12.1	9.7	6.6	1,033.0	FCR	Granite	Local/ Vicinity	Carbon	–
BB:13:6	Stratum 504	3359	Pithouse	Floor fill	9206.01	Mano	Flat/ Concave	Whole	No	Strategic	Single	–	Moderate	Food processing	Food processing	13.7	11.5	6.1	1,499.0	–	–	–	–	–
BB:13:6	Stratum 504	3370	Exterior pit	Fill	9275.01	Mano	Basin	Whole	No	Strategic	Reused	Concomitant	Moderate	Food processing	Multiple	11.6	10.2	7.5	1,192.0	Handstone	Volcanic, felsic	Local/ Vicinity	–	–
BB:13:6	Stratum 504	3371	Pithouse	Floor	9298.01	Mano	Basin	Whole	No	Strategic	Reused	Concomitant	Heavy	Food processing	Food processing	8.8	7.9	5.2	534.0	Mano	Quartzite	Unknown	–	–
BB:13:6	Stratum 504	3371	Pithouse	Floor	9301.01	Mano	Flat/ Concave	Whole	No	Strategic	Single	–	Moderate	Food processing	Food processing	12.2	8.5	6.7	984.0	–	Dacite	Local/ Vicinity	–	–
BB:13:6	Stratum 504	3414	Extramural	Surface	9294.01	Mano	Flat/ Concave	Whole	No	Strategic	Redesigned	–	Moderate	Food processing	Food processing	10.2	8.7	7.0	913.0	Mano	Dacite	Local/ Vicinity	–	–
BB:13:6	Stratum 504	3414	Surface	Occupation	9295.01	Mano	Flat/ Concave	Whole	No	Strategic	Single	–	Moderate	Food processing	Food processing	11.0	11.5	5.9	1,215.0	–	Dacite	Local/ Vicinity	–	–
BB:13:6	Undated	0		Unknown	6880.01	Mano	Basin	Whole	No	Expedient	Single	–	Heavy	Food processing	Food processing	10.1	9.8	7.3	1,126.0	–	–	–	–	–
BB:13:6	Undated	0		Sheet trash	8734.01	Tray	Knobbed	Broken	No	Strategic	Unknown	Unknown	Unknown	Paraphernalia	Unknown	–	12.8	5.7	–	–	–	–	–	–
BB:13:6	Undated	0		Sheet trash	8954.01	Axe	3/4-wedge	Whole	No	Strategic	Unused	–	Unused	Percussion	Unused	13.0	6.2	7.4	730.0	–	–	–	–	–
BB:13:6	Undated	0		Unknown	7784.01	Metate	3/4-trough	Whole	No	Strategic	Single	–	Light	Food processing	Food processing	54.3	26.4	14.7	–	–	–	–	–	–
BB:13:6	Undated	0		Unknown	8122.01	Mano	Flat/ Concave	Whole	No	Strategic	Single	–	Moderate	Food processing	Food processing	14.7	12.0	7.4	1,615.0	–	–	–	–	–
BB:13:6	Undated	3344	Exterior pit	Fill	9147.01	Lapstone	Flat	Whole	No	Strategic	Single	–	Moderate	General processing	General processing	14.2	6.7	1.7	373.0	–	–	–	–	–

[a] FCR = Fire-cracked rock.

Table 9.6. Rock type and source availability during specific time periods from the Clearwater site, AZ B:13:6 (ASM), and the Tucson Presidio, AZ BB:13:13 (ASM).

Availability	Age/Stratum	Rock Type	Artifact	Total
Local/Vicinity	Hohokam	Andesite	Tabular tool	38
		Chrysocolla	Debris	1
		Quartzite	Mano	1
		Rhyolite	Mano	1
		Schist	Tablet	1
	Early Ceramic	Hematite, earthy	Pigment	2
		Limonite, earthy	Pigment	1
	Cienega	Andesite	Lapstone (2)	7
		Basalt/Andesite, vesicular	Donut stone (4), handstone (3), lapstone, mano, metate, mortar, netherstone (4), pestle, polisher, shaped, ray, unidentified (5)	24
		Dacite	Handstone (2), unidentified (2)	4
		Granite	Mano (3), pestle, handstone, unidentified	6
		Granodiorite	Mano, unidentified	2
		Hematite, earthy	Pigment	9
		Hematite, rock	Pigment	1
		Iron oxide	Pigment	2
		Latite	Mano	2
		Muscovite	Mineral	1
		Quartzite	Handstone (2), mano (4), unidentified (2)	8
		Rhyolite	Pestle, pigment, polisher, unidentified (4)	7
		Schist	Abrader	1
		Tuff	Ball	1
		Volcanic	Abrader, handstone, lapstone (2), mortar	5
	Stratum 504	Andesite	Unidentified	1
		Basalt/Andesite, vesicular	Hammerstone	1
		Copper miner	Mineral	1
		Dacite	Mano (3), pestle	3
		Granite	Handstone	1
		Hematite, earthy	Pigment	4
		Limonite, earthy	Pigment	3
		Rhyolite	Pigment, shaped	2
		Volcanic	Mano	1
	Undated	Basalt, vesicular	Pestle	1
Vicinity/Distant	Hohokam	Diabase	Polisher	1
		Shale	Lapstone	1
	Cienega	Azurite	Pigment	1
		Dacite	Metate	2
		Diabase	Polisher	1
		Diorite	Polisher	1
		Granite	Mano	1
		Turquoise	Ornament	1
	Stratum 504	Volcanic	Polisher	1

Table 9.6. Continued.

Availability	Age/Stratum	Rock Type	Artifact	Total
Unknown	Spanish/ Mexican	Muscovite	Debris (2), mineral	3
	Hohokam	Volcanic	Polisher	1
	Early Ceramic	Chalcedony	Mineral	1
		Muscovite	Debris	1
	Cienega	Chalcedony	Debris, mineral	2
		Granodiorite	Concretion, handstone	2
		Hematite, earthy	Pigment	1
		Quartzite	Polisher	1
		Sandstone	Polisher	1
		Slate	Chopper	1
		Volcanic	Polisher	1
	Stratum 504	Quartzite	Mano	1
Total				169

The basin metate fragment was probably never used with the mano and was never as big as the whole metate. It was found to the left of the woman's head. Next to her right heel was a vesicular basalt mortar. It is rectangular, with a shallow basin that has use-wear from a stone pestle. Two shades of red pigment (see Table 9.9) cover parts of the mortar's bottom and sides, which were probably used to abrade processed pigment into powder. Pigment stains were found around and on her feet, legs, and torso. Chunks of red hematite were under her right hand and next to her right ear.

These early burials are described in more detail in Chapter 18 (this volume). The condition of the items associated with these two individuals is evidence of specific mortuary behaviors. It is obvious with at least one of these burials that the intentional breaking of mortuary accoutrements may have begun by the Early Agricultural period, if not earlier (Mabry 1998, 2005). There is evidence that this practice continued with later mortuary contexts in the Tucson Basin. For example, palettes recovered from Early Rincon phase cremations at Julian Wash were intentionally broken. The color red has been associated with death and other rituals throughout time in both New World and Old World cultures (see, for example, Wreschner 1980). Pigment-stained items and a pigment processing tool were recovered from Cienega phase burials at Wetlands (Adams 1998b:170; Thiel and Mabry 1998:Table 6.1).

Collectively, the artifacts from Stratum 503, Stratum 504, and those from the two Early Agricultural burials could easily be lost among the San Pedro phase assemblage from Las Capas, a site located 15 km down stream from the Clearwater site (Adams 2005). Evidence for pigment processing was abundant at Las Capas, and the food grinding technology is identical. Even the postoccupational absence of metates is the same. Further similarities are probably obfuscated due to the differences in sample size. The much larger Las Capas assemblage has more complexity representative of a much wider variety of activities. At the current level of analysis, it is not possible to determine if the differences between the Las Capas assemblage and the Clearwater assemblage are related to differences in occupation strategy or to archaeological sampling.

Cienega Phase

Slightly more than 100 ground stone items were analyzed from Cienega phase contexts at Clearwater (see Table 9.7). Those from 14 features were associated with the Brickyard locus, and those from 16 features were associated with the Mission locus (see Table 9.1). Most of the 115 items were found on or near pithouse floors (see Table 9.8). The activities associated with Cienega phase contexts are almost equally represented and include tools for food processing, general processing, and manufacturing, with a few used in pigment processing and for items of ornamentation (see Table 9.8). The largest percentage (40 percent) of items, however, was used in multiple activities.

Food-processing activities were represented by 11 manos, 3 metates, and 3 pestles. All of the manos were used against flat/concave metates. The only flat/concave metate was recovered from the floor of Feature 3323 where there were no flat/concave manos.

Table 9.7. Temporal comparisons of ground stone artifact types from the Clearwater site, AZ BB:13:6 (ASM), and the Tucson Presidio, AZ BB:13:13 (ASM).

	Stratum 504		Stratum 503		Cienega		Early Ceramic		Hohokam		Spanish Period O'odham		Spanish and Mexican Periods, AZ BB:13:13 (ASM)		Undated		Total	
Artifact	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Abraders	–	–	–	–	2	2	–	–	–	–	3	38	–	–	–	–	5	3
Axes	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	13	1	1
Balls	–	–	–	–	1	1	–	–	–	–	–	–	–	–	–	–	1	1
Choppers	–	–	–	–	2	2	–	–	1	2	1	13	–	–	–	–	4	2
Debris	–	–	–	–	1	1	1	7	1	2	–	–	2	50	–	–	5	3
Donut stones	–	–	–	–	4	5	–	–	–	–	–	–	–	–	–	–	4	2
Hammerstones	1	5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
Handstones	1	5	–	–	11	13	–	–	1	2	1	13	–	–	–	–	14	7
Lapstones	–	–	1	100	6	7	1	7	1	2	–	–	–	–	1	13	10	5
Manos	7	37	–	–	12	14	3	21	4	8	2	25	1	25	3	38	32	17
Metates	–	–	–	–	5	6	–	–	–	–	–	–	–	–	1	13	6	3
Mortars	–	–	–	–	3	3	–	–	–	–	–	–	–	–	–	–	3	2
Netherstones	–	–	–	–	4	5	4	29	–	–	–	–	–	–	–	–	8	4
Ornaments	–	–	–	–	1	1	1	7	–	–	–	–	–	–	–	–	2	1
Palettes	–	–	–	–	–	–	–	–	1	2	–	–	1	25	–	–	2	1
Pecking stones	–	–	–	–	–	–	–	–	1	2	–	–	–	–	–	–	1	1
Pestles	–	–	–	–	5	6	–	–	1	2	–	–	–	–	1	13	7	4
Pigment	8	42	–	–	17	20	3	21	–	–	–	–	–	–	–	–	28	15
Polishers	1	5	–	–	8	9	1	7	2	4	1	13	–	–	–	–	13	7
Shaped	1	5	–	–	1	1	–	–	–	–	–	–	–	–	–	–	2	1
Spindle bases	–	–	–	–	1	1	–	–	–	–	–	–	–	–	–	–	1	1
Tablets	–	–	–	–	–	–	–	–	1	2	–	–	–	–	–	–	1	1
Tabular tools	–	–	–	–	–	–	–	–	38	73	–	–	–	–	–	–	38	20
Trays	–	–	–	–	2	2	–	–	–	–	–	–	–	–	1	13	3	2
Whorls	–	–	–	–	1	1	–	–	–	–	–	–	–	–	–	–	1	1
Subtotal	19	99	1	100	87	100	14	99	52	101	8	102	4	100	8	103	193	106
Unidentified[a]	1	5	–	–	24	22	6	29	5	9	22	73	1	20	–	–	59	23
Fire-cracked rocks	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	1	–
Total artifacts	20		1		111		21		57		30		5		8		253	
Ecofact																		
Concretions	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	2	–
Minerals	1	–	–	–	2	–	1	–	–	–	–	–	1	–	–	–	5	–
Subtotal	1	–	–	–	4	–	1	–	–	–	–	–	1	–	–	–	7	–
Grand total	21		1		115		22		57		30		6		8		260	

Note: Unidentified not included in percentage calculations.
[a]Percentage of assemblage including unidentified

A flat/concave mano from the floor of Features 3327, and another from an interior pit in Feature 3245, were most compatible with this metate, although almost any flat/concave mano could have been used (Figure 9.2). The secondary use of the mano from Feature 3327 to grind red pigment (see Table 9.9) was

Table 9.8. Temporal comparisons of ground stone variables from the Clearwater site, AZ BB:13:6 (ASM), and the Tucson Presidio, AZ BB:13:13 (ASM).

	Stratum 504		Stratum 503		Cienega		Early Ceramic		Hohokam		Spanish Period O'odham		Spanish and Mexican Periods, AZ BB:13:13 (ASM)		Undated		Total	
Variable	No.	%[a]	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Context																		
Extramural pit	2	10	1	100	2	2	–	–	41	72	6	20	6	100	2	25	60	23
Extramural surface	2	10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	1
Fill	–	–	–	–	8	7	1	5	9	16	–	–	–	–	–	–	18	7
Roof/Wall fall	–	–	–	–	8	7	5	23	–	–	–	–	–	–	–	–	13	5
Floor fill	2	10	–	–	39	34	14	64	1	2	–	–	–	–	–	–	56	22
Floor	2	10	–	–	39	34	2	9	1	2	–	–	–	–	–	–	44	17
Interior pit	–	–	–	–	8	7	–	–	2	4	–	–	–	–	–	–	10	4
Other interior[a]	–	–	–	–	2	2	–	–	1	2	–	–	–	–	–	–	3	1
Nonfeature	13	62	–	–	–	–	–	–	–	–	–	–	–	–	–	–	13	5
Burial	–	–	–	–	9	8	–	–	2	4	–	–	–	–	1	13	12	5
Trash	–	–	–	–	–	–	–	–	–	–	14	47	–	–	–	–	14	5
Sheet trash	–	–	–	–	–	–	–	–	–	–	10	33	–	–	2	25	12	5
Unknown	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	38	3	1
Subtotal	21	102	1	100	115	101	22	101	57	102	30	100	6	100	8	101	260	101
Condition																		
Broken	5	24	1	100	47	41	15	68	16	28	24	80	6	100	1	13	115	44
Whole	16	76	–	–	68	59	7	32	41	72	6	20	–	–	7	88	145	56
Subtotal	21	100	1	100	115	100	22	100	57	100	30	100	6	100	8	101	260	100
Burned																		
Heat-cracked	1	5	–	–	28	25	10	50	6	11	25	83	2	33	–	–	72	28
No	17	81	1	100	68	60	9	45	49	86	4	13	4	67	8	100	160	62
Yes	3	14	–	–	18	16	1	5	2	4	1	3	–	–	–	–	25	10
Subtotal	21	100	1	100	114	101	20	100	57	101	30	99	6	100	8	100	257	100
Design																		
Expedient	5	29	–	–	29	38	4	36	9	64	6	86	–	–	1	13	54	39
Strategic	12	71	1	100	47	62	7	64	5	36	1	14	4	100	7	88	84	61
Subtotal	17	100	1	100	76	100	11	100	14	100	7	100	4	100	8	101	138	100
Wear																		
Light	3	27	–	–	13	22	2	25	5	38	3	50	–	–	2	29	28	27
Moderate	6	55	–	–	31	53	5	63	2	15	3	50	1	100	3	43	51	49
Heavy	2	18	1	100	9	16	–	–	5	38	–	–	–	–	1	14	18	17
Unused	–	–	–	–	5	9	1	13	1	8	–	–	–	–	1	14	8	8
Subtotal	11	100	1	100	58	100	8	101	13	99	6	100	1	100	7	100	105	101

Table 9.8. Continued.

	Stratum 504		Stratum 503		Cienega		Early Ceramic		Hohokam		Spanish Period O'odham		Spanish Period, AZ BB:13:13 (ASM)		Undated		Total	
Variable	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Use																		
Single	11	55	–	–	50	49	7	37	9	16	5	17	–	–	5	71	87	36
Reused	2	10	–	–	5	5	1	5	–	–	–	–	–	–	–	–	8	3
Multiple	1	5	1	100	3	3	–	–	1	2	–	–	–	–	–	–	6	3
Redesigned	1	5	–	–	1	1	–	–	2	4	–	–	–	–	–	–	4	2
Recycled	2	10	–	–	32	31	8	42	8	14	25	83	2	50	1	14	78	33
Unused	3	15	–	–	11	11	3	16	36	64	–	–	2	50	1	14	56	23
Subtotal	20	100	1	100	102	100	19	100	56	100	30	100	4	100	7	99	239	100
Sequence																		
Concomitant	3	60	1	100	8	20	1	11	–	–	–	–	–	–	–	–	13	14
Sequential	2	40	–	–	32	78	8	89	10	100	25	100	2	100	1	100	80	85
Both	–	–	–	–	1	2	–	–	–	–	–	–	–	–	–	–	1	1
Subtotal	5	100	1	100	41	100	9	100	10	100	25	100	2	100	1	100	94	100
Activities																		
Food processing	6	30	–	–	10	10	1	5	1	2	–	–	–	–	4	50	22	9
General processing	–	–	–	–	14	14	–	–	5	9	1	3	–	–	1	13	21	9
Decorative	6	30	–	–	12	12	4	20	–	–	–	–	–	–	–	–	22	9
Manufacture	1	5	–	–	13	13	3	15	38	66	3	10	2	40	1	13	61	25
Pottery manufacture	–	–	–	–	–	–	–	–	–	–	1	3	–	–	–	–	1	–
Pigment processing	–	–	–	–	3	3	2	10	2	3	–	–	–	–	–	–	7	3
Multiple	4	20	1	100	40	40	8	40	11	19	25	83	2	40	1	13	92	38
Unused	3	15	–	–	9	9	2	10	1	2	–	–	1	20	1	13	17	7
Subtotal	20	100	1	100	101	101	20	100	58	101	30	99	5	100	8	102	243	100

Note: Unidentified fragments, and indeterminate and not applicable variables not included.
[a]Other interior includes postholes and floor groove.

concomitant, so that it was usable in a metate on one surface and used to process pigment on the other. It may have been used interchangeably for food-processing chores in Feature 3323 and for processing pigment in Feature 3327. The only basin metate was recovered from the floor of Feature 3327 where there were no manos other than the flat/concave mano just described. Another metate was found on the floor of pithouse Feature 3273 where there were no compatible manos; however, this one was still in the early stages of manufacture. This metate is evidence that food-processing tools were manufactured at Clearwater.

In addition to the mano from Feature 3327, manos from Features 7 (floor), Feature 126 (interior pit), and Feature 9357 (roof/wall fall) were secondarily used to process red pigment (see Table 9.9). A flat/concave mano recovered from the fill of extramural pit Feature 69 was manufactured to a perfect disk and is unusually large (17 cm in diameter) (Figure 9.3). The use-wear is compatible with having been worked with a rocking stroke in a flat/concave metate. This mano and four others (Features 151, 3245, 3264, and 9357) were only used for food processing. One mano (Feature 3270) is too broken to recognize anything more than its artifact type.

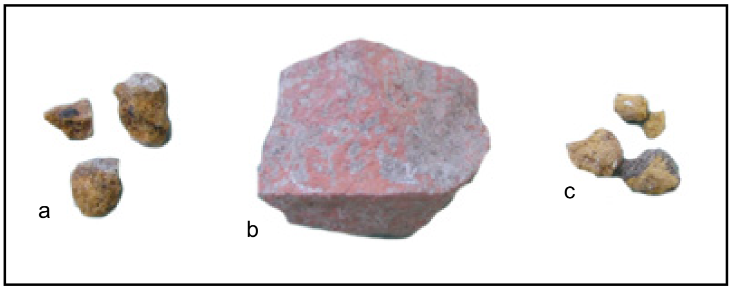

Figure 9.1. Hematite and limonite chunks collected for use as colorants: (a) unmodified limonite (FN 7180); (b) ground hematite, 3.3 cm long, 2.6 cm wide, 2 cm thick (FN 7327); (c) processed limonite (FN 7492). All were recovered from Stratum 504 of the Clearwater site, AZ BB:13:6 (ASM), dating to the unnamed phase of the Early Agricultural period.

Three pestles were classified as food-processing tools, primarily based on their size and because their use-wear is consistent with having been worked in deep stone mortars. They were found on pithouse floors (Features 126, 3262, and 3270) where there were no compatible mortars.

General processing tools include the usual lapstones, netherstones, handstones, and pestles, as well as two unusual mortars. The pestle on the floor of Feature 126 was used in larger, deeper mortars than the two mortars found on the same floor. The mortars are similar to containers referred to in the literature as knobbed trays (Adams 2002:221; Ferg 1998). Those with use-wear in the bottom are classified as mortars—a use confirmed by pestle-generated use-wear and occasionally by the presence of a compatible pestle (Ferg 1998:Figure 14.11). The mortars on the floor of Feature 126 were carefully manufactured and have use-wear in the basins from pestle use, although they differ in configuration. One has extended corners reminiscent of knobs and was manufactured from vesicular basalt (Figure 9.4a). It is plain with more of a rim than the second mortar.

The second mortar was manufactured from a volcanic rock. The exterior is decorated with a pecked design consisting of three broad grooves that run lengthwise along the bottom and a set of four perpendicular lines on either side of the rim that extends to the broad grooves along the bottom. The bottom area between the broad lines is filled with zigzag lines (Figure 9.4b). It has two knobs on one end and a depression on the other end that was probably a manufactured feature used to pour off the processed contents. A notch near one of the knobs may also have been for pouring off the contents. Use-wear on the knob farthest away from the notch indicates it was handheld.

Table 9.9. Pigments and pigment processing tools from the Clearwater site, AZ BB:13:6 (ASM), and the Tucson Presidio, AZ BB:13:13 (ASM).

Period/Stratum	Feature	Artifact	Color
Early Ceramic	3014	Mano	10R 4/8
	3014	Pigment	2.5YR 6/8
	3038	Netherstone	10R 5/6
	3038	Pigment	10R 3/4, 2.5YR 5/8
Cienega	7	Mano	10R 4/8
	15	Pigment	10R 3/2, 10R 3/6, 10R 4/6, 10R 5/6
	29	Lapstone	10R 4/6
	65	Pigment	10R 4/6, 10R 5/4
	112	Pigment	10R 5/8, 2.5YR 4/8
	126.04	Mano	10R 6/6
	128	Pigment	Blue
	3264	Pigment	10R 3/6, 10R 4/2
	3270.02	Pigment	10R 4/6, 10R 4/8, green
	3273	Netherstone	10R 5/8
	3273	Pigment	10R 3/6
	3327	Mano	10R 6/6
	9357	Lapstone	10R 5/8
	9357	Mano	10R 4/8
Early Agricultural	603	Tray	Multiple
Stratum 503	3374	Lapstone	2.5YR 4/4
Stratum 504	0	Pigment	10R 4/8, 10R 6/6, 10YR 6/6, 10YR 7/8

Figure 9.2. Flat/concave mano and metate recovered from Cienega phase pithouses at the Clearwater site, AZ BB:13:6 (ASM): (a) metate (FN 9251) recovered from the floor of Feature 3323; 55 cm long, 50 cm wide, and 14 cm thick; (b) mano (FN 9140) recovered from the floor of Feature 3327; 14.0 cm long, 13.1 cm wide, and 4.7 cm thick. The mano and metate are compatible in size and shape, but it is uncertain if they were used together.

A broken corner and part of the rim are all that remain of what may have been a third knobbed mortar. It was found in a pit inside Feature 3300, a pithouse, and it may have been intentionally broken.

The two whole knobbed trays may be the earliest examples of unbroken knobbed trays in the Tucson Basin (see Ferg 1998:573-582). Broken corners of knobbed trays were found in Cienega phase contexts at Stone Pipe (Adams 1998a:405, Figure 10.21) and at the Donaldson site, AZ EE:2:30 (ASM) (east of the Tucson Basin); a whole tray (not knobbed) was found at Donaldson (Huckell 1995:65-66, Figures 4.8, 4.9). Huckell (1995:65) contends that stone trays were made as early as the Chiricahua phase; knobbed corners may have been a distinctive Early Agricultural design.

Evidence for processing pigment among Cienega phase contexts is abundant, with many tools secondarily used, such as a lapstone (Figure 9.5) and a netherstone from the floors of Features 29 and 3273, respectively. Also on the floor of Feature 3273 was a piece of ground hematite. The hematite is dark red (see Table 9.9) and the pigment stain on the netherstone is red (see Table 9.9). The manos found in Features 7 and 126 that were secondarily used to process pigment have already been mentioned.

Figure 9.3. Flat/concave mano (FN 6195) recovered from a Cienega phase exterior pit, Feature 69, at the Clearwater site, AZ BB:13:6 (ASM); 17.0 cm in diameter and 5.8 cm thick.

Processed chunks of red pigment (see Table 9.9) were found on the floor of Feature 112 and near the floor of Feature 65, and unworked minerals were recovered from near the floor of Feature 112. The fill of Feature 15 had both processed pigments and unworked minerals. Processed pigment was recovered from one interior pit in Feature 3270, and unprocessed earthy hematite was recovered from another. A soft, unworked chunk of turquoise recovered from a third interior pit in Feature 3270 may have been intended for making blue pigment. It was not durable enough for ornament manufacture. However, no pigment processing tools were recovered from this pithouse. One processed chunk of earthy hematite (see Table 9.9) was recovered from the fill of Feature 3262, and a crumbly piece of rhyolite found near the floor of this feature may have been gathered for eventual pigment processing.

The use of red colorants first noted in earlier contexts obviously continued into the Cienega phase. Tools used for processing pigment appear to have been more abundant in Cienega phase contexts, possibly because more features from this later time period were excavated. The few ceramics produced during the Cienega phase were not decorated; therefore, it seems safe to conclude that these colors were used for decorating baskets, hides, and human bodies. The only Cienega phase burial containing ground stone items did not have pigment-stained artifacts, nor were there pigment stains on the bones to suggest color was used in the associated mortuary ritual

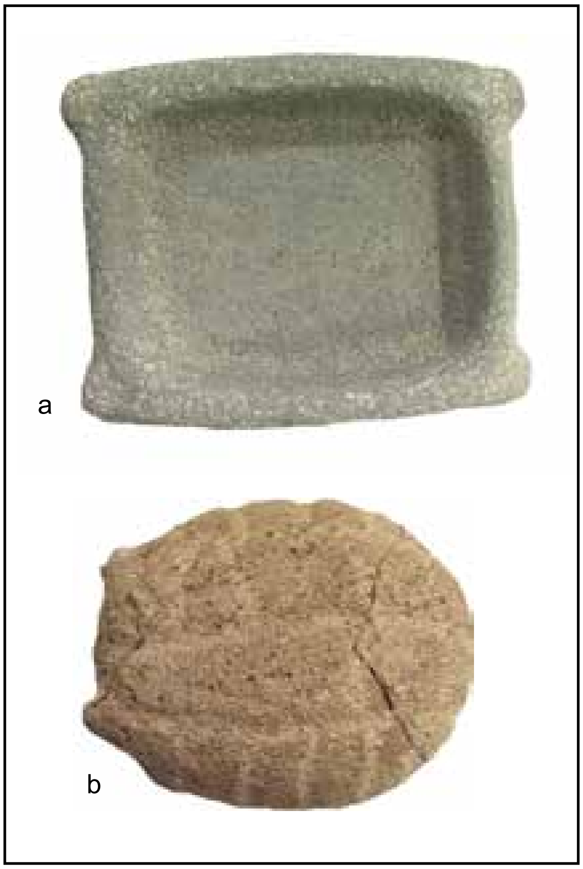

Figure 9.4. Mortars, sometimes called knobbed trays, recovered from the floor of Feature 126, a Cienega phase pithouse at the Clearwater site, AZ BB:13:6 (ASM): (a) use-wear visible on the bottom of the mortar (FN 6455); mortar is 20.2 cm long, 16.4 cm wide, and 4.3 cm thick; (b) incised base of an oval mortar (FN 6454); mortar is 18.7 cm long, 15.4 cm wide, and 5.3 cm thick.

as with the Early Agricultural burial previously described. However, as mentioned previously, other Cienega phase burials have been uncovered that did contain red-stained items or pigment processing tools (Adams 1998b:170; Thiel and Mabry 1998:Table 6.1).

Manufacturing activities represented among the Cienega phase deposits include eight polishers, a flat abrader, a lapstone, the unfinished metate previously mentioned, and an unused grooved abrader, as well as two unusual items—a spindle base and a whorl. Both tools were found on the floor of Feature 3262, and may be evidence for fiber processing. The spindle base is a spherical piece that was ground enough to enhance its natural shape. Natural depressions on either end have use-wear consistent with the working of wood. The whorl was ground to shape and has four deep parallel lines on one side. The sheen in the hole is consistent with the insertion of a wooden spindle.

Figure 9.5. Lapstone (FN 5700) recovered from the floor of a Cienega phase pithouse, Feature 29, at the Clearwater site, AZ BB:13:6 (ASM). Both sides used to process red pigment with a slightly different shade processed on each side. Something other than pigment was subsequently processed wearing a clean spot in the middle of the grinding surface. Lapstone is 13.4 cm long, 10.2 cm wide, and 2.2 cm thick.

Manufacturing activities are most obviously associated with pithouse Feature 15. An unfinished item that was either intended to be a disk mortar or a donut stone was on the floor (Adams 2002:130-134, 201-204). There is no obvious use-wear in the pecked depressions to indicate it was used as is. A broken donut stone was found near the floor of Feature 3262. It was manufactured from vesicular basalt and has a biconical hole, but it is otherwise too small to determine more about it.

Three polishers were near the floor of Feature 15; two were used to burnish hard, probably stone surfaces, and the third was probably collected for eventual use as a polisher. Polishers were also found near the floors of Features 7, 97, and 121. The polisher from near the floor of Feature 7 has use-wear very similar to that found on pottery polishers; however, because there were no pots manufactured at this time, the use-wear must have been from burnishing plaster. One polisher is a disk-shaped pebble with well-worn edges that have use-wear consistent with burnishing hard wooden or bone surfaces. It was found on the floor of Feature 3270. Similar disk-shaped pebble polishers were found at Los Pozos, with use-wear consistent with polishing stone surfaces (Adams 2001:126, Figure 5.13).

A hand axe recovered from a posthole in Feature 3264 may have been used to procure materials for manufacture, such as the wood items worked by the flat and grooved abraders. The flat abrader was recovered from the floor of Feature 3296, and the unused grooved abrader was in a floor groove in Feature 3273.

The 115 ground stone items analyzed from Cienega phase contexts provide a glimpse of the activities that occurred at the Brickyard and Mission loci of the Clearwater site. Most of the assemblage is typical for this time period along the Santa Cruz River. The spindle base is unusual, and although no stone whorls have been recognized among other Cienega phase contexts, six were recovered from San Pedro deposits at Las Capas (Adams 2005:Table 4.3). Consequently, there is some evidence for whorl-driven spinning, either of fibers or of drills. The co-occurrence of a spindle base in the Cienega phase deposits at Clearwater is stronger evidence for fiber processing. Food-processing technology during the Cienega phase continues to have predominately flat/concave tool designs, and as with most Early Agricultural period settlements, the metates were probably removed postoccupation.

Early Ceramic Period

Twenty-two ground stone artifacts were analyzed from two Early Ceramic period pithouses in the Mission Gardens locus at Clearwater. Half are fire-cracked fragments and another 18 percent are broken (see Table 9.8). Many (64 percent) were recovered from near the floors of two pithouses, Features 3014 and 3048 (see Table 9.5).

The only item clearly in contact with the floor in Feature 3014 is a flat/concave mano that was secondarily used to process red pigment (Figure 9.6; see Table 9.9). Processed earthy hematite was recovered near the floor, but it is a yellow shade of red (see Table 9.9). Colors were not the only ornamentation associated with this pithouse, however. A ground fragment of mica was either debris from ornament manufacture or an unfinished piece. It was recovered from near the floor. Another possible ornament was ground to shape, but retains much of its naturally rectangular shape. One narrow end has a small notch or a V-shaped groove in which there is use-wear from contact with something soft. The notch may have confined a sinew lashing that held another component in place. A lapstone found near the floor has use-wear consistent with shaping small hard items and may have been used in the manufacture of the possible ornaments. Two broken netherstones were also found near the floor, but not enough remains for confident identification of how they were used. One of the netherstone fragments and one unidentified fragment near the floor, as well as another fragment from the fill, are fire-cracked, which may indicate they were once used in roasting pits and dumped as trash into the abandoned pithouse.

Figure 9.6. Flat/concave mano (FN 8245) secondarily used to process red pigment recovered from the floor of an Early Ceramic period pithouse, Feature 3014, at the Clearwater site, AZ BB:13:6 (ASM). Mano is 10.4 cm long, 6.1 cm wide, and 6.1 cm thick. Note that the color has been enhanced to make the pigment more clearly visible.

The only item clearly associated with the floor of Feature 3038 is a flat/concave mano that was never used. One edge was partially pecked to create what appears to be a finger grip. The cobble from which it was made is thin, and its intended use may have been as a lapstone. Two processed pieces of pigment were recovered from near the floor; one is earthy hematite and the other is earthy limonite (see Table 9.9). A netherstone recovered from roof/wall fall deposits was used to process red pigment (see Table 9.9). It and a broken trough mano were burned, and another piece from the same deposit was fire-cracked. These items may have belonged to the occupants of this pithouse and may have been stored either on or within the roof; the structure may have subsequently burned. Four items recovered from near the floor of this pithouse were fire-cracked, which seems more in keeping with the dumping of trash from roasting pit cleanout as discussed for Feature 3014. An unburned polisher was recovered from the roof/wall deposits, although it was not used enough to result in identifiable use-wear.

Processing and manufacturing activities were apparently similar during both the Early Agricultural and Early Ceramic periods, assuming these few analyzed artifacts are representative. Mica ornament manufacture and pigment processing have a long history, as can be seen by the previous Early Agricultural and Cienega assemblage descriptions reported here and elsewhere, including Santa Cruz Bend, Stone Pipe, Square Hearth (Adams 1998a), Las Capas, Los Pozos (Adams 2005), Wetlands (Adams 1998b), Valencia Vieja (Adams 2003), Julian Wash (Adams 2006), and Sunset Mesa (Adams 2000).

Hohokam Periods

Evidence for Hohokam occupation was uncovered at four features within the Mission Gardens locus, one feature in the Brickyard locus, and one feature at the Presidio (see Tables 9.1 and 9.5). Fifty-seven ground stone items were analyzed (see Table 9.7). Relatively few of the items were recovered from on or near pithouse floors (see Table 9.8); 72 percent of the items analyzed from this time period were a cache of tools and raw materials in an extramural pit (Feature 3058) (Figure 9.7).

The cache was in the Mission Gardens locus and contained tabular tools in various stages of manufacture and use—all tabular cobbles of andesite. Thirty-two pieces were unmodified; four had been flaked to create usable edges and were lightly worn. Two were used to scrape pliable surfaces; both have use-wear from where they were handheld. The third tabular tool was used to slice something pliable. The edge is thicker and more irregular than those used for scraping. The fourth tabular tool has a notch in the center of the edge that was used to scrape something pliable and round. Such a tool would have been useful for debarking branches. Two pieces in the cache are debris from edge manufacture and have no obvious use-wear. Also in the extramural pit were a mano, a pestle, and a chopper (Figure 9.8). The mano has moderate wear from use against a flat/concave metate. The chopper was lightly used in general processing, perhaps for cleaning fibers or chopping off agave leaves. The pestle remains unused.

The fill of pithouse Feature 3005, also in the Mission Gardens locus, was probably used as a dump for fire-cracked rock cleaned out of a roasting or heating pit. All seven of the ground stone items analyzed from the fill were fire-cracked—five are too small to recognize their original artifact type. One was a pecking stone and another was a handstone; both are currently too broken to recognize more about them.

Two broken manos were found in the fill covering human burials in the Mission Gardens locus. One, Feature 3019, was heavily used in a basin metate, and the other, Feature 3025, was heavily used against a flat/concave metate. The broken manos are assumed to have been in the dirt used to cover the bodies and were likely not intentionally placed.

Six items were analyzed from pithouse Feature 308 in the Congress Street locus. Two tablet-like pieces were minimally modified on the edges to shape. One is broken and was found in the fill; the other is whole and was found near the floor. A lapstone that had been used to smooth small hard objects was on the floor, and it was redesigned into a tabular tool with a serrated edge. The serrated edge had received enough use to wear the serrations almost smooth and to create use-wear from where the tool was handheld. Two pottery polishers were recovered from an interior pit. Both were used enough to create facets.

Figure 9.7. Field photograph of a tabular tool cache, Feature 3058, at the Clearwater site, AZ BB:13:6 (ASM).

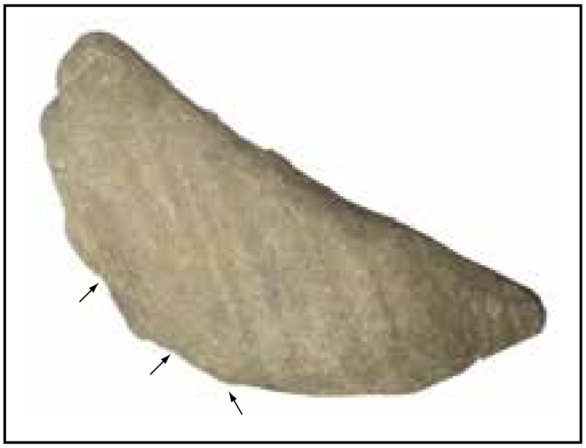

Figure 9.8. Tabular tool (FN 9365) from the tool cache, Feature 3058, at the Clearwater site, AZ BB:13:6 (ASM). Tool was used as a chopper and is 29.3 cm long, 11.8 cm wide, and 2.7 cm thick. Arrows point to the flaked and worn edge.

The only Hohokam artifact analyzed from the Tucson Presidio was a broken palette (Figure 9.9a). All that remains is a small section of one side with enough to determine the surface was distinguished from the border by an incised line. The border is decorated with an incised line that parallels the edge, with exterior edge notching.

Although few artifacts were associated with Hohokam periods, some inferences about specific manufacturing activities are possible. The cache of tabular tools and raw materials was probably the work of someone who specialized in at least the procurement of the appropriate materials, if not in the manufacture of tabular tools. The source for tabular andesite was probably more than 1 km away and may have required a day-long trip. Collectively, the tabular material weighs 21.6 km (47.6 lbs)—a weight that could have been carried by one individual with some effort, or easily by two or three people. Pottery manufacture was evident by the two well-worn pottery polishers. These were found in the same interior pit and probably belonged to a single potter. Wear rates have not been experimentally or ethnographically documented, although judging from pottery polishers used by a modern Hopi potter, those with facets may have been used by more than one generation of potter. These are two clear examples of manufacturing behaviors typical of Hohokam periods.

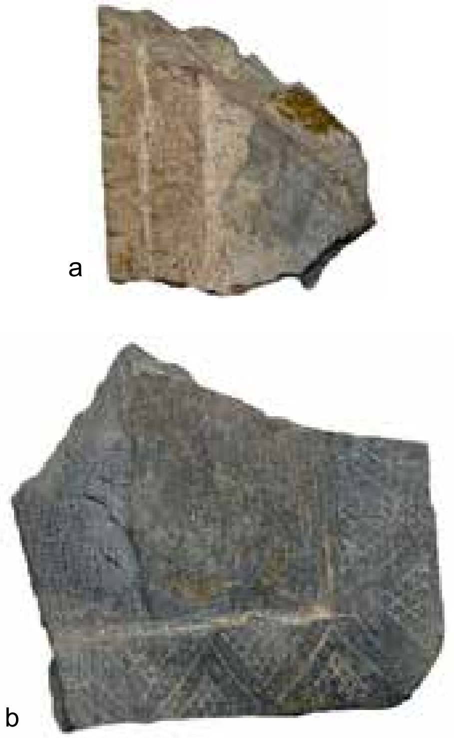

Figure 9.9. Palette fragments recovered from the Tucson Presidio, AZ BB:13:13 (ASM): (a) found in the fill of a Hohokam pithouse, Feature 417 (FN 3996); the fragment is approximately 5 cm on a side; (b) found in a Spanish period exterior pit, Feature 409 (FN 4371); the fragment is less than 10 cm long.

Spanish Period O'odham

Thirty ground stone items were analyzed from Spanish period O'odham contexts. All of the contexts were in the Mission locus. Eighty percent of the artifacts were from trash, Features 64 and 166, and the rest were from four extramural pits. Eighty percent of the analyzed artifacts recovered from sheet trash, Feature 64, are fire-cracked and were probably cleaned out from roasting or heating pits. The two unburned artifacts are abraders that were too lightly used to create recognizable use-wear. Ninety-three percent of the analyzed ground stone from Feature 166 were fire-cracked fragments. The only whole artifact, a handstone, was also burned and may not have been heated and cooled enough to crack apart like the other fragments. If these artifacts were associated with the Spanish period occupation at this location, they were probably recycled prehistoric artifacts used in historic-era roasting pits.

The pottery polisher and an abrader from Feature 177 are the only unburned artifacts recovered from any of the extramural pits dated to the Spanish period; both have moderate wear. If these were used during the Spanish period, they appear to be based on technological traditions that developed at least as early as the Hohokam periods. The four other analyzed artifacts from three extramural features (Features 178, 193, and 203) are all fire-cracked, although only the two from Feature 203 are so small that they cannot be identified by artifact type. A fire-cracked fragment of a trough mano was recovered from Feature 193, and a whole but fire-cracked chopper was recovered from Feature 178.

These few artifacts provide little insight into the Spanish period O'odham occupation of the area. Prehistoric trash was probably recycled into roasting pits and may also have been mined for other usable tools such as manos and polishers. These are behaviors that probably had a long history in the area.

Spanish and Mexican Periods

Six ground stone items were analyzed from three exterior pits (Features 373, 409, and 422) that have been dated to the Spanish and Mexican periods at the Tucson Presidio (see Table 9.1). All six items are broken, two because they were fire-cracked (see Table

9.8). A broken palette corner was recovered from Feature 409 (Figure 9.9b). Only enough of the palette remains to discern that the basin was distinguished from the border by an incised line. Incised running triangles decorate the border and extend from the corner onto two sides of the basin. The triangles fill the entire border width, are outlined with plain bands, and are filled with diamond shapes. There is no obvious use-wear or evidence of intentional breakage; it may have broken during manufacture.

Three fragments of muscovite were recovered from Feature 373. Two were incompletely ground to specific shapes and may be evidence of the continued manufacture of mica ornaments. Similarly unfinished mica ornaments were found in earlier Spanish period O'odham deposits at Clearwater. A fire-cracked mano was the only other ground stone item recovered from Feature 373. It was used in a flat/concave metate long enough to create moderate wear and was probably then recycled into a roasting activity. Whether it had anything to do with the use of Feature 373 is unknown. The same uncertainty is expressed for the broken ground stone item recovered from Feature 422. It was fire-cracked into a piece too small for further recognition.

Very little can be learned about the Spanish and Mexican period occupations from these few ground stone pieces. Even though the extramural pits were stratigraphically associated with these occupations, these stone items could have filled in the pits with surrounding dirt and trash from earlier occupations.

CONCLUSIONS

This sampling of items uncovered during the excavations in advance of the Rio Nuevo Archaeology project has provided interesting glimpses into the daily lives of those who lived here at different points in time. What has been learned fits well with the information gathered from other projects in the Santa Cruz River basin (see Tables 9.2 and 9.3). Prior to 800 B.C., the technologies for processing pigments, grinding foods, and manufacturing stone and wooden items through pecking and polishing techniques were apparently well established. Carefully shaped items such as knobbed trays are representative of masterful skill levels and perhaps of a style that extended beyond the Tucson Basin (Ferg 1998). Mortuary rituals that may also have had meaning beyond the local were represented by the powdering of red pigment over a deceased woman. The accompanying, compatible mano and metate were probably her well-used, and perhaps cherished, possessions.

A continuation of food grinding, pigment processing, and manufacturing technologies is evident with the recovered Cienega phase artifacts. Food continued to be ground with basin or flat/concave manos and metates. Pigment was processed on lapstones and netherstones. Polishers and abraders were used in manufacturing. New evidence for spinning technology was uncovered with the whorl and spindle base from one Cienega phase pithouse.

The technological evidence from Hohokam contexts was not as broadly representative as was the case with previous contexts (see Tables 9.2 and 9.3). However, the cache of tabular material from one extramural pit (see Figure 9.7) provides invaluable insight into the gathering and preparation of raw material for the manufacture of a tool type that can be used in many different cutting, scraping, and slicing tasks. The well-used pottery polishers also speak to the efforts of what were probably a single individual who used her tools long enough to create distinctive wear facets. The manos recovered from Hohokam contexts do not reflect the incorporation of trough designs that were evident in other Hohokam contexts in the Santa Cruz River basin beginning in the Tortolita phase (Adams 2003:Table 6.19) and continuing throughout prehistory. This omission is probably the result of sample size and not the lack of technological development.

Even into the Hohokam periods, the technologies of food grinding and pigment processing changed little, and apparently neither did the removal of certain objects, such as metates, either by departing residents or by subsequent scavengers. Consistently, through time, whole manos are found on pithouse floors far more often than whole metates. Not much can be said, however, about the technological traditions specific to the Spanish period O'odham, or during the Spanish and Mexican periods. Most of the ground stone items removed from the historic-era contexts were recycled trash dumps from heating or roasting pits.

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CHAPTER 10

FLAKED STONE

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INTRODUCTION

The Rio Nuevo flaked stone analysis focused on materials recovered from several loci of the Clearwater site, AZ BB:13:6 (ASM): (1) the earliest occupations at the Congress Street locus; (2) two Agua Caliente phase features from the Mission Gardens locus; and (3) one Spanish period O'odham feature at the Mission locus. The earliest assemblage is the most recent addition to the large body of data about the unnamed phase of the Early Agricultural period (2100-1200 B.C.). The Clearwater site artifacts provide the first opportunity to investigate technological behaviors from different locations within the floodplain of the Santa Cruz during this previously inadequately understood interval. Similarly, literature about the flaked stone technology utilized by Pima populations in the Tucson area is virtually nonexistent; the Piman lithic assemblage is limited, but it is significant for beginning explorations of this time period.

SAMPLING

The analyzed sample included all artifacts from strata 503 and 504 (comprising the unnamed phase preceding the San Pedro phase of the Early Agricultural period, 2100-1200 B.C.) at the Congress Street locus (Stratum 503, *n* = 127; Stratum 504, *n* = 1,493), as well as all artifacts from Early Ceramic and Pima features at the Mission and Mission Gardens loci (*n* = 306). All projectile points recovered during the project were analyzed regardless of context. Therefore, the projectile point discussion includes the significant point assemblage recovered from the Cienega phase (800 B.C.-A.D. 50) occupations of the Clearwater site.

METHODS OF ANALYSIS AND DEFINITIONS OF TERMS

Artifact Classification and General Terminology

The typology used here utilizes a technological division of gross artifact classes, including cores, debitage, retouched flake implements, core tools, core hammers, and cobble hammers. These artifacts are differentiated on the basis of blank type and the presence or absence of retouch. Types and subtypes within the classes represent increasing levels of detail in the suites of attributes used to make the identifications. A number of key attributes were recorded for each artifact, including raw material, artifact class, artifact type, platform type (if applicable), presence or absence of cortex, weight, and maximum linear dimension. Definitions of some of the more frequently used terms in this chapter are presented in Table 10.1.

Cores

Cores are pieces of parent material from which flakes or blades are struck. They are recognizable by the presence of more than two aspects, striking surfaces (platforms) and negative flake scars. Specific core types are defined on the basis of the number of platforms present and the direction(s) in which they are oriented. They include single-platform, opposed-platform, bidirectional, multiple-platform, and bifacial cores. If fewer than three negative flake scars are present on an otherwise unaltered piece of raw material, the artifact is classified as a tested piece.

Attribute Recording. The attributes recorded include raw material, type (defined according to the number of platforms present), the presence/absence of cortex, mass (gm), and the maximum linear dimension (mm).

Debitage

Debitage includes all unretouched lithic artifacts that were struck from some parent material. Types are defined based on the set of technological attributes the artifacts possess; these include complete flakes, fragmentary flakes, and shatter. Special debitage types forming subsets of the main types above include bifacial thinning flakes, implement resharpening flakes, core rejuvenation flakes, and bipolar flakes.

Bifacial thinning flakes have distinctive platforms that are oriented at an acute angle to the dorsal aspect of the flake. These are usually lipped and often show faceting or grinding. The flakes have lateral margins that expand outward from proximal end to

Table 10.1. General terminology for Desert Archaeology, Inc., flaked stone analysis.

Term	Definition
Retouch	Intentional, macroscopically visible modification to the edge of a piece of lithic material, generally in the form of flaking; the conventional requirement for classifying edge modification as retouch is the presence of three or more contiguous intentional flake removals along a common edge.
Utilization damage/ Edge damage/Use-wear/ Wear traces	Macro- or microscopically visible modification of the edge of a piece of lithic material as a result of utilization or postdepositional processes; it is an unintentional by-product of behavior rather than an intended effect. Given this and the definition used for retouch, the term "use retouch" is misleading and is avoided here.
Implement	A piece of stone that was either utilized or designed to be utilized to perform a task.
Retouched implement/ Flake tool	Flake with one or more retouched edges, regardless of the presence or absence of wear traces.
Utilized flake	An unretouched flake that has been used to perform a task; identified by the presence of wear traces.
Formal tool/Formally retouched implement	Implement with patterned retouch corresponding with one of the traditionally established, intuitive tool types (e.g., projectile point, drill, biface, notch, graver, perforator, endscraper, sidescraper).
Expedient tool/Expediently retouched implement	Retouched implement characterized by unpatterned, usually nonextensive retouch; these may also be referred to as informal tools.
Core tool	Core with one or more retouched edges; flake implements are made from the by-products of core reduction, while core tools are made by shaping original cobbles or tablets of raw material into implements through flaking.

termination, giving them a semitriangular shape, and have incurved bulbar aspects that result in a distinctive appearance in cross section. Desert Archaeology analyses include both specifically identified bifacial thinning flakes (BTF) and potential retouch flakes (PRF), which include all complete flakes whose metric attributes fall within the range of variation observed for the BTF from a given region and time period.

Implement resharpening flakes are recognizable by a use bevel or other wear traces along the length of their platform edges; they are struck from a dulled edge to provide a fresh, sharp edge for continued work.

Core rejuvenation flakes are struck from cores to remove exhausted platforms and extend the use-life of the core. These are generally recognizable from the flaking platforms and partial flake scars around their perimeters, or by a ridge formed by remnant platforms across the dorsal aspect of the flake.

Another special debitage type that warrants a separate discussion is the utilized flake, which is a non-retouched flake with edge damage (abrasion, flaking, crushing, striations) and/or polish indicating it has been used to perform some task. While utilized flakes are subsumed by the debitage artifact class (due to the absence of retouch), they are usually included with retouched flake tools in discussions of task-related behaviors at a site.

Attribute Recording. Debitage was coded individually; recorded attributes included raw material, completeness, portion (if incomplete), presence/absence of cortex, platform type, termination type, type of platform preparation (grinding and/or faceting), number of remnant flake scars on the dorsal aspect, mass (gm), and a measure of linear dimension (mm). Desert Archaeology analyses rely on a single measurement of a flake's maximum linear dimension (irrespective of the flaking axis); dividing flake mass by this number results in a mass index value used to express relative flake thickness (lower values result from a lower weight-to-linear size ratio, indicating thin flakes).

Potential Retouch Flakes. The metric attributes recorded for debitage are used to discriminate subsets of artifacts representing various technological behaviors. In this analysis, the distribution of size and weight data for identified bifacial thinning flakes was used to set the size thresholds for potential retouch flakes in the assemblage. The maximum mass index for likely retouch flakes was obtained from the mean value across all identified BTF in the Desert Archaeology database, plus 1 sigma (0.076). This mass index threshold covers 91 percent of the BTF, which is a tolerable level of accuracy in filtering the overall debitage assemblage. Therefore, discussions of potential retouch flakes in this report refer to the proportion of complete flakes in the assemblage that do not exceed this mass index threshold.

Unifaces

Unifaces are flakes with retouch extending from an edge onto only one aspect of the implement. Note that an implement with retouch on both aspects is still classified as a uniface as long as the sets of retouch flakes do not originate from a common edge.

Attribute Recording. The attributes recorded for unifaces include raw material, cortical coverage, mass (gm), and maximum linear dimension (mm). When time allows, the location, shape, and length of the retouched edge is recorded; otherwise, the retouch attributes exhibited by a particular artifact are summarized with reference to an established type name.

Retouch is described with reference to dichotomous qualitative attributes and the angle of the resulting modified edge (Table 10.2; after Rozen 1984: 457-459). Attributes are assigned through a series of yes-no questions (e.g., is the retouch extensive? is the retouch invasive?) to create a set of attributes corresponding to a technological type.

Bifaces

Although it is sometimes impossible to determine if a biface was made on a flake/blade blank or a core blank, in the current system, bifaces are considered to be flake tools with retouch extending onto both aspects of the blank from a common margin.

Common bifacial types include general bifaces, drills, and projectile points. General bifaces lack designed special-function components such as elongated bits or hafting elements and are classified according to stage of manufacture (Table 10.3). Drills have pronounced bits that are usually thick and diamond-shaped or square in cross section. Most drills are designed with some provision for hafting, such as a narrow, pointed base that fits into a socket in a wooden shaft, or flanges or notched bases allowing the drill to be secured to a shaft with sinews or other wrapping material. Projectile points have a sharp

Table 10.2. Definitions of retouch attributes.

Retouch Type	Definition
Unifacial	Retouch scars that extend onto only one aspect, or face, of the implement.
Bifacial	Retouch scars that extend from a common margin onto both aspects of the implement.
Irregular	Two or more noncontiguous retouch scars, but not more than two contiguous scars.
Continuous	At least three contiguous retouch scars.
Marginal	Retouch scars whose lengths do not exceed 10 percent of the maximum dimension of the implement.
Invasive	Retouch scars whose lengths exceed 10 percent of the maximum dimension of the implement.
Nonextensive	Continuous retouch scars whose extent is less than 20 percent of the perimeter of the implement.
Extensive	Continuous retouch scars whose extent is greater than 20 percent of the perimeter of the implement.

Table 10.3. Stages of biface manufacture (from Anderson and McDonald 1986:7.48-7.52).

Stage	Characteristics
1	Thick cross sections; markedly sinuous edges; hinge and step fractures; and deep, broad flake scars; cortical surfaces and stacked step fractures common.
2	Significantly lower length, width, and thickness than Stage 1 bifaces; irregular but straighter edges, irregular but more shallow flake scars, and far fewer hinge and step fractures, likely due to a shift by the knapper from a hammerstone to an antler billet; cortex expected to occur at a rate of roughly 30 percent.
3	Slightly sinuous edges, infrequent hinge and step fractures, and more regular, diffuse, and less expanding flake scars; approximately 30 percent thinner than Stage 2 bifaces; manufacture-induced breakage common; essentially finished implements lacking pressure flaking, final thinning, and hafting elements.
4	Regular outlines, straight edges, and regular flake scars; pressure finishing common; cortex completely absent; tend to be significantly shorter than Stage 2 bifaces and 30 percent thinner.

point at one end and a hafting element at the other. Point classification systems are regionally specific, with types defined according to sets of morphological attributes, such as notch location, stem shape, blade shape, length-to-width ratio, and flaking technique. Some types incorporate subregional or phase-based variants.

From a technological view, it is informative to address general bifaces in terms of the stages of manufacture, and thus, the level of labor investment they represent. The classification system used here for bifaces replicates that developed by Anderson and McDonald (1986) for the Wupatki Archeological Inventory Survey project. The latter was based on Womack's (1977) technological analysis and experimentation, which determined that thickness-to-width ratios and flake scar patterns are the variables most relevant for discerning biface reduction strategies. The resultant general biface types, produced in four stages of manufacture, are defined as follows (from Anderson and McDonald 1986:7.48-7.52).

Stage 1 bifaces have thick cross sections, markedly sinuous edges, hinge and step fractures, and deep, broad flake scars. Cortical surfaces and stacked step fractures are common. Stage 2 bifaces have significantly lower length, width, and thickness than Stage 1 bifaces. They are characterized by irregular but straighter edges, irregular but more shallow flake scars, and far fewer hinge and step fractures, likely due to a shift by the knapper from a hammerstone to an antler billet. Cortex is expected to occur on these bifaces at a rate of roughly 30 percent. Stage 3 bifaces have slightly sinuous edges, infrequent hinge and step fractures, and more regular, diffuse, and less expanding flake scars. These are approximately 30 percent thinner than Stage 2 bifaces, and manufacture-induced breakage is common. These are basically finished implements, but without pressure flaking, final thinning, and hafting elements. Stage 4 bifaces have regular outlines, straight edges, and regular flake scars; pressure finishing is common and cortex is completely absent. These tend to be significantly shorter than Stage 2 bifaces and 30 percent thinner.

Attribute Recording. The minimum set of recorded attributes includes raw material, cortical coverage, mass (gm), and maximum linear dimension (mm) measured relative to the long axis of the artifact. When time allows, more complete metric measurements are taken, although these vary according to biface type. All other measurements are taken parallel or perpendicular to this line.

Projectile point measurements include total length (mm) and the lengths, widths, and thicknesses (mm) of the blade and stem. Other measurements that can be useful for distinguishing differing point types include neck width, basal concavity depth, notch depth and width, and tang angle. Ratios among sets of these attributes are used to quantify the morphology of a given point and place it within a range of observed variation corresponding to a particular type.

Core Tools

Core tools are distinguished from retouched flake implements by blank type; flake implements are made on the by-products of core reduction, while core tools are produced by shaping original cobbles or tablets of raw material into implements through flaking. Core tools are generally larger and heavier than flake tools, but their edge morphologies are analogous. In the interest of comparative studies, it is preferable to deal with cores, core tools, core hammers, and cobble hammers separately, providing other researchers the opportunity to group or separate them as they wish.

Core tools include scrapers, choppers, discoids, denticulates, and composite tools. Other, more rarely encountered examples include perforators and notches. The classification process is essentially the same as for retouched flake implements, although a smaller set of tool types is defined than for flake tools.

Attribute Recording. Recorded attributes include raw material, cortical coverage, mass (gm), and maximum linear dimension (mm). As with flake tools, retouch location, type, and angle are summarized with reference to an established type name.

Core Hammers

A core hammer is a core with evidence of secondary use as a hammer (battering). Core hammers are treated separately from core tools, because even though they were utilized as something other than a source for flakes, they were generally not specially shaped for the second function. These and cobble hammers are the only flaked stone artifacts defined explicitly in terms of their inferred function.

Due to the specific nature of the type definition, the only types defined for this artifact class are complete core hammers and fragmentary core hammers.

Attribute Recording. Raw material, the presence/absence of cortex, mass (gm), and maximum linear dimension (mm) are recorded.

Cobble Hammers

A cobble hammer, or hammerstone, is an otherwise unmodified cobble that exhibits battering in one or more locations. Due to the specific nature of the type definition, complete hammerstones and fragmentary hammerstones are the only types defined for this artifact class.

Attribute Recording. Raw material, the presence/absence of cortex, mass (gm), and maximum linear dimension (mm) are recorded.

A Note on Tool Classification

Each retouched implement was categorized according to the location, type, and extent of retouch it exhibited, in conjunction with edge angle attributes. As type definitions are technologically, rather than functionally, derived, there should be no overlap of unifacial and bifacial retouch within tool types. All retouched implements which could not be accurately described by a shorthand term such as "endscraper" or "drill" were typed according to their retouch attributes and are discussed in the analysis as expediently retouched implements or informal tools. As explained earlier, manufacture-derived attributes (retouch), rather than inferred function, serve as the basis for an implement type designation. However, while the attribute sets are quite effective in differentiating implement types based on their technological attributes, many of the resulting type names are equally nonintuitive and unwieldy.

To make the results of the analysis easier to read and understand, traditional type names were used when possible to describe the assemblage; e.g., "continuous invasive unifacial retouch, medium/steep, denticulate, proximal/distal end" becomes the much easier to comprehend "denticulated endscraper." Because these terms carry functional implications from long-term traditional use in the literature, it must be emphasized that *no specific functional inferences are implied* for simplified implement types such as "scraper" or "chopper;" they are used here only to facilitate communication.

Southwestern formal tools are quite different in overall appearance than those from the Paleolithic, Mesolithic, and Neolithic of Europe and the Middle East. Tools from these Old World regions were manufactured from standardized blanks (blades), which had the effect of homogenizing the appearance of the tool assemblages.

In contrast, Southwestern retouched flake implements were made from unstandardized blanks (flakes). Although this contributes to an "informal" appearance for the Southwestern tools, the retouched edges themselves are, in fact, quite standardized. Therefore, the Southwest can be considered to have produced formal tools other than projectile points—the retouched edge morphologies rather than the blank morphologies being the relevant attributes. The edge morphologies of the formal, "intuitive" tool types can be defined in terms of the retouch attributes discussed above.

ASSEMBLAGE DESCRIPTIONS

Pre-San Pedro Phase Assemblage

A total of 1,600 flaked stone artifacts was recovered from pre-San Pedro phase (strata 503 and 504) contexts at the Congress Street locus of Clearwater. Most of the assemblage was debitage, with relatively small numbers of cores, hammers, and retouched implements also recovered (Table 10.4). Slightly more cores and retouched implements were recovered from extramural pits than from pithouse fill or non-feature, extramural space, but overall artifact distributions were fairly consistent across the contexts.

Raw materials are dominated by igneous rock available in the immediate vicinity of the site (Table 10.5). The most frequently occurring materials include fine-grained basalt from the foothills of the Tucson Mountains; a fine-grained, ashy-gray rhyolite with small phenocrysts; and fine-grained quartzites available in cobble form in the bedload and lag gravels of the Santa Cruz River. Exceptionally high-quality rock occurred in smaller but regular quantities across the early contexts. Primary among these is a salmon-colored jasper and a very fine-grained, lavender-to-blue dacite. Sources for these materials have not been identified, but their consistent occurrence in San Pedro and Cienega phase assemblages from sites along the Santa Cruz as far north as Ruthrauff Road (Wetlands site, AZ AA:12:90 [ASM]; Sliva 1998b) suggests a western Tucson Basin source readily accessible from the floodplain settlements.

Bifacial implements, particularly projectile points, dominate the tool assemblage (Table 10.6). The few unifacial tools include scrapers, a perforator, and a notch/spokeshave. Five of the 10 points were complete enough to be stylistically diagnostic; four of these are Cortaro points (the three most complete are pictured in Figure 10.1a-c) and another is possibly a San Pedro (Figure 10.1f). All of these points were recovered from Stratum 504 contexts dated to circa 2100 B.C. (Chapter 19, this report). Cortaro points first appear in the Chiricahua phase of the Middle Archaic period (3000 B.C.-2100 B.C.), but are common, if in low numbers, through the end of the Cienega phase of the Early Agricultural period (800 B.C.-A.D. 50). San Pedro points first appear in the San Pedro phase (1200-800 B.C.) and persist through the earlier portion of the Early Ceramic period (A.D. 50-350). Additional point types recovered from contexts that may not be associated with the strata 503 and 504 occupations include an Armijo-like point (Chiricahua phase; Figure 10.1d) and a San Pedro (Figure 10.1e).

The technological attributes of the assemblage are consistent with patterns established for San Pedro

Table 10.4. Pre-San Pedro phase (strata 503 and 504) flaked stone artifact class distributions at the Congress Street locus, the Clearwater site, AZ BB:13:6 (ASM).

Context	Artifact Class	Total	Percent
Pithouse/Possible pithouse	Debitage	328	97
	Core	5	1
	Biface	5	1
Total		338	100
Extramural pit	Debitage	68	92
	Core	3	4
	Biface	2	3
	Hammerstone	1	1
Total		74	100
All feature contexts	Debitage	396	96
	Core	8	2
	Biface	7	2
	Hammerstone	1	<1
Total		412	100
Extramural space (nonfeature)	Debitage	1,163	98
	Core	8	1
	Uniface	4	<1
	Biface	11	1
	Core tool	1	<1
	Core hammer	1	<1
Total		1,188	100
All contexts	Debitage	1,558	97
	Core	16	1
	Uniface	4	<1
	Biface	18	1
	Core tool	1	<1
	Core hammer	1	<1
	Hammerstone	1	<1
Total		1,599	100

phase assemblages within the Tucson Basin (Table 10.7). The relatively high occurrence of PRF indicates tool-manufacturing activities. However, this should be viewed at the level of this individual site or, more accurately, a location within the site that happened to be excavated, rather than as a definitive marker discriminating this unnamed phase from the San Pedro phase proper.

Agua Caliente Phase

Two pithouses at the Mission Gardens locus, Features 3014 and 3038, dating to the Agua Caliente phase (A.D. 50-500) of the Early Ceramic period were excavated, yielding a flaked stone assemblage of 273 artifacts. In addition to debitage, the assemblage includes seven cores or core fragments, two hammers, a scraper, and a notch (Table 10.8). No diagnostic artifacts were recovered.

Spanish Period O'odham

One O'odham feature, Feature 64, dating to the Spanish period, a trash concentration at the Mission locus, contained 44 flaked stone artifacts. One core and three projectile points were recovered; the remainder of the assemblage is debitage (Table 10.9). Nine Pima arrow points were recovered from five

Table 10.5. Pre-San Pedro phase raw material distributions, by context, at the Congress Street locus, the Clearwater site, AZ BB:13:6 (ASM).

	Pithouse/Possible Pithouse		Extramural Pit		Nonfeature, Extramural Space		All Contexts	
Material	Total	Percent within Context	Total	Percent within Context	Total	Percent within Context	Total	Percent
Unspecified fine-grained igneous	27	8	7	9	230	19	264	17
Unspecified medium-grained igneous	33	10	4	5	87	7	124	8
Unspecified coarse-grained igneous	0	0	0	0	16	1	16	1
Basalt or basaltic andesite	70	21	13	18	147	12	230	14
Fine-grained dacite, lavender to white	41	12	3	4	40	3	84	5
Rhyolite	62	18	31	42	224	19	317	20
Fine-grained ashy gray rhyolite or andesite/black and white phenocrysts	13		17		61		91	
Fine-grained gray rhyolite/black and white phenocrysts	6		0		12		18	
Fine-grained black rhyolite/black and white phenocrysts	2		1		10		13	
Fine-grained Rillito Peak rhyolite ("Rillito Peak jasper")	6		0		26		32	
Fine-grained dark brown rhyolite/white phenocrysts	7		4		36		47	
Fine-grained brown rhyolite/black and white phenocrysts	1		2		10		13	
Fine-grained red rhyolite/white phenocrysts	3		0		1		4	
Fine-grained red rhyolite/black and white phenocrysts	1		0		1		2	
Fine-grained purple rhyolite/white phenocrysts	0		0		1		1	
Medium-grained gray rhyolite/ white phenocrysts	4		1		20		25	
Medium-grained gray rhyolite/ black and white phenocrysts	3		1		10		14	
Medium-grained light brown rhyolite/white phenocrysts	10		1		25		36	
Medium-grained brown rhyolite/ black and white phenocrysts	3		4		5		12	
Medium-grained pink-gray rhyolite/white phenocrysts	1		0		2		3	
Medium-grained purple rhyolite/ white phenocrysts	1		0		2		3	
Coarse-grained Rillito Peak rhyolite ("Rillito Peak jasper")	0		0		2		2	
Coarse-grained brown rhyolite/ white phenochrysts	1		0		0		1	
Obsidian	1	<1	0	0	14	1	15	1
Fine-grained metasediment	20	6	5	7	93	8	118	7
Fine-grained quartzite	21	6	3	4	97	8	121	8
Extremely fine-grained quartzite	18	5	3	4	60	5	81	5
Silicified limestone	6	2	1	1	10	1	17	1

Table 10.5. Continued.

	Pithouse/Possible Pithouse		Extramural Pit		Nonfeature, Extramural Space		All Contexts	
Material	Total	Percent within Context	Total	Percent within Context	Total	Percent within Context	Total	Percent
Medium-grained quartzite	1	<1	0	0	1	<1	2	<1
Unspecified fine-grained metamorphic	2	1	0	0	3	<1	5	<1
Unspecified medium-grained metamorphic	1	<1	0	0	0	0	1	<1
Chert	18	5	1	1	99	8	118	7
Unspecified chert	13		1		76		90	
Buff's chert	5		0		23		28	
Jasper	6	2	0	0	50	4	56	4
Chalcedony	6	2	0	0	2	<1	8	1
Quartz	4	1	0	0	13	1	4	<1
Unidentified/Other	1	<1	0	0	1	<1	2	<1
Total	338	100	71	100	1,187	100	1,583	100

additional Spanish period features, including a wall and four extramural pits (Table 10.10).

Raw material distributions are similar to those seen in the pre-San Pedro phase assemblage, with virtually all artifacts made from fine- to medium-grained, locally available materials (Table 10.11). The exception to this is the range of materials represented by the projectile points, most of which were manufactured from stone types that do not occur in the Tucson Basin (cherts and jaspers from unknown sources; Figure 10.2a-j). The single Cienega point recovered from a Spanish period O'odham context is produced from Buff's chert (Figure 10.2k) and is one of only six points of this material known from all Desert Archaeology excavations in the Santa Cruz floodplain. The remaining points closely resemble some Sobaipuri (Protohistoric) forms, but are more properly called "Piman" due to their association with historic-era features. The points are quite small (with one exception, all are less than 20 mm long), triangular blades with moderately deep concave bases. Two have finely serrated edges; none have side notches.

The available sample is too small to construct a valid technological profile for Spanish period O'odham flaked stone at the Clearwater site. General impressions, however, suggest at least some bifacial manufacture occurred. Seven bifacial thinning flakes were recovered, and most of the debitage falls within the size parameters observed in Early Agricultural period assemblages (which tend to be dominated by tool-manufacturing activities; Sliva 2005).

PROJECTILE POINTS FROM RIO NUEVO

The projectile point styles recovered during the Rio Nuevo excavations span the Middle Archaic and Early Agricultural periods and fit well with the stylistic and chronological sequence demonstrated for the Tucson Basin by earlier investigations (Sliva 1997, 1998a, 1998b, 1999b, 2005). The earliest contexts at the Congress Street locus (Stratum 504) yielded complete and fragmentary points that are typically associated with the Middle Archaic period to the San Pedro phase of the Early Agricultural period (see Table 10.6). These include three Cortaro points (see Figure 10.1a-c), a fragmentary possible San Pedro blade (see Figure 10.1f), and three non-diagnostic point tips (see Figure 10.1g-i). While these tips are non-diagnostic, their acute angles fit within the ranges of variability for Armijo and Empire points. Two additional points from surface and trench collections are included in Figure 10.1 due to their chronological affinity with the earlier time period—one is an Armijo point (associated with the Middle Archaic period, see Figure 10.1d), and the other is a San Pedro (associated with the San Pedro phase through the Early Ceramic period, see Figure 10.1e). Although the latter two points are not directly associated with the pre-San Pedro occupation of the site, they may have been scavenged from the area by later inhabitants. However, the Armijo-like point, which was collected from a trench wall, may be associated with the pre-San Pedro occupation of Stratum 504.

Table 10.6. Projectile points and other retouched artifacts from pre-San Pedro (Stratum 504) contexts at the Congress Street locus, the Clearwater site, AZ BB:13:6 (ASM).

Context	Field Number	Artifact Type	Figure
Nonfeature, extramural space	7173	Cortaro point base	10.1b
Nonfeature, extramural space	7194	Non-diagnostic Archaic point fragment; distal half of blade with long impact fracture	10.1g
Nonfeature, extramural space	7195	Non-diagnostic point tip fragment	10.1h
Nonfeature, extramural space	7289	Non-diagnostic point tip fragment	N/A
Nonfeature, extramural space	7306	Basal quarter fragment, possibly of Cortaro point	N/A
Nonfeature, extramural space	7469	Non-diagnostic point tip fragment with impact fracture	N/A
Extramural pit Feature 624, fill	7650	Possible San Pedro point blade midsection	10.1f
Pithouse Feature 3371, floor fill	9279	Non-diagnostic point tip fragment	10.1i
Pithouse Feature 3371, floor	9299	Cortaro point basal fragment with impact fracture	10.1a
Pithouse Feature 3359, floor fill	9204	Cortaro point with an impact fracture and possible secondary use as drill	10.1c
Pithouse Feature 3359, floor fill	9234	Complete Stage 1 biface	N/A
Nonfeature, extramural space	7142	Large flake perforator	N/A
Nonfeature, extramural space	7174	Sidescraper	N/A
Nonfeature, extramural space	7241	Fragmentary point preform	N/A
Nonfeature, extramural space	7258	Fragmentary Stage 1 biface	N/A
Nonfeature, extramural space	7310	Fragmentary Stage 4 biface	N/A
Nonfeature, extramural space	7329	Notch	N/A
Nonfeature, extramural space	7336	Large humpback biface	N/A
Nonfeature, extramural space	7385	Denticulated composite scraper	N/A
Nonfeature, extramural space	7597	Fragmentary Stage 1 biface	N/A
Pithouse Feature 516, floor fill	6926	Fragmentary Stage 1 biface	N/A
Extramural pit Feature 622, fill	7641	Fragmentary Stage 2 biface	N/A

Although the assemblage from the Cienega phase occupations at the Congress Street, Mission, and Brickyard loci was not sampled for this study, all points from Cienega phase contexts were analyzed (Table 10.12). Two are the smaller Cienega Short varieties that are generally associated with the Early Cienega phase (Figure 10.3a-b; Sliva 1999a). Most are Cienega Long points, which were produced throughout the Cienega phase (Figure 10.3c-k). Two San Pedro points also came from Cienega phase contexts (Figure 10.3l-m). An additional point included in the figure is a Cienega Flared (Figure 10.3n) recovered from an American Territorial period well. In all, the Cienega phase contexts contained a full suite of point styles known to be associated with the Early Cienega phase occupation of the Santa Cruz floodplain. The absence of Cienega Stemmed points, a subtype exclusively associated with the Late Cienega phase (Sliva 1999a), suggests the excavated Cienega deposits belong to the earlier portion of the phase.

The highest degree of stylistic uniformity is exhibited by the Piman points recovered from Spanish period O'odham contexts (see Figure 10.2a-j; see Table 10.9). All are small, triangular points with moderate-to-deep basal concavities. The lone non-Piman point recovered from these contexts is a broken, partially reworked Cienega Long point produced from Buff's chert (see Figure 10.2k); this point was likely scavenged from the site and modified by later occupants before being discarded.

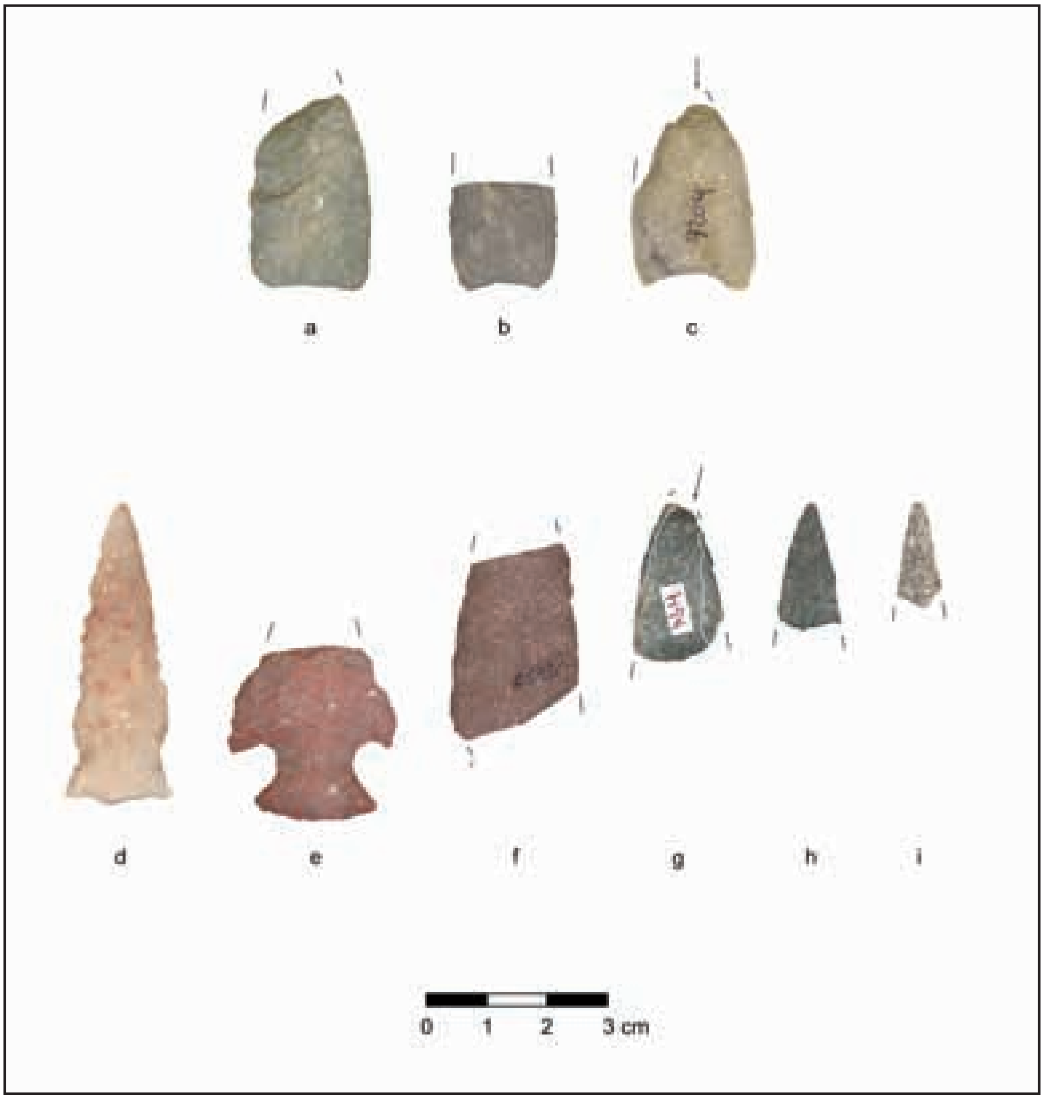

Figure 10.1. Projectile points from pre-San Pedro or unknown period contexts at the Congress Street locus, the Clearwater site, AZ BB:13:6 (ASM): (a-c) Cortaro; (d) Armijo-like; (e-f) San Pedro; (g-i) non-diagnostic tips.

Table 10.7. Technological profiles of assemblages from pre-San Pedro contexts at the Congress Street locus, the Clearwater site, AZ BB:13:6 (ASM), compared with aggregated data from other Early Agricultural period sites in southern Arizona.

			Debitage				Cores[d]			Percent of Tools[e]		
Context	*n*	Tool Percent	Average Size (mm)	Average MI[a]	Percent NC[b]	Percent PRF[c]	Percent	Flakes: Core[d]	Average Size (mm)	Expedient Uniface	Formal Uniface	Biface
Pre-San Pedro phase features	412	2	20.94	0.111	86	74	2	49	60.73	0	0	100
Pre-San Pedro phase extramural space (nonfeature)	1,188	1	21.64	0.122	87	73	1	145	62.61	0	27	73
All pre-San Pedro phase contexts	1,600	1	21.46	0.119	87	74	1	97	61.73	0	18	82
San Pedro phase	19,270	1	23.68	0.108	87	69	1	146	58.38	6	32	62
Early Cienega phase	12,096	3	25.14	0.165	77	58	1	81	60.81	8	36	56
Late Cienega phase	24,076	2	30.97	0.252	76	45	3	35	72.38	12	38	49

Note: Details and references for aggregated phase-level data are available in Sliva 2005:Table 3.11.

[a] Mass index; weight/maximum linear dimension; shatter and debris excluded.

[b] Noncortical debitage.

[c] Potential retouch flake population, including identified bifacial thinning flakes and all other debitage with a mass index no more than one standard deviation greater than the average for identified bifacial thinning flakes from all assemblages in the Desert Archaeology database.

[d] Includes core hammers.

[e] Includes all retouched flake implements; untypable fragmentary artifacts excluded.

Table 10.8. Agua Caliente phase flaked stone artifact class distributions at the Mission Gardens locus, the Clearwater site, AZ BB:13:6 (ASM).

Context	Artifact Class	Total	Percent
Pithouse fill	Debitage	253	96
	Core	7	3
	Uniface	2	1
	Hammer	2	1
Total		264	100
Pithouse floor/ Floor pit	Debitage	8	89
	Core hammer	1	11
Total		9	100
Total		273	100

Table 10.9. Spanish period O'odham flaked stone artifact class distributions at the Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

Context	Artifact Class	Total	Percent
Extramural pit	Debitage	43	84
	Biface	8	16
Total		51	100
Trash concentration	Debitage	95	90
	Core	2	2
	Uniface	1	1
	Biface	7	6
	Core hammer	1	1
Total		106	100
All contexts	Debitage	138	88
	Core	2	1
	Uniface	1	1
	Biface	15	10
	Core hammer	1	1
Total		157	100
Total		358	100

Table 10.10. Projectile points from Spanish period O'odham contexts at the Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

Context	Field Number	Point Type	Figure
Feature 1 (Spanish compound wall)	5025	Piman	10.2a
Feature 64 (trash concentration)	5910	Piman (fragmentary)	10.2b
Feature 64 (trash concentration)	6247	Cienega Long (scavenged)	10.2k
Feature 166 (trash concentration)	6656	Piman	10.2c
Feature 177 (extramural pit)	6555	Piman	10.2d
Feature 178 (extramural pit)	6502	Piman	10.2e
Feature 178 (extramural pit)	6517	Piman	10.2f
Feature 178 (extramural pit)	6515	Piman (fragmentary)	10.2g
Feature 203 (extramural pit)	6604	Piman	10.2h
Feature 203 (extramural pit)	6605	Piman	10.2i
Feature 203 (extramural pit)	6606	Piman	10.2j

Table 10.11. Spanish period O’odham raw material distributions, by context, at the Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

	Total	
Material	Total	Percent
Unspecified fine-grained igneous	35	11
Unspecified medium-grained igneous	23	7
Unspecified coarse-grained igneous	1	<1
Basalt or basaltic andesite	69	22
Fine-grained dacite, lavender to white	3	1
Rhyolite	65	19
Fine-grained ashy gray rhyolite or andesite/black and white phenocrysts	20	
Fine-grained gray rhyolite/black and white phenocrysts	4	
Fine-grained black rhyolite/black and white phenocrysts	4	
Fine-grained Rillito Peak rhyolite ("Rillito Peak jasper")	2	
Fine-grained dark brown rhyolite/white phenocrysts	4	
Fine-grained red rhyolite/black and white phenocrysts	1	
Medium-grained gray rhyolite/white phenocrysts	8	
Medium-grained light brown rhyolite/white phenocrysts	17	
Medium-grained brown rhyolite/black and white phenocrysts	3	
Medium-grained red rhyolite/white phenocrysts	1	
Coarse-grained Rillito Peak rhyolite ("Rillito Peak jasper")	1	
Fine-grained metasediment	14	4
Silicified limestone	3	1
Fine-grained quartzite	20	6
Extremely fine-grained quartzite	16	5
Chert	46	15
Unspecified chert	29	
Buff's chert	17	
Chalcedony	15	5
Jasper	2	1
Quartz	4	1
Other	1	<1
Total	317	100

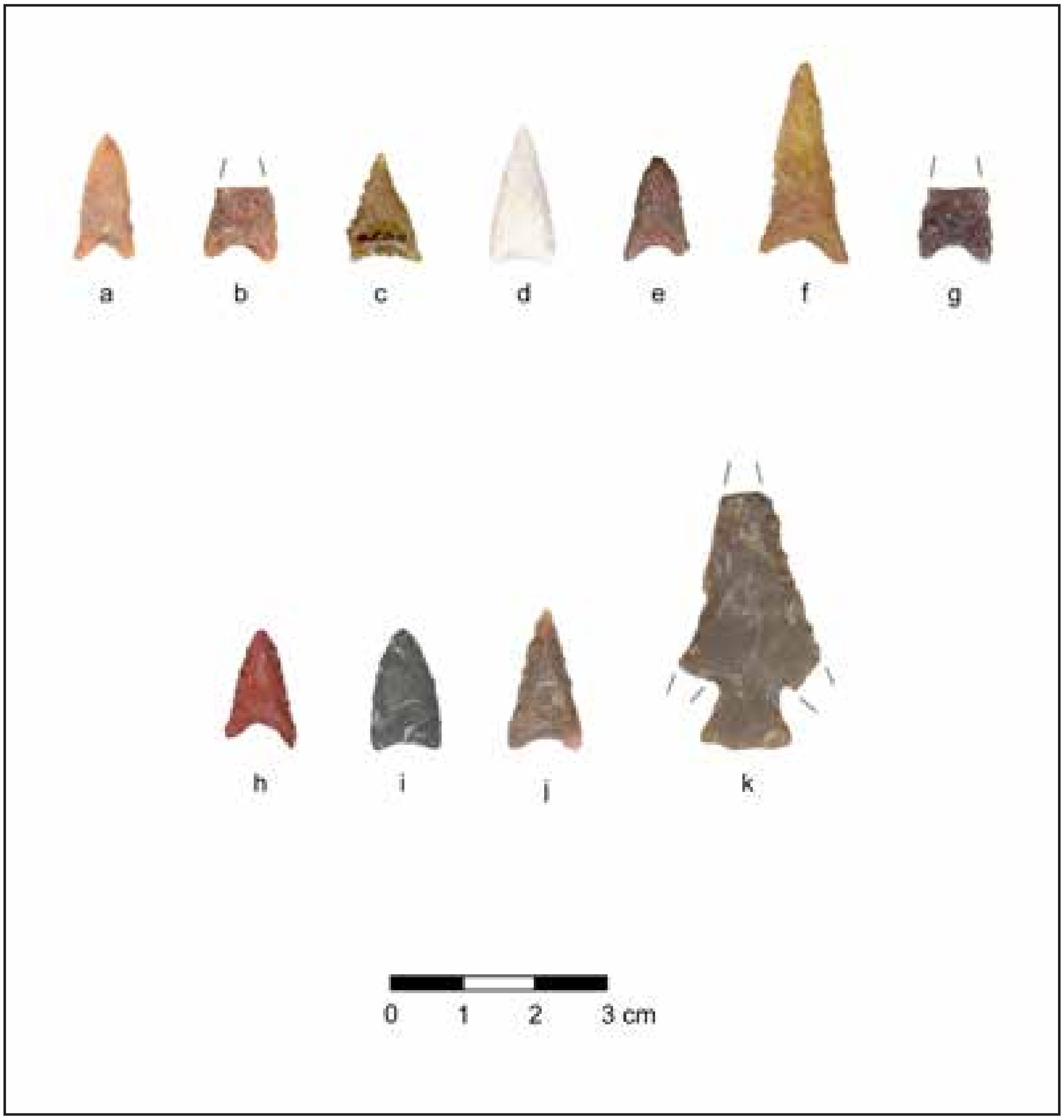

Figure 10.2. Projectile points from Spanish period O'odham contexts at the Mission locus, the Clearwater site, AZ BB:13:6 (ASM): (a-j) Piman; (k) reworked Cienega Long.

Table 10.12. Projectile points and a drill from Cienega phase, American Territorial period, or unknown period contexts at the Mission, Congress Street, and Brickyard loci, the Clearwater site, AZ BB:13:6 (ASM).

Context	Field Number	Date	Point Type	Figure
Feature 3357 (burial)	9329	Cienega phase	Cienega Short	10.a
Feature 3294 (pithouse floor fill)	8912	Cienega phase	Cienega Short	10.b
Sheet trash	8711	Unknown	Cienega Long	10.c
Feature 15 (pithouse floor fill)	5850	Cienega phase	Cienega Long	10.d
Sheet trash	8953	Unknown	Cienega Long	10.e
Feature 3270 (pithouse floor fill)	8761	Cienega phase	Cienega Long	10.f
Feature 15 (pithouse floor fill)	6005	Cienega phase	Cienega Long	10.g
Feature 9372 (pithouse fill)	8421	Cienega phase	Cienega Long	10.h
Feature 3264 (pithouse floor)	8686	Cienega phase	Cienega Long	10.i
Sheet trash	5928	Unknown	Cienega Long	10.j
Feature 3245 (pithouse floor fill)	3245	Cienega phase	Cienega	10.k
Feature 15 (pithouse floor fill)	5988	Cienega phase	San Pedro	10.l
Feature 3262 (pithouse floor fill)	8632	Cienega phase	San Pedro	10.m
Feature 3006 (well)	7749	American Territorial period	Cienega Flared	10.n
Feature 3074 (pithouse floor fill)	7873	Unknown	Drill	10.o

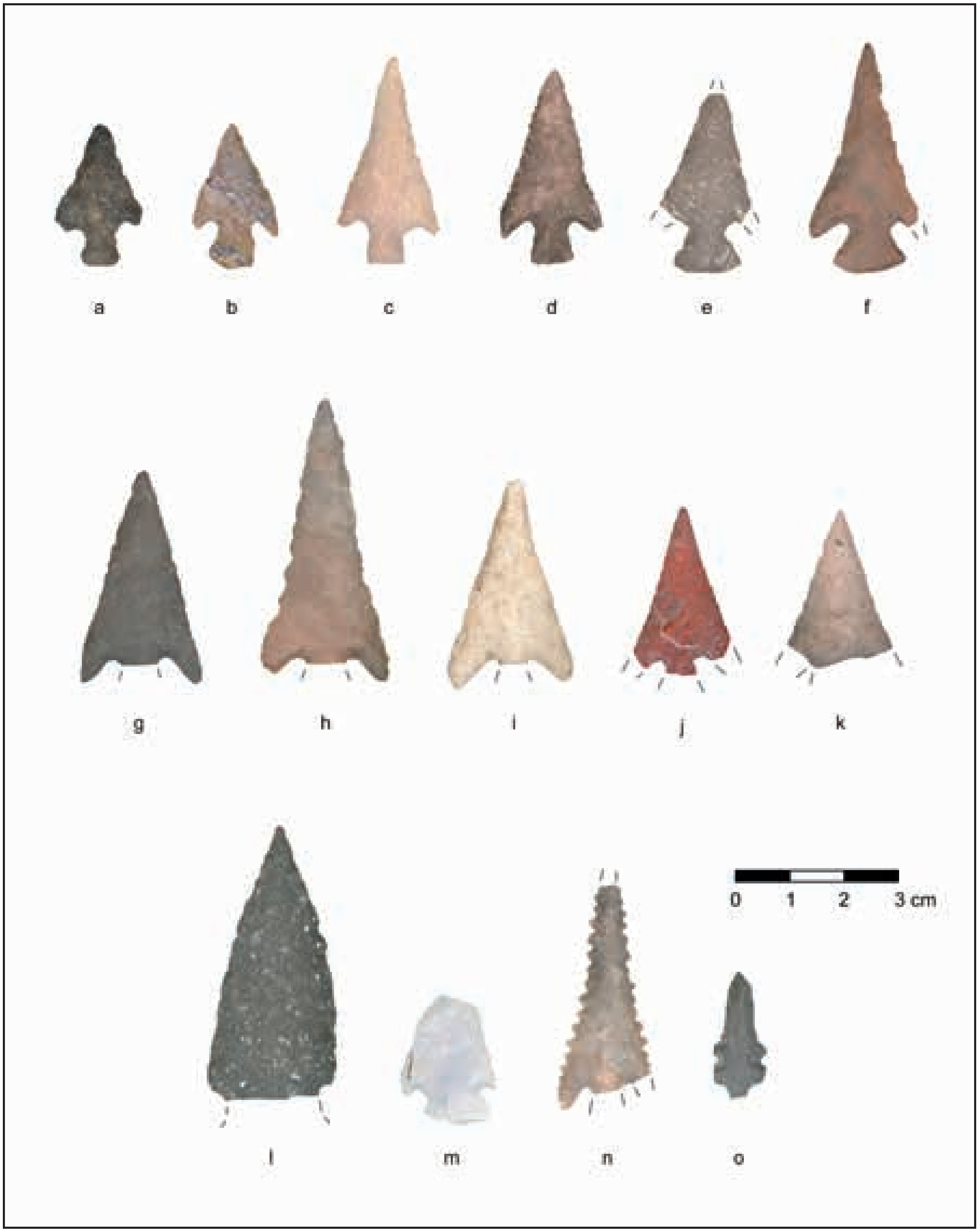

Figure 10.3. Projectile points and a drill from Cienega phase, American Territorial period, or unknown period contexts at the Mission, Congress Street, and Brickyard loci, the Clearwater site, AZ BB:13:6 (ASM): (a-b) Cienega Short; (c-j) Cienega Long; (k) non-diagnostic Cienega; (l-m) San Pedro; (n) Cienega Flared; (o) drill.

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CHAPTER 11

SHELL ARTIFACTS

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Arizona State Museum

Recent excavations at sites within the Rio Nuevo development area in the west-central Tucson Basin—the Clearwater site, AZ BB:13:6 (ASM); the Tucson Presidio, AZ BB:13:13 (ASM); and AZ BB:13:481 (ASM)—resulted in the recovery of an assemblage of 1,366 pieces of shell, estimated to represent approximately 867 individual items. Although much of the collection is dominated by freshwater and terrestrial mollusks, a number of marine specimens are also present. This collection reflects an occupation that extends back to the Early Agricultural period, and that continued intermittently into recent historic times. The specific contexts and temporal associations of the shell material are provided in Appendix A (Table A.1).

METHODOLOGY

The procedures and analytical criteria utilized during this analysis have been described in other publications about Early Agricultural period shell assemblages (Vokes 1998a, 2001a). Definitions for specific terminology related to the structural elements of shell can be found in the glossaries available in most malacology guides, and figures illustrating these elements and their associated nomenclature have been published previously (Vokes 1984, 1986).

The artifact classification structure used in this analysis is based largely upon the system presented by Haury (1937, 1976). The nomenclature and biological determinations were made in accordance with Keen (1971); additional information was obtained from Abbott (1974). The freshwater and terrestrial pelecypods and gastropods were identified through the use of several guides, particularly Bequaert and Miller (1973), Abbott (1989), and Cheatum and Fullington (1971).

GENERA AND SPECIES

Two general sources of shell were available to the inhabitants of southern Arizona during the Prehistoric era. The first of these sources is the marine communities along the coasts of California and northwestern Mexico; the other sources are the streams and rivers that drain the region. These streams and rivers contained populations of freshwater mollusks. Finally, terrestrial snails also inhabit the region, and while these are present in the current sample, they do not appear to have been purposely collected. In the Historic era, the possible sources for shell—particularly marine material—increased substantially with the introduction of new and exotic markets and populations. This is particularly true after the railroad came to Tucson in 1880.

The species of shell identified in the current collection are summarized in Table 11.1. The Gulf of California clearly provided most of the marine material. Although substantially more numerous in frequency, the types of marine pelecypod genera represented in the collection are somewhat fewer as compared with gastropods. This is largely the result of an emphasis on four different genera, each of which served a somewhat different role in the local economy over the temporal span of the occupation. *Glycymeris* is primarily associated with one artifact form, the shell bracelet, which is one of the most common ornaments recovered from Hohokam sites. *Spondylus* and/or *Chama* were extensively utilized in the creation of cut beads during the preceding Early Agricultural period. In contrast, *Ostrea* (oysters) were consumed as a delicacy after the railroad linked the Tucson area with the coast, providing a relatively safe means to ship these shellfish to the interior communities.

Laevicardium elatum, which is the most numerous species of this genus in the current material, is found in both of the Pacific biotic communities present along the western coast of North America. However, it has a limited range in the colder waters off the coast of California, where it extends only as far north as San Pedro, California (Abbott 1974:486). Further, it does not appear to be as common in these colder waters as it is in the warmer Panamic province, and it does not appear to have been extensively used by the native populations of southern California (Gifford 1947). Therefore, it seems likely that most, if not all, of the *Laevicardium* recovered from the prehistoric occupation originated from the Gulf of California. This pattern of dominance of Gulf species is also seen among the gastropods identified in the sample. With one exception, all the marine gastropods in the assemblage have species endemic to the warmer tropical environment of the Panamic Province.

Table 11.1. Shell species recovered during the Rio Nuevo Archaeology project excavations.

Species	Minimum Number of Individuals	Number of Identifiable Specimens	Province	Common Name
Marine species				
Pelecypods				
Glycymeris				
Glycymeris sp.	11	13	Gulf of California	Bittersweet
Glycymeris gigantea	24	27	Gulf of California	Giant bittersweet
Laevicardium				
Laevicardium elatum	18	19	Gulf of California and California coast	Giant Pacific egg cockle
Lavecardium elenense	2	4	Gulf of California	–
Pecten				
Pecten sp.	1	1	–	–
Pecten vogdesi	1	1	Gulf of California	Scallop
Argopecten circularis	3	4	Gulf of California	Calico scallop
Dosinia				
Dosinia sp.	3	3	Gulf of California	Dosinia
Dosinia ponderosa	1	1	Gulf of California	Ponderous dosinia
Pteria/Pinctada	2	3	California Coast and Gulf of California	Wing oyster/Pearl oyster
Trachycardium				
Trachycardium sp.	6	8	Gulf of California	Cockle
Trachycardium panamense	6	6	Gulf of California	Panama cockle
Spondylus sp.	2	2	Gulf of California	Thorny oyster
Chama sp.	7	7	Gulf of California	Jewel box
Spondylus/Chama	58	69	Gulf of California	–
Ostrea sp.	34	62	All	Oyster
Chione sp.	4	4	All	–
Megapitaria sp.	2	2	Gulf of California	Clam
Protothaca				
Protothaca sp.	2	2	Gulf of California	Littlenecks
Protothaca grata	1	2	Gulf of California	Beaded venus
Spisula sp.	1	1	All	Surf calm
Unidentified	15	16	–	–
Gastropods				
Olivella				
Olivella sp.	5	5	Gulf of California	Dwarf olive
Olivella dama	7	7	Gulf of California	Dama dwarf olive
Conus perplexus	1	1	Gulf of California	Puzzled cone
Turritella				
Turritella sp.	1	1	Gulf of California	Turret-shell
Turritella leucostoma	6	6	Gulf of California	Turret-shell
Cerithium stercusmuscarum	1	1	Gulf of California	Pacific fly-specked cerith
Columbella strombiformis	1	1	Gulf of California	Dove shell
Theodoxus luteofasciatus	2	2	Gulf of California	Painted nerite

Table 11.1. Continued.

Species	Minimum Number of Individuals	Number of Identifiable Specimens	Province	Common Name
Turbo sp.	1	1	Gulf of California	Turban shell
Tegula sp.	1	1	–	Tegula
Acanthina tyrianthina	6	6	Gulf of California	Rock-shell
Strombus granulatus	1	1	Gulf of California	Granulated conch
Crucibulum spinosum	2	2	California Coast and Gulf of California	Spiny cup-and-saucer
Acmaea sp.	5	5	California Coast and Gulf of California	Limpet
Haliotis				
Haliotis sp.	1	1	California Coast	Abalone
Haliotis rufescens	4	4	California Coast	Red abalone
Unidentified marine univalve	4	4	–	–
Unidentified nacreous	1	2	–	–
Unidentified shell	1	1	–	–
Freshwater				
Pelecypods				
Anodonta californiensis	280	700	–	California floater
Gastropods				
Physa virgata	7	8	–	–
Helisoma sp.	318	342	–	–
Ancylidae (freshwater limpets family)	2	2	–	Freshwater limpets
Terrestrial				
Gastropods				
Succinea sp.	4	4	–	–
Unidentified nacreous shell	1	1	–	–
Total	867	1,366		

The exception to this emphasis on the tropical marine environment is *Haliotis*, or abalone. In North America, these mollusks occur only in the colder waters off the Pacific coast, although the range of several species of *Haliotis* extends along the outer, western coastline of the Baja peninsula. Nacreous shells belonging to this genus were extensively used by the native populations along the California coast, and they were also commonly exchanged with populations inhabiting the interior regions of the Great Basin and the Southwest. Beads and ornaments manufactured from abalone have been reported from numerous Archaic period sites in the Great Basin region (Bennyhoff and Hughes 1987), as well as from Arizona and southern Utah (Lindsay et al. 1968; Vokes 1998a, 1998b, 2001a).

The second general source for shell includes the rivers and streams that cross the region. For the inhabitants of the western Tucson Basin, the most reliable of these was the Santa Cruz River, which passes a short distance from the eastern slope of the Tucson Mountains. This river, which is characterized by intermittent surface flow today, would have—in prehistoric times—provided a reliable supply of freshwater as the volcanic rock base of the A-Mountain area pushed the water to the surface. Under these conditions, the river would probably have been a convenient source for freshwater shellfish and other aquatic resources.

Anodonta californiensis is a moderately large, although very gracile bivalve, endemic to most of the permanent watercourses in Arizona prior to the impoundment of the rivers that occurred early in the last century (Bequaert and Miller 1973:220-223). Its presence in considerable quantities in prehistoric sites that occur along the Salt and other Arizona rivers has lead to the suggestion that some prehistoric populations may have exploited this shellfish as a food resource, as well as a raw material for the local artisans (Haury 1976:308; Howard 1987:77, Vokes 1988:373). However, *Anodonta* has been comparatively rare in the assemblages from sites in the Tucson Basin. This may, however, have more to do with the dynamics of streamflow and the availability of surface water. Excavations of American Territorial period contexts associated with the Tucson Urban Renewal project in central Tucson provided evidence that this shellfish was consumed by the Chinese population in the late nineteenth and early twentieth centuries (Bequaert and Miller 1973:221; Lister and Lister 1989:Figure 3.35).

The presence of freshwater and terrestrial gastropods (see Table 11.1) in the current assemblage is likely fortuitous. *Helisoma*, one of the most widely distributed aquatic gastropods, appears to prefer slow-moving bodies of water (Bequaert and Miller 1973:108-109) such as the canal channels that crossed the project area. Although the shell is relatively large in comparison with other local gastropods, it is also very fragile. Fragments are often recovered from stream-associated debris. It could have been accidentally introduced into cultural features through the harvesting of streamside plants or from scooping sediments of the river for plastering of houses. The high number and variety of sizes of *Helisoma* in a local well (Feature 4 in the Mission locus, Clearwater site) may represent the presence of a living population within its pool.

Succinea, a terrestrial snail, is generally characterized as favoring moist, well-vegetated areas along the edges of marshes and streams. However, some members of this genus have been shown to sustain themselves for periods of time in relatively xeric conditions (Shimek 1935:6-10). Most of the current specimens were probably fortuitously introduced into the site environment, although some of these gastropods could also reflect endemic populations living along the canals that crossed the area or among the cultural middens created during the occupations.

THE ARTIFACT ASSEMBLAGE

The artifact forms present in the current collections are summarized in Table 11.2. These include finished artifacts, specimens in the production process, and complete unmodified valves, as well as fragmentary material that are either worked in some manner, or that are unmodified.

Finished Shell Artifacts

In terms of numbers, beads, principally cut forms, largely dominate the collection of finished artifacts. There are also a number of whole shell and cut pendant forms, bracelets, and a limited number of other types of ornaments.

Beads

The current collection has a total of 84 shell beads, 65 of which are cut forms, such as disk and bead pendants that are present in roughly similar quantities within a limited number of contexts. Whole shell forms represent a second, less prevalent, group of beads.

Whole Shell Beads. Two different approaches are used for suspending whole shell beads. Most of those recovered from the Rio Nuevo excavations are simple spire-lopped bead forms (Figure 11.1a-b), in which the apex of a gastropod's shell is ground or broken away, and the interior columella structure is sufficiently cleared away to permit the passage of the cord. The other technique for perforating whole shell beads is to punch or grind a hole through the back of the body whorl (see Figure 11.1c-f) so that the cord passes through it and out the natural aperture. Perforated in this manner, the bulk of the shell will be suspended below the cord, which has lead some researchers to group these with whole shell pendants. These are referred here to as beads due to their size, and further, when found in burials, they tend to be in multiple sets, often as bracelets or anklets.

Cut Shell Beads. These are forms in which the shell is modified to such an extent that the original shape of the valve is essentially immaterial to the finished product. While the shell is used as a medium for creating the bead, the decorative value is derived from the manufactured form of the bead, along with the color and texture of the wall of the shell. Sixty-five cut shell beads were recovered during the current excavations; 29 are disc beads, and an additional 36 specimens are bead pendants, or what Haury (1937:141, 1976:310) termed "ground" bead pendants.

The cut beads were concentrated in three mortuary deposits located in the Congress Street locus of the Clearwater site. Two of the inhumations, Features 574 and 603, probably dated to the Cienega phase, contained disk beads made from *Chama* or *Spondylus* shell. The single disk bead not from a mortuary context was recovered from a Cienega phase pithouse (see Figure 11.1g). This was also the only bead cut from a nacreous shell, probably *Pteria* or *Pinctada.* All of the bead pendants—also manufactured from *Chama* or *Spondylus* shell—were recovered from a Cienega phase inhumation, Feature 605, where they appear to have comprised a single strand that was placed around the neck of the individual.

Table 11.2. The Rio Nuevo collection, summarized by genus and artifact form.

	Finished Artifact Forms																		Manufacturing Evidence				Fragmentary Material			
	Beads				Pendants									Bracelets			Other		Artifacts in Process							
		Cut Forms				Cut Forms									Decorated											
						Life Forms		Geometric Shapes																		
Genus	Whole Shell	Disk	Claw	Cap	Whole Shell Pendant	Zoomorphic, Unknown	Pelican/Heron	Washer	Rectangular	Triangular	Other Geometric	Cut, Unknown Form	Unknown Form	Plain Bracelet	Bracelet, Marginal Nicking	Carved Bracelet, Frog	Plain Ring Pendant	Geometric, Curvilinear	Geometric Pendant	Cut Pendant, Unknown Form	Plain Bracelet	Carved Manufacturing Debris	Worked, Unknown Form	Unworked	Whole Valve	Total
Marine																										
Pelecypods (bivalves)																										
Glycymeris	–	–	–	–	–	1	–	–	–	–	–	–	–	29	1	1	1	–	–	–	1	–	–	1	–	35
Laevicardium	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	2	1	–	–	–	16	–	20
Pecten	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	1	–	2
Pectinidae (cf. *Argopecten*)	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	3
Dosinia	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4	–	4
Pteria/Pinctada	–	1	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	2
Trachycardium	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	12	–	12
Spondylus/Chama	–	25	32	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	58
Spondylus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	–	2
Chama	–	3	4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	7
Ostrea	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	34	–	34
Chione	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4	–	4
Megapitaria	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	2
Protothaca	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	–	3
Spisula (surf clams)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1
Unidentified marine bivalve	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	14	–	15
Gastropods (univalves)																										
Olivella	12	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	12
Conus	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Turritella	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	2	7
Cerithium	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Columbella	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Theodoxus	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
Turbo	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1
Tegula	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
Strombus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
Crucibulum	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	2
Acmaea	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	4	5
Haliotis	–	–	–	–	–	–	–	–	1	–	1	–	–	–	–	–	–	–	–	–	–	–	2	1	–	5
Acanthina	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	6	6
Unidentified marine univalve	1	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	4

Table 11.2. Continued.

	Finished Artifact Forms																		Manufacturing Evidence				Fragmentary Material			
	Beads				Pendants									Bracelets			Other		Artifacts in Process							
		Cut Forms				Cut Forms									Decorated											
						Life Forms		Geometric Shapes																		
Genus	Whole Shell	Disk	Claw	Cap	Whole Shell Pendant	Zoomorphic, Unknown	Pelican/Heron	Washer	Rectangular	Triangular	Other Geometric	Cut, Unknown Form	Unknown Form	Plain Bracelet	Bracelet, Marginal Nicking	Carved Bracelet, Frog	Plain Ring Pendant	Geometric, Curvilinear	Geometric Pendant	Cut Pendant, Unknown Form	Plain Bracelet	Carved Manufacturing Debris	Worked, Unknown Form	Unworked	Whole Valve	Total
Unidentified marine, nacreous	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1
Unidentified marine shell	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1
Freshwater																										
Pelecypods (bivalves)																										
Anodonta	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	–	–	–	–	–	–	1	5	272	–	280
Gastropods (univalves)																										
Physa	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	5	7
Helisoma	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	25	293	318
Ancylidae (freshwater limpets)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	2
Terrestrial																										
Gastropods (univalves)																										
Succinea	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	3	4
Unidentified nacreous shell	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1
Total	18	29	36	1	3	1	1	1	1	1	2	2	1	29	1	1	1	1	2	1	1	2	7	406	318	867

Figure 11.1. Examples of shell artifacts recovered from the Rio Nuevo excavations, the Clearwater site, AZ BB:13:6 (ASM).

Other Bead Forms. The only other shell bead present in the current sample is a single example of a "cap" bead (see Figure 11.1h). This type of bead is formed from the middle and lower portions of the spire of a medium-sized univalve, where the body of the shell whorl and the apex of the spire are completely removed. The shell here appears to have been either a *Conus* or *Oliva* valve. Beads of this style were reportedly used in a necklace that was recovered from a burial associated with a late Classic site along the San Pedro River (Carpenter 1977). Carpenter (1977) noted that the cap bead form could be the product of natural polishing and surface reduction from beach wear. The current specimen was recovered from the fill of a historic-era well at the Mission locus of the Clearwater site, and it may be an example of this natural process, because all the edges, including the interior structure, are rounded and polished.

Pendants

Like beads, several styles of pendants were present in the current collection. The simplest are whole shell pendants that rely on the natural shape and coloration of the shell to provide the decorative elements. These are distinguished from beads on the basis of size and the fact that they are usually recovered as single occurrences, sometimes associated with other styles of beads. The majority of the carved pendants were geometric forms (see Figure 11.1j-m), with rectangular shapes the most common. The only life form represented as a pendant is a fragment of a bird with an elongated body (see Figure 11.1i), possibly a representation of a heron or other water bird. The fragment retains the lower portion of the body and the legs, which are shown as a simple extension projecting behind the body. The feathers of the bird are indicated by a series of shallow notches cut into the back. This specimen was recovered from the upper fill of a Cienega phase pithouse, although it may represent an intrusion from the later Hohokam occupation, because zoomorphic pendants have not been previously reported in assemblages associated with the Cienega phase. Similar pendants are, however, known from later Hohokam collections. A fragment of a second, possibly similar, zoomorphic pendant was recovered from Feature 308, a floor pit within a Hohokam pithouse dating to the Cañada del Oro phase (A.D. 750-850); however, it is too fragmentary to be certain of the form represented.

A number of fragments representing at least three other pendants were recovered during the excavations. These are too fragmentary to permit identification of their form. In each instance, a portion of the perforation is a visible indication that the piece is a segment of a pendant, but the perimeter margin is largely missing. One of these is a small sliver of a *Pecten* shell. The others were produced from nacreous shells—one of *Anodonta* and another of *Pteria* or *Pinctada*.

Bracelets

The 31 finished bracelet fragments in the current collection are primarily a plain style, in that they are not embellished beyond what was required to fashion the basic form. The exceptions include a band that is decorated with notches cut into the ventral edge and an example in which the umbo is carved into the likeness of a frog or toad.

Plain Bracelets. Twenty-nine bands are considered to be plain bracelets. All specimens are fragmentary, with the largest representing slightly more than half of the original band. Roughly one-quarter of the band segments incorporated portions of the dorsal margin, but only four retained portions of the umbo and beak areas. In all cases, the umbones essentially retained their natural form, but were perforated. Haury (1976:313) suggests such perforations of the umbo may have been to provide a point of attachment for small objects, such as feathers, which would hang below the band as tassels.

The exterior faces of 17 bands are ground back to artificially steepen the natural curvature of the shell. The intention appears to have been to give band a nearly flat, vertical face when viewed on the arm. There is considerable range in the width of the bands, with specimens ranging from a narrow 3.37 mm, to a maximum of 10.27 mm, with the majority falling between 4 mm and 6 mm.

Decorated Bracelets. Two bracelets in the sample exhibit decorative treatments that were intended to embellish the bracelet. The simplest of these is a section of the ventral margin from a bracelet that was decorated by cutting shallow notches along the exterior margin (see Figure 11.1n). The exterior surface is ground with a faceted profile so that the lower portion of the exterior surface forms a short vertical face at the margin. The adjacent underside of the margin edge is also ground smooth. Five shallow notches are cut into the lower edge as if to emulate the natural crenellations that were present along the margin prior to grinding the vertical face. The execution of these notches is somewhat variable, and they are unevenly spaced.

The other decorated specimen is a fragment in which the band is plain but the umbo area is carved into a realistic representation of a frog or toad (see Figure 11.1o). It is carved so that the head is directed toward the margin, with the beak forming the nose. No effort was made to show detail of the features of the head. The legs are depicted drawn up to the body as if the animal were at rest, but ready to leap.

Ring Pendants

A single fragment of a plain ring pendant (see Figure 11.1p) was recovered. It is manufactured from a medium-sized—probably juvenile—*Glycymeris* shell. The segment, which is approximately one-third of the band, incorporated the ventral margin of the shell. The exterior surface was ground back to form a vertical face similar to that present on many of the bracelets. The band was similar in finish and has a comparable band width (4.35 mm). The estimated diameter of the interior aperture—approximately 16 mm—made it relatively small in overall size.

Evidence in the form of in situ deposits associated with inhumations indicates these bands were used in several different ways, including finger rings and pendants or earrings. Fewkes (1896) first reported on their use as finger ornaments, while Di Peso (1956:91-92) described several inhumations at Paloparado, AZ DD:8:12 (ASM), that had "rings" in the area of the neck, as well as on the fingers of some individuals. The presence of specimens beside the cranium of a burial in the Tonto Basin (Vokes 2001c:389) supports their use as earrings. This leads to the conclusion that these bands are multifunctional ornaments. The term "ring-pendant" (Urban 1981:317) has been suggested as an inclusive descriptive label for this artifact form.

Other Cut Shell

A relatively small, serrated disk of nacreous shell was recovered in a Cienega phase burial context. The disk, which measures 11.84 mm across, has 28 closely spaced notches cut into the perimeter. There is no evidence to suggest any intention to perforate the disk. Rather, this specimen may have been an ornamental embellishment on some larger object to which it was attached with an adhesive.

Manufacturing Evidence

Evidence indicating that local artisans supplied some of the demand for the shell ornaments is found in three different, but related forms: ornaments in the manufacturing process, waste and debris by-products of the manufacturing activity, and whole shells that may represent raw material.

Artifacts in Process

Four specimens were recovered that seem to be ornaments still in the process of being manufactured. All but one are carved pieces of *Laevicardium* that appear to be pendants in various stages of production (see Figure 11.1q-r). Each of these pendant blanks has been shaped by grinding, but with varying degrees of finish to the edges. One of these blanks has a somewhat beveled edge around the perimeter, with a shallow drilled depression that may be an initial attempt to perforate the specimen.

The fourth unfinished artifact is a segment of a plain bracelet band in the final stages of being shaped and ground (see Figure 11.1s). The exterior surface retained much of the natural slope and seems to be largely unmodified, while the interior surface was flaked to shape, but had yet to be ground and finished.

Manufacturing Debris

In addition to the unfinished specimens, two deposits contained pieces that appear to be debris resulting from local manufacturing efforts. One of these is a group of *Anodonta* fragments, several of which have roughly cut edges resulting from carving the shell while it was still relatively fresh. Due to its fragile nature, this shell must be cut and ground while the shell is still somewhat green and malleable. The other piece of debris is an irregular-shaped segment of a very pitted *Spondylus* shell whose white interior mantle is scored and slightly flattened from surface abrasion.

Whole Valves

Most of the whole shells encountered during analysis of these materials are freshwater gastropods that are probably incidental to the cultural activities conducted in the area. Many were, in fact, recovered from the deposits associated with the various canals that crossed the project area, or from a historic-era well. However, there are 15 whole marine shells (see Figure 11.1t-x), as well as a number of large fragments. While some of these may represent raw material for local artisans, others look to be the product of an inquisitive collector. Perhaps the best example of the latter is the complete *Strombus granulatus* (see Figure 11.1u) that was recovered from Feature 310, a small pit associated with the Territorial period occupation at the Art Museum locus of the Tucson Presidio. The shell, which retains much of its natural gloss and coloration, is unknown from prehistoric contexts. In contrast, the *Turritella* shells (see Figure 11.1t) are possible examples of raw material for local artisans. Pendants made of this shell are not uncommon, with two examples in the current collection. Unfortunately, the current whole shells were recovered from general fill and cannot be associated with any specific period of the occupation. As with the *Strombus*, these two specimens retained much of their natural coloration, which might suggest they were also recent acquisitions.

Fragmentary Material

Shell fragments that, while worked, are too incomplete to be classified, or that lack any evidence of having been worked, are often encountered in archaeological assemblages. These remnants may be derived from fragmentation of finished artifacts or whole shells, or through local manufacturing activities. As discussed, some limited evidence indicates the presence of low levels of on-site production; however, given the number of finished objects in the collection, much of this material probably derived from breakage of finished artifacts and whole shells.

Worked Fragments

It is not uncommon to find worked fragments of artifacts that, due to the lack of diagnostic features, cannot be attributed to a specific artifact category. These fragments characteristically have one or two worked facets or edges, indicating they may have originally been part of a finished object, but are too incomplete to permit identification of their original form. Those fragments in which the edges are clearly not finished, have rough cuts, and so forth, have been incorporated into the manufacturing discussion. Seven pieces of shell with finished edges or polished surfaces were found, but these are too fragmentary to determine their original form. Much of this material is the local freshwater *Anodonta* and could be derived from either finished objects or efforts to work the shell.

Unworked Fragments

In contrast with the relatively few fragments that are worked but whose form is uncertain, over 406 unmodified fragments were recovered. Most (nearly 67 percent) are pieces of *Anodonta*, with the second-most common genus being *Ostrea* (oysters), with 34 fragments. Therefore, the two most common unmodified shells are genera that are known to have had potential dietary roles in the community.

The widespread distribution of unmodified fragments of *Anodonta californiensis* shells across the project area and over the span of the occupation suggests it was primarily used as a food resource rather than as a medium for shell artifact production. As food, it would have served as a dietary supplement rather than as a primary source of animal protein and caloric intake. Data on the nutritional value of freshwater mussels supplied by Parmalee and Klippel (1974:432) indicates shellfish were a relatively poor source of food energy and that they "contain far fewer calories per given unit than provided by most other meat animals." The presence of a large number of individuals in the fill of Feature 4 at Clearwater, a well associated with the American Territorial period occupation of the Mission Gardens locus, indicates the local consumption of this shellfish. Unlike *Helisoma*, which was also present in large quantities, *Anodonta* could not have thrived in the pool of the well, because it requires the presence of fish during the early part of its lifecycle. Thus, the fragments in the deposit likely represent shellfish that were collected from the nearby river, eaten, and the waste discarded into the well.

The oysters are limited to the Historic era—principally to the time after the arrival of the railroad in 1880—because it was only with the ability to move perishable cargo by insulated railcars that were packed with ice, that the shellfish could be supplied to interior markets such as Tucson. The three pieces reported from a Spanish period context were in the upper level of an extramural pit, Feature 373, and are likely intrusive to the deposit. All oysters are technically edible, and several species were actively harvested and shipped to markets. A number of oyster species inhabit the coastal waters off western North America, including several from the warm Panamic waters of the Gulf of California. In addition to the native species, the Eastern oyster (*Crassostrea virginica*) was also available to western markets. Beginning in 1870, shipments of seed oysters from the East coast were received in San Francisco, California, where they were laid out in beds within the bay and allowed to mature (Bonnot 1935:67). Once grown, these Eastern oysters were harvested and sold.

The remaining unmodified fragments of marine shell are dispersed among a number of features that represent both the Prehistoric and Historic era occupations. The prehistoric subset includes genera that are well represented among the finished artifacts in the collection, such as *Laevicardium* and *Spondylus*. Other genera, like *Crucibulum* and *Trachycardium*, while not represented among the current selection of ornaments, are known to have occurred in other Prehistoric era assemblages. The material historic-era occupation also includes familiar genera; however, some material that is unique in the collection is also present. These include fragments of *Spisula* (surf clams) and *Megapitaria.*

DESCRIPTIVE SUMMARY

The current collection represents a series of occupations that, in their totality, extended over several millennia. The diversity of the shell assemblage reflects changes in use and ornamental repertoire associated with these occupations. Like other Cienega phase assemblages, the material associated with occupations of earlier times emphasized various styles of beads and geometric pendants. During the later Hohokam period, *Glycymeris* bracelets—which were not present in the prior assemblage—were, by far, the most common artifacts. In the Historic era, there is considerable diversity of genera present in the deposits, but few are worked, suggesting these may have been collected for other reasons. It is during the late nineteenth century that many individuals became interested in amassing natural history collections. That much of the historic-era marine shell is intact, unmodified valves may reflect this collecting behavior.

DISCUSSION

The shell artifacts recovered from recent excavations within the Rio Nuevo development area in the west-central Tucson Basin reflect an occupation that began as early as the Cienega phase, and continued intermittently into recent historic times. Following is a brief summary of the patterns observed in the data, with respect to time and space.

The assemblage was recovered from various loci within two sites, one west of the Santa Cruz River and the other east of the river. Most of the prehistoric occupation is found in the western complex, the Clearwater site, with deposits related to the Early Agricultural period and the subsequent Hohokam periods distributed in the Congress Street, Mission, and Mission Gardens loci. The Tucson Presidio site east of the river also has evidence of prehistoric occupations, although that information is currently limited. In the Historic era, both areas were occupied, although the nature of these occupations was different. These differences are reflected in certain aspects of the shell material associated with the respective occupations.

The entire assemblage is summarized without regard to temporal or special association in Table 11.1. The temporal associations and specific contexts are provided in Appendix A (Table A.1), and the temporal associations are summarized in Table A.3. The collection is dominated by a high incidence of freshwater and terrestrial shell, predominately the freshwater pelecypod *Anodonta* and the freshwater snail *Helisoma.* Occurrences of the freshwater and terrestrial gastropods are probably incidental to the cultural activities of the local inhabitants, although the contexts associated with their distribution are often cultural features such as the canals and wells. In contrast, the distribution of the freshwater bivalve *Anodonta* suggests this shellfish was, at times, actively collected and consumed by some of the local population. The rest of the assemblage is comprised of marine shell, representing 22 different genera, many of which are fashioned into finished artifacts. Some specimens are also still in the production process, and in some cases, the marine material is present as complete unmodified shells.

Cienega Phase Shell

The initial occupation of the project area is represented by the shell material recovered from contexts associated with the Cienega phase centered in the Mission, Brickyard, and Congress Street loci, which are situated west of the Santa Cruz River. The shell material from this phase is associated with both mortuary and non-mortuary contexts. While the non-mortuary material is widely scattered in the site loci, the shell associated with burial contexts was relatively concentrated.

The collection (Table 11.3) is relatively typical of the phase in that there are several styles of shell beads—both whole shell and cut forms—and a number of cut shell pendants. There are also no shell bracelets associated with these deposits. The pendants are primarily geometric shapes, with rectangular forms somewhat more common. There is one representation of a bird in the sample, which is unusual because zoomorphic forms are unknown in other contemporary assemblages. This style of bird effigy, however, is well known from later Hohokam assemblages. The current specimen was recovered from the upper fill of a structure, Feature 3323, in the Brickyard locus, and may be intrusive to the deposit, as there is a later Hohokam occupation overlying the Cienega phase deposits in this portion of the site.

Styles of beads that have been recovered from other Early Agricultural period sites in the basin are absent, particularly the square/rectangular forms and the ring beads (Vokes 1998a, 1998b, 2005, 2006). Their absence may reflect the small size of the current sample, as only one cut bead was recovered from non-mortuary contexts and the mortuary sample was concentrated in a few deposits that were spatially confined within the community.

The mortuary sample is comprised of 64 beads and one piece of nacreous shell that is carved into a serrated disk shape. These artifacts are associated with three inhumations within the Congress Street locus. The temporal association of one deposit, Feature 574, is somewhat uncertain, although it probably dates to the Cienega phase. The other two, Feature 603 and Feature 605, are attributed to the Cienega phase.

Feature 574 is the remains of an infant that appears to have had six disk beads placed with the body. The beads were cut from the back of either *Spondylus* or *Chama* shells. Unfortunately, the remains were so ephemeral that it was impossible to determine the nature of the burial or the placement of the shell beads with respect to the body. The lack of physical remains makes it difficult to determine the temporal association of the grave, but the stratigraphic context indicates a Cienega phase age.

Table 11.3. Shell artifacts from the Rio Nuevo excavations, summarized by temporal association.

	Prehistoric					Historic					Total
	Early Agricultural	Ceramic					Euro-American				
Artifact Form	Cienega Phase	Late Agua Caliente	Hohokam	Protohistoric	Prehistoric, Unknown	Spanish/Mexican Period	American Territorial Period	American Statehood Period, Unspecified	Euro-American, Unknown	Unknown Association	
Finished artifacts											
Beads											
Whole shell	4	–	1	–	–	3	2	–	1	7	18
Cut bead forms											
Disk	23	–	–	–	6	–	–	–	–	–	29
Bead pendants	36	–	–	–	–	–	–	–	–	–	36
Cap bead	–	–	–	–	–	–	1	–	–	–	1
Pendant											
Whole shell	–	–	–	–	–	–	1	–	1	1	3
Cut pendants											
Zoomorphic	1	–	1	–	–	–	–	–	–	–	2
Geometric	3	–	–	–	–	–	–	–	–	2	5
Unknown	2	–	–	–	–	–	–	–	–	1	3
Bracelets											
Plain	–	3	10	1	–	1	5	–	–	9	29
Decorated											
Marginal nicking	–	–	1	–	–	–	–	–	–	–	1
Carved umbo, frog	–	–	1	–	–	–	–	–	–	–	1
Plain ring pendant	–	–	–	–	–	–	1	–	–	–	1
Other cut shell, geometric	1	–	–	–	–	–	–	–	–	–	1
Manufacturing evidence											
Artifacts in process											
Cut pendant in process	–	–	1	–	–	–	–	–	–	2	3
Bracelet in process	–	–	1	–	–	–	–	–	–	–	1
Carved shell debris	1	–	1	–	–	–	–	–	–	–	2
Fragmentary material											
Worked fragments, unknown form	–	–	4	–	–	–	2	–	–	1	7
Unworked fragments	11	–	15	2	3	10	247	3	10	77	378
Whole shells	1	–	–	–	–	–	11	1	–	2	15
Total	83	3	36	3	9	14	270	4	12	102	536

Note: This summary does not include the freshwater and terrestrial snails that are likely incidental to cultural activities.

Feature 603 is the interment of a young adult female with 22 disk beads, also made from *Spondylus* or *Chama* shell, placed around the left wrist and hand. In general, this set of beads is distinct from the previous set in that they are considerably larger in their dimensions and have substantially more surface pitting from marine parasite activity that damaged the original shells. Also placed with this burial is a small, nacreous shell disk with a finely serrated perimeter. The absence of any visible means of suspension indicates the object is not a pendant, but might have been part of a larger ornament or a decorative embellishment on an item that was placed with the individual. The disk was recovered near a stone vessel placed by the right heel of the individual.

The third burial was a tightly flexed inhumation of a juvenile who had a necklace of at least 36 claw-shaped, ground bead pendants, which were also produced from *Spondylus* or *Chama* shells. These were mostly scattered around the shoulder and neck area, which suggests the strand was placed around the neck when the body was interred. As with the larger disk beads, many of these bead pendants exhibited extensive surface pitting.

All three individuals were buried within the Congress Street locus, but it is unknown what, if any, relationship existed between them. Early Agricultural period burials are commonly interred without personal ornaments; therefore, the presence of the beads is unusual, although not unique. Two other burials with associated shell ornaments are known in the literature, although each is unusual for other reasons. One is a multiple secondary burial, probably dating to the Cienega phase, from the Wetlands site, AZ AA:12:90 (ASM), that included elements of eight individuals (Thiel and Mabry 1998:113-121). There were 67 shell beads and pendants made of black abalone scattered among the bone in the pit (Vokes 1998b:257). The other deposit is a cremation at the Coffee Camp site, AZ AA:6:19 (ASM), where there was a necklace of 886 square nacreous beads placed in the fill of the pit above the cremated bone (Huckell 1993:308). Cremations are rare in Early Agricultural period contexts, although some have been reported in eastern Arizona (Haury 1957).

There is a relatively high frequency of nacreous shell utilized in the production of these artifacts among the non-mortuary sample (Table 11.4), with five of the 11 finished ornaments manufactured from nacreous shell: two are either *Pteria* or *Pinctada*, one is *Haliotis*, and two other are *Anodonta*. Such high incidences of nacreous shell in the production of ornaments during this period has been noted in assemblages from other Early Agricultural period sites in southern Arizona (Huckell 1993; Vokes 1998a, 1998b, 2000, 2005, 2006).

Ceramic Period and the Hohokam

During the ensuing ceramic period of prehistory, the shell material was again largely associated with the occupation of the western component of the project area. Beginning as early as the Agua Caliente phase (A.D. 50-500) of the Early Ceramic period, there is a marked shift in the composition of the shell ornament assemblage. While some of the forms from the previous Early Agricultural period, such as whole shell beads and various types of pendants, continue to be found, the major development is the introduction and subsequent dominance of bracelets, which were produced from the perimeter of the *Glycymeris* shell. Although the current sample is relatively small, the pattern is very clear; bracelets account for nearly 90 percent of the finished shell artifacts associated with the ceramic period. This pattern is replicated repeatedly in assemblages throughout southern Arizona (Vokes 1988, 1989, 1995, 1998b, 2001b). The reason for this dramatic shift is not well understood, although it seems to roughly coincide with the introduction of ceramic container technology.

The Historic Era

The Spanish entrance into southern Arizona initiated a new and very different economic and cultural environment within the region. A limited sample of shell material was recovered from contexts associated with the Spanish occupation, but much of it may be the result of mixing from other periods of the occupation. Most of the Spanish period material was recovered from Feature 373, a large pit within the presidio walls. Among the shell in this deposit are several fragments of *Ostrea* (oysters), which are likely intrusive from a later occupation, because the importation of oysters is generally associated with the arrival of the railroad. The source of this material is likely Feature 360, a privy pit, that dates to the American Territorial period, and that cuts through part of Feature 373. The other shell material that may be associated with the Spanish period were isolated pieces recovered from several features in the Mission and Mission Gardens loci. These were beads and a bracelet fragment from overburden and other contexts, which lack a strong association with the dated features. Consequently, there is little in the way of shell artifacts attributable to the Spanish occupation with confidence.

This is not the case with the Euro-American occupation. Numerous pits and other features are attributed to the Territorial period, which contain shell material. The nature of this material, however, is very different from the prehistoric assemblages. Virtually all of it is unmodified, with much appearing to be associated with local dietary choices. Most of the shell

Table 11.4. Shell genera recovered from the Rio Nuevo excavations, summarized by temporal association.

	Prehistoric					Historic					Total	
	Early Agricultural	Ceramic					Euro-American					
Genus	Cienega Phase	Late Agua Caliente	Hohokam	Protohistoric	Prehistoric, Unknown	Spanish/Mexican Period	American Territorial Period	American Statehood Period, Unspecified	Euro-American, Unknown	Unknown Association	Minimum Number of Individuals	Number of Identified Specimens
Marine												
Pelecypods												
Glycymeris	–	3	14	1	–	1	7	–	–	9	35	40
Laevicardium	2	–	2	–	–	–	4	–	–	12	20	23
Pecten	–	–	–	–	–	–	1	–	–	1	2	2
Argopecten	–	–	–	–	–	–	2	–	–	1	3	4
Dosinia	–	–	–	–	–	–	2	–	–	2	4	4
Pteria/Pinctada	2	–	–	–	–	–	–	–	–	–	2	3
Trachycardium	1	–	–	–	–	–	3	–	–	8	12	14
Spondylus/Chama	52	–	–	–	6	–	–	–	–	–	58	69
Spondylus	–	–	2	–	–	–	–	–	–	–	2	2
Chama	7	–	–	–	–	–	–	–	–	–	7	7
Ostrea	–	–	–	–	–	3	15	–	–	16	34	62
Chione	–	–	–	–	–	–	1	–	–	3	4	4
Megapitaria	–	–	–	–	–	–	1	–	–	1	2	2
Protothaca	–	–	–	–	–	–	–	–	–	3	3	4
Spisula	–	–	–	–	–	–	1	–	–	–	1	1
Unidentified	3	–	–	–	–	1	6	–	–	5	15	16
Gastropods												
Olivella	3	–	–	–	–	3	–	–	1	5	12	12
Conus	–	–	–	–	–	–	1	–	–	–	1	1
Turritella	–	–	–	–	–	–	–	–	1	6	7	7
Cerithium	–	–	–	–	–	–	–	–	–	1	1	1
Columbella	–	–	–	–	–	–	1	–	–	–	1	1
Theodoxus	1	–	1	–	–	–	–	–	–	–	2	2
Turbo	–	–	–	–	–	–	–	–	–	1	1	1
Tegula	–	–	–	–	–	–	1	–	–	–	1	1
Acanthina	–	–	–	–	–	–	6	–	–	–	6	6
Strombus	–	–	–	–	–	–	–	1	–	–	1	1
Crucibulum	2	–	–	–	–	–	–	–	–	–	2	2
Acmaea	–	–	–	–	–	–	5	–	–	–	5	5
Haliotis	1	–	–	–	–	–	2	–	–	2	5	5
Unidentified	–	–	–	–	–	1	1	–	–	2	4	4
Unidentified marine, nacreous	1	–	–	–	–	–	–	–	–	–	1	2
Unidentified marine shell	–	–	–	–	–	–	–	–	–	1	1	1

Table 11.4. Continued.

	Prehistoric					Historic					Total	
	Early Agricultural	Ceramic					Euro-American					
Genus	Cienega Phase	Late Agua Caliente	Hohokam	Protohistoric	Prehistoric, Unknown	Spanish/Mexican Period	American Territorial Period	American Statehood Period, Unspecified	Euro-American, Unknown	Unknown Association	Minimum Number of Individuals	Number of Identified Specimens
Freshwater												
Pelecypods												
Anodonta	8	–	17	2	3	5	210	3	10	22	280	700
Gastropods												
Physa	1	–	–	–	–	–	2	–	3	1	7	8
Helisoma	19	–	–	–	–	2	156	–	132	9	318	342
Ancylidae (Limpets family)	–	–	–	–	–	–	–	–	–	2	2	2
Terrestrial												
Gastropods												
Succinea	2	–	1	–	–	–	–	–	1	–	4	4
Unidentified nacreous shell	–	–	–	–	–	–	–	–	–	1	1	1
Total	105	3	37	3	9	16	428	4	148	114	867	1,366

attributed to the Territorial period occupation of the mission area was recovered from Feature 4, a well associated with Chinese farmers. This well contained over two-thirds of the *Anodonta* recovered during the entire project. *Anodonta* could not have naturally flourished in this environment due to its dependency on fish in its lifecycle. Thus, it appears that the shellfish was collected from the nearby river and canals, the animal was prepared and eaten, and the shell was finally discarded as part of the kitchen midden. Previous excavations during the Tucson Urban Renewal project produced evidence of similar gathering and consumption of *Anodonta* within the Chinese community in downtown Tucson in the late nineteenth and early twentieth centuries (Bequaert and Miller 1973: 221; Lister and Lister 1989:Figure 3.35). Interestingly, there is no occurrence of oysters, another edible shellfish present in other contexts, in the Mission locus.

As noted above, oysters represent a second edible shellfish that is present in some deposits attributed to the Territorial period occupation. However, unlike *Anodonta*, which would have been locally available from the canals and riverbed, oysters had to imported from the coasts by railroad, which first reached the community in 1880. Several species of oyster inhabit the coastal waters off North America, including the warm Panamic waters of the Gulf of California. All oysters are technically edible, and several species were actively harvested and shipped via the railroad to interior markets. These shellfish would have been something of a luxury, and presumably more costly to acquire. In the current assemblage, all of the oyster shells were associated with the Tucson Presidio. At least 34 shells are present within this area, with specimens widely distributed across the locus. Individuals who lived in this neighborhood may have been somewhat more affluent than some of their contemporaries within the settlement.

Other shells recovered from contexts attributed to the Territorial period occupation include some species that were not represented in other periods. Among these are a *Strombus* shell and a large surf clam, *Spisula*. This additional material is generally present as single occurrences or in limited numbers, indicating that, unlike the oysters or *Anodonta*, they were not related to the dietary habits of the local population. Virtually all of these are unmodified, with several being whole shells. This suggests that at least some may have been collected as souvenirs or retained as family heirlooms, reminding their owners of past experiences.

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CHAPTER 12

HISTORIC ERA ARTIFACTS

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A large number of Historic era artifacts were recovered during archaeological work at the San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM), and the Tucson Presidio site, AZ BB:13:13 (ASM). Analysis focused on three assemblages: Spanish and Mexican period artifacts from the Tucson Presidio, American Territorial period items from the Tucson Presidio, and the artifacts at the Mission locus found in a well filled in by Chinese gardeners.

TRACES OF DAILY LIFE AT THE TUCSON PRESIDIO

Excavations beneath the parking lot at the southwest corner of Church Avenue and Washington Street and at the Tucson Museum of Art complex resulted in the recovery of a large sample of presidio-occupation (1775-1856) artifacts and food remains. These items, as well as artifacts found at other presidio and mission sites in Arizona, provide information that was not recorded in the surviving contemporary documents. Recovered artifacts reveal how foods were cooked, stored, and served. Scraps of bones and charred plants identify the kinds of foods eaten by Mexican soldiers. A few pieces of firearms tell us the types of weapons used by soldiers. Buttons and beads provide a small idea about the styles of clothing and adornment.

Many of the Tucson Presidio records disappeared when the presidio was evacuated in 1856. One record that has survived is an inventory of a single house in the community. On 17 September 1820, Father Pedro Arriquibar prepared his last will as he lay dying at the Tucson Presidio (Table 12.1).

Arriquibar's household, however, may not have been representative of a typical household at the Tucson Presidio. He had been a priest for 23 years, accumulating a sizable amount of money. He owned a large number of books and religious items, probably more than any other household in the community. Because he was a single male, he probably had his meals prepared by the women of the community. Thus, his inventory may lack the kinds of kitchen items likely found elsewhere. Despite these caveats, the inventory suggests that houses at the presidio were sparsely furnished and that both imported and local items were likely present inside dwellings.

Artifacts from presidio times were found in the seven borrow pits at the northeastern corner, scattered in soil layers throughout the corner parking lot area, as well as in the pre-1860 layers at the Art Museum. These items, as well as those found during previous excavations within the Tucson Presidio and at other Spanish and Mexican period sites, suggest that the people who lived at the fortress imported a small amount of goods, ranging from necessities such as weapons, to luxuries like chocolate and Asian ceramics. When items were broken or worn out, usable portions were recycled. Imported items were only discarded when they were completely unusable, or when they were accidentally lost. It was difficult to import bulky items into the community, and residents purchased many large ceramic vessels from local Native Americans who modified the vessel forms they produced to meet new demands. Perishable materials, such as wood, leather, or cloth, were used in items that were imported or made locally, but they have left few traces behind.

Kitchen Artifacts

Items used to store, prepare, and serve food were the most common of the basic categories of Spanish and Mexican period artifacts found during the Rio Nuevo excavations. From the 1770s to the 1850s, residents of the presidio probably cooked food indoors in small corner fireplaces such as the one found at the Art Museum, on outside hearths, or in indoor adobe hornos or bread ovens.

Previous excavations have also revealed that presidio residents ate primarily beef, with mutton and chicken contributing smaller amounts of meat. Charred plant remains in sediment samples indicate that wheat was the most common plant food eaten, followed closely by maize. Peppers, squash, beans, and prickly pear cactus have also been identified in sediment samples. All of these foods, both plants and animals, were locally grown. Some wild foods, such as cactus fruit and mesquite pods, may also have been collected or obtained through trade with local Native Americans. Mescal, an alcoholic beverage made from agave, was also reported to have been made in Tucson. A small amount of foods and beverages were probably imported into the region. These

Table 12.1. Inventory of Father Arriquibar's household in 1820 (Stoner 1959).

House with a parlor and two rooms, a storeroom, enclosure in rear of the back yard
A table and chairs
A statue of Our Lady of Sorrows
A Roman cassock
A rosary from Jerusalem
4 Roman breviaries
A book of sermons on parchment
11 Latin books bound in yellow pasteboard
4 Latin books bound in pasteboard
6 large sermon books on parchment
30 books bound in parchment and 2 without bindings
8 *ordos* in Latin
A package of manuscript sermons
A wood mattress, much worn
2 Pima sheets, much worn, and a pillow
1 black blanket and cot with horsehair rope lacing
A palmleaf hat bound with cotton duck
Some drawers, a shirt, some breeches of cotton duck, and some hose
A large handkerchief and some shoes
A mantle of blue wool cloth, a large snuff box, a snuff canister, and some glasses
A razor case, 2 razors, and a hone
An inkwell and 2 small bottles
4 pottery wine jars
A saddle with saddleskirts, horn bags, sweat leathers, and spurs
A metal knife and fork and spoon
A tin can
A candlestick and snuffers
7 saddle horses and 1 mule
5 mules
15 mares and their stallion
About 40 head of cattle
596 pesos, 3 *reales*, which remained . . . after deducting 200 pesos . . . for the stipulated pious works and the redemption of captives in Jerusalem

would have included chocolate, olive oil, wine, salt, and spices.

Many of the containers used to transport luxury goods would have been made of perishable materials, but a handful of sherds from green glazed "olive" jars—thick terra cotta jars imported from Spain—were found in presidio-occupation features or soil layers in Tucson and other sites in Arizona (Figure 12.1). These jars, similar to Roman amphoras, were sturdy and useful for carrying liquids overland on pack trains (Deagan 1987:32). The 1820 inventory of Father Arriquibar's house in Tucson indicates he had "four pottery wine jars" (see Table 12.1).

Food preparation artifacts found at the site were mostly limited to locally produced Native American vessels, as noted in Chapter 7 (this volume). Some presidio residents probably also had large copper or iron pots, but the metal was apparently recycled when they were no longer usable. Copper *chocolatero* pots have been found at Terrenate, Tubac, and near Marana (Figure 12.2). These small copper vessels have a bulbous base and a cylindrical top. They were used to brew hot chocolate, which was whisked with a wooden *molinillo* to make the beverage frothy.

Pieces of food-service vessels are much more commonly found. The presidio residents dined from Mexican, Chinese, and English ceramics, along with locally produced Native American vessels. The most common imported ceramics were majolica dishes, brought to Tucson by mule train, originating in Puebla, Oaxaca, and other towns farther south in Mexico. A total of 831 pieces was found during the current project (Figure 12.3). Most trash at this time was discarded on the ground and then walked on by people and animals. Thus, most pieces found

Figure 12.1. A Spanish period olive jar, provenience unknown (ASM 76-18-10).

Figure 12.2. Copper *chocolateros* discovered near Marana, Pima County, Arizona (AHS/SAD 88.22.1 and 88.22.2).

were quite small, making it difficult to identify the varieties present.

Three categories of food-service vessels were present. Majolica with blue decorations was most common, with 351 pieces identified. Polychrome (multicolored) pieces accounted for 201 fragments. Plain white fragments, most of which were probably the undecorated portions of vessels with blue or polychrome designs, totaled 279 pieces. At least one undecorated cup was represented by several pieces.

Decorated majolica has been the subject of study by several researchers, who have separated the blue and polychrome varieties into various styles. Majolica dishes with blue designs were meant to imitate Chinese porcelains. Polychrome majolica was introduced in the 1770s, and imitated ceramics made in Europe. Unfortunately, the dating of these particular styles is currently not well understood, although the initial manufacture of blue varieties predated the introduction of polychrome varieties (Goggin 1968).

The majolica imported into Tucson was mostly in the form of plates, with a smaller number of cups and a handful of bowls. In contrast with the locally made Native American ceramics, the bright decorations on these dishes brought color to the tables of families and helped them to recall the times spent further south.

Chinese porcelain was brought in the same pack trains north to Tucson, but in much smaller quantities. Previous excavations in Tucson have identified several varieties of Chinese porcelain, some with blue designs and others with red and blue hand-painted patterns. These vessels traveled a great distance to arrive in the community—sent by ship to the Philippines and then to western Mexico. It is not surprising, then, that so few dishes ended up in Tucson.

English ceramics became available after Mexican Independence, with an Anglo-Mexican trade treaty signed in 1824, allowing for the importation of English goods directly to Mexico. Small quantities of transfer-printed and shell-edged ceramics began to be sent to Tucson. Many of the transfer-printed vessels bore scenes depicting the European world. Residents would have looked at the scenes of castles, cathedrals, and forests in amazement. In a time before books, magazines, or newspapers, these images would have provided a glimpse of another world. A small number of pieces were found in Mexican period deposits. Most of these were blue, with floral designs (Figure 12.4).

The kitchen-related artifacts found during the Rio Nuevo project and previous archaeological excavations at the Tucson Presidio suggest the importance of maintaining the traditions brought to Mexico from Spain. Families prepared meals using recipes handed down through the generations, serving foods and beverages in imported dishes. Locally made ceramic vessels replaced some Spanish and Mexican counterparts, such as the use of beanpots for cooking instead of metal pots. However, local O'odham potters modified vessel forms to meet the needs of presidio residents, creating *comales* to make tortillas on and *chocolateros* to make a chocolate beverage in.

Architecture

The architectural traditions brought to Tucson by the presidio soldiers contrasted strongly with those of the local Native Americans. Instead of dome-shaped huts made from saplings and covered with grass and mud, the soldiers elected to construct a large, elaborate fortress out of adobe bricks. The soldiers

Figure 12.3. Mexican majolica from Spanish or Mexican period features from the Tucson Presidio, AZ BB:13:13 (ASM). Top: unidentified polychrome variety, Feature 409 (FN 3667 and FN 3786); middle row: San Elizario Blue-on-white, Feature 0 (FN 3221); unidentified blue variety, Feature 0 (FN 3901); and Puebla Blue-on-white, Feature 0 (FN 2232); bottom row: Aranama Polychrome, Feature 0 (FN 3632); and unidentified blue variety, Feature 376 (FN 2939).

brought ideas about how to build structures that were rooted in Europe, North Africa, and Mexico, tempered by the necessity to use locally available materials. For example, while adobe bricks formed the basis for the presidio structures, saguaro ribs and ocotillos were used as roofing material.

Surviving historical accounts and the portions of buildings found within the presidio suggest most people lived in small, one-story adobe brick homes built against the presidio walls. These homes lacked many of the amenities enjoyed by modern-day Tucsonans. There were no glass windows; in fact, most dwellings probably lacked windows. Milled lumber was scarce, so doorways were covered with hides instead. Earth was tamped down for inside floors and exterior courtyard areas. There was no running water in people's homes. An *acequia* (canal) was present just outside the main gate, and families could carry *ollas* (ceramic jars) down to the Santa Cruz River to collect water or to wash clothes, or they could walk a little further to the south to a spring called Los Ojitos. These conditions sound harsh, although they were what the presidio soldiers and their families were used to and they would have duplicated living conditions in Mexico.

Figure 12.4. English transfer-print ceramics recovered from Spanish or Mexican period borrow pits within the Tucson Presidio, AZ BB:13:13 (ASM). Top: Feature 409 (FN 3667); bottom left: Feature 441 (FN 4345); bottom right: Feature 409 (FN 4148).

Few architectural artifacts, other than a handful of adobe brick fragments and a couple of nails, were found in presidio features. This reflects the use of local materials, many of which have completely decomposed, and the careful conservation of metal items, including nails, hooks, and other hardware.

Arms and Ammunition

The Spanish and Mexican soldiers stationed in Tucson relied on a variety of weapons for protection, including muskets, lances, knives, and several brass cannons. The presidio had an *armero*, whose job it was to care for and repair the weapons used by the soldiers. Inspection reports frequently commented on the poor condition of firearms, and on more than one occasion, the presidio commander requested additional muskets. The *armero* did the best he could under trying conditions, eventually recycling parts of muskets worn out from frequent use during campaigning. Because metal was valued and could be reworked into other items, such as nails or horseshoes, relatively few pieces of weaponry have been recovered at Spanish and Mexican period archaeological sites in Arizona, except at the Presidio Santa Cruz de Terrenate. Excavations in the 1950s and artifact looting in the 1960s and 1970s at Terrenate located many items left behind when the fort was hastily evacuated in 1780. Numerous fragments of

Figure 12.5. Brass gunstock ornaments from the Terrenate Presidio, AZ E:4:11 (ASM), dating to 1775-1780 (AHS/SAD 83-26-21 and 83-26-20).

brass gunstock ornamentation were among these (Figure 12.5).

In contrast, excavations at the Tucson Presidio have mostly found lead musket balls, which were easily lost, and gunflints, which were discarded when they were worn out, replaced by flints made from locally available stone. Twenty-five lead musket balls and three gun flints were found during the work at the presidio. The only musket part discovered during the Rio Nuevo excavations was the end of a ramrod holder (Figure 12.6). The fragment was a brass tube with a flared end and a projecting tab that allowed the holder to be attached to the underside of a musket. The ramrod, used to clean gunpowder residue from the barrel and to tamp the powder and lead ball into place, was held onto the underside of the musket barrel by this holder.

Two prior excavations have each yielded a single gun part dating to the presidio occupation. Work in 1943 uncovered a cast brass military *escopeta* trigger guard once used by a soldier during the Spanish period. Excavations at the León farmstead, occupied by a soldier who served in the Mexican military, resulted in the discovery of another trigger guard, this one from a Brown Bess musket, manufactured in England in the 1820s and imported by the Mexican military.

Clothing and Personal Items

Residents of the presidio probably owned a few pieces of clothing each. Hilario Gallego (1935:75-76), who was born in Tucson in 1850, provided a description of the clothing worn by local residents:

Figure 12.6. Brass ramrod holder recovered from the Tucson Presidio, AZ BB:13:13 (ASM), Feature 0 (FN 3273).

> For clothing most of the men wore nothing but 'gee-strings' just like the Indians. Every six months or so the government would send to Hermosillo and bring back manta or unbleached cotton cloth from which men's trousers and women's skirts were made. The women wore long skirts and shawls or scarfs. Our shoes were mostly taguas, or rough shoes made of buck-skin, and guaraches, which were flat pieces of leather tied to the foot with buck-skin strings which ran between the big toe and the next. Many of the smaller children went naked, though a few wore 'gee strings.'

A few other documents provide additional information about the subject. At least one presidio soldier was jailed for gambling away his pants. Travelers passing through the area in the 1840s to early 1850s were able to trade cloth, needles, and sewing notions to Tucson women. The lack of a store in the community made these items difficult to acquire. An illustration of the Tucson military chapel, drawn in the 1850s, was a contemporary depiction of what people wore in Tucson. The paintings within the San Xavier Mission may provide some clues as to the clothes typical in the late 1790s.

Articles of clothing were made from textiles and leather and rarely survived once they were discarded. Clothing-related artifacts recovered from the Tucson Presidio during the current project were limited to a small number of brass buttons found at the Art Museum in presidio soil layers.

Examples at Terrenate reveal that a variety of button styles were used by soldiers and their families at that presidio between 1775 and 1780. They ranged from plain pewter and brass buttons, either circular or octagonal, to elaborate molded buttons with flowers and geometric designs (Figure 12.7). Clothing and shoe buckles found at the site were equally elaborate and suggest residents enjoyed nice clothing (Figure 12.8). Cloth bale seals collected at the presidio reveal that at least some of the cloth was imported from England at a time when trade with that country was prohibited by Spanish law.

All of the people living in the presidio probably once owned a few treasured items—pieces of jewelry, personal hygiene items, books, or other items that were considered their own possessions. Few of these items were found during the excavations at the presidio, which is not surprising given the value placed on these items. A pair of faceted blue beads and a striped glass bead were found in a borrow pit, Feature 409. Fragments of a bone comb were also found in this feature. The double-sided comb was made from a thin slice of cattle bone and had fine teeth on each side. It is identical to combs found at other eighteenth century Spanish sites in Florida. A Mexican *cuarto real* dating between 1831 and 1836 and a probable "piece of eight," a silver coin clipped into a pie-shaped wedge to make change, were also recovered. Several gaming pieces manufactured from flattened musket balls were probably used by presidio residents to play chess, checkers, or in other pastimes (Figure 12.9).

Figure 12.7. Brass buttons from the Terrenate Presidio, AZ E:4:11 (ASM), dating to 1775-1780 (AHS/SAD 83-26-74, 76-79).

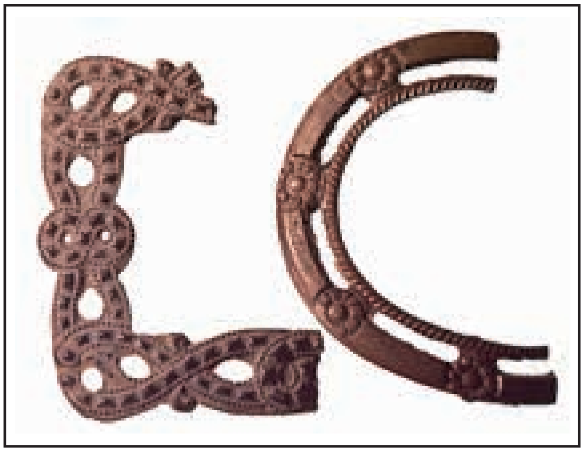

Figure 12.8. Brass clothing buckles from the Terrenate Presidio, AZ E:4:11 (ASM) (AHS/SAD 83-26-34, 83-26-32A).

Overall, the diversity of Tucson Presidio-occupation artifacts is relatively small. Excavations and looting activities at the Terrenate Presidio suggest a greater variety of items have been found at Spanish period sites, but due to decomposition or recycling, these items are not recovered in Tucson.

Summary

Trash disposal was very casual—artifacts were tossed into nearby pits or onto the ground. As a result, many artifacts were smashed into small pieces, hindering their identification. A relatively small number of imported artifacts that date to presidio times have been found. This is partially because these items were costly to import. Other items were made from perishable materials, such as cloth, leather, basketry, and wood, that decompose once discarded. Items produced from recyclable materials, such as metal,

Figure 12.9. Small metal artifacts from the Tucson Presidio, AZ BB:13:13 (ASM). Top row: a "piece of eight" and a Mexican *cuarto real*, Feature 373 (FN 2454 and 3606); bottom row: a pair of gaming pieces fashioned from lead musket balls, Feature 0 (FN 2811 and FN 3015).

were probably sold to the blacksmith shops and reworked into new items. Those artifacts that were found—principally majolica dish fragments, buttons, coins, beads, and lead bullets—were either discarded when they broke or were lost by accident. The recovery of large amounts of majolica, although outnumbered by Native American pottery, indicates a strong desire by the people living in Tucson to recreate or emulate the lifestyles of people living in towns further south.

Excavations at other Spanish period sites in Arizona, especially the Terrenate Presidio; surviving inventories; and items found at the missions of San Xavier and Tumacacori allow identification of a wider range of artifacts brought into the area. These range from *chocolatero* pots to bookbindings to religious items. A small number of surviving images of the time, drawn or painted in California and Mexico, also provide clues about daily lives in presidios in the seventeenth and eighteenth centuries.

AMERICAN TERRITORIAL PERIOD

Artifacts from the Presidio Site Parking Lot

The artifacts found in American Territorial period features differ dramatically from those found in the earlier features of the presidio occupation. When Solomon Warner opened his store in 1855, increasing amounts of consumer goods were available in the community. Previously, a small amount of dishes, luxury foods, clothing and sewing notions, and religious articles were carried to Tucson in pack trains from the south. Warner's freight wagons from southern California brought some of these same items, but they also brought bottled liquor, tools, bolts of cloth, and packaged foodstuffs. By the late 1850s, advertisements in the first newspaper published in Arizona indicated that a wide variety of goods were now available to those who had the means to purchase them.

Freighting businesses, such as Tully, Ochoa & Company, specialized in importing goods. The arrival of new loads were eagerly anticipated by residents, especially new arrivals who sought to maintain their accustomed lifestyles. The arrival of the railroad in March 1880 brought an unprecedented glut of items to local stores. The old freighting companies soon went out of business, unable to compete with the cheaper prices of goods transported by trains.

Archaeologists working in downtown Tucson can clearly see the growing availability in consumer goods after the arrival of the railroad. The sheer quantity and variety of artifacts found at historic-era sites dating after 1880 is sometimes amazing. Outhouses, wells, and borrow pits are frequently filled with thousands of artifacts. This proved to be the case for American Territorial period features found beneath the parking lot at the southwest corner of Washington Street and Church Avenue, where excavations yielded large samples of everyday items discarded and lost by residents of the lot.

The artifacts were brought back to the Desert Archaeology laboratory, washed, labeled, and given to analysts for identification. Each item was examined, and descriptive and interpretive information, which included such things as each item's form and function, were entered into a computer database. Some artifacts had maker's marks that could be researched in collector's guides, allowing features to be dated. Other items provided an understanding—not available in documents—of the lives of the people who lived on Lot 1.

Feature 376, Borrow Pit

A total of 9,279 artifacts was found in the excavated portion of this borrow pit. The base of the pit contained items from the late 1870s, while the uppermost portion of the pit had artifacts from the 1890s. As is typical of most historic-era sites in southern Arizona, architectural items and artifacts used to store, prepare, and serve food were most common (Table 12.2). At least five Mexican mixing and cooking bowls were represented by 34 fragments. Two pieces of yellowware bowls were also found. A pan, a lid to a large pot, and a pot handle were present. Food-service items included bowls, cups, saucers, plates, a brass tablespoon, a rice bowl, a shot glass, stemware, and two glass tumblers. Several pieces were decorated with a sponge-print design featuring pineapples and leaves (Figure 12.10). Elaborate serving dishes sometimes used in more affluent households were not present.

Food containers found in the pit included two lard buckets, 3,237 fragments of at least 36 tin cans, and two sauce bottle stoppers. The large number of tin cans reveals that the household residents who threw trash into the pit ate a lot of canned foods. The 1897 Sears, Roebuck, and Company catalogue sold a wide variety of canned fruits, vegetables, and meats. Apricots in heavy syrup cost 14 cents a can, as did Bartlett pears. A 1-pound can of corned beef sold for 12 cents, while a 5-pound pail of lard sold for 40 cents. Residents could purchase canned foods from local dry goods stores. Many things that could not be grown in Arizona, from pineapple to canned oysters, were readily available for purchase.

Alcoholic beverages were represented by 315 fragments of at least 10 beer, liquor, wine, and champagne bottles. Thirty-eight pieces of a Mexican ceramic canteen were found near the base of the pit.

Table 12.2. Number of artifacts from selected American Territorial period features at the Tucson Presidio, AZ BB:13:13 (ASM).

	Features			
	359 and 437	360	376	408
Kitchen				
Kitchen	5	2	4	2
Food preparation	3	1	47	4
Food service	208	222	716	445
Food storage	1,564	788	3,248	1,306
Alcoholic beverage	123	101	319	107
Beverage	26	44	42	34
Bottle glass	1,132	604	945	548
Native American ceramics	397	47	1,319	86
Architectural				
Architectural	–	7	1	4
Window glass	212	347	185	39
Nails	1,210	943	1,057	678
Construction hardware	19	10	3	5
Door parts	1	–	2	–
Materials	23	8	2	17
Electrical related	4	4	1	11
Utility	–	2	1	–
Furniture				
Furniture	2	22	7	181
Hardware	–	–	1	–
Lighting	14	15	6	4
Cleaning	–	–	4	3
Arms				
Ammunition	8	84	19	18
Gun part	–	–	1	–
Clothing				
Apparel	82	75	237	55
Accessories	8	3	6	1
Making/Repair	4	7	2	1
Personal				
Personal	15	2	5	2
Coins/Tokens	3	2	2	2
Hygiene	100	49	64	32
Tobacco	2	2	5	2
Religious	–	–	–	1
Medicine	4	27	4	39
Activities				
Activities	5	1	4	25
Tools	1	–	2	1
Toys	9	8	27	15
Miscellaneous hardware	33	49	79	55
Communication	8	13	68	13

Table 12.2. Continued.

	Features			
	359 and 437	360	376	408
Paint	2	–	1	1
Nuts and bolts	–	1	4	1
Transportation				
Transportation	7	4	7	1
Stable items	3	4	67	7
Mechanical	–	6	8	34
Unidentified				
Unidentified	480	232	757	523
Total	5,717	3,736	9,279	4,303

This unique container was made in two halves and fused together in the kiln.

Architectural artifacts found in the pit included 1,057 nail fragments, 185 pieces of window glass, wire, brick, and two door locks. Many of the nails may have come from packing crates or other nonarchitectural uses.

Pieces of furniture are not often found at archaeological sites, either because furniture was rarely discarded, or because, once discarded, its components become unrecognizable (nails) or decompose (wood and cloth). Four porcelain drawer pulls, a candlestick, and a clock were represented by artifacts found in the large pit. These items were probably tossed away when they broke and were unrepairable. A decorative English bowl with a fish peering from inside was an unusual find (Figure 12.11).

Nineteen pieces of ammunition were found. These were mostly brass cartridge casings in a number of sizes, indicating residents once owned weapons of varying calibers. All of the cartridges were heavily corroded, making it impossible to read any markings they may have had.

Clothing artifacts included: 3 suspender buckles, 73 buttons, an eye hook, 4 eyelets, a garter snap, several hooks and eyes, 21 brass and iron rivets, blue yarn, and 128 fragments from at least 13 shoes. The shoes were for both adults and children; they were very poorly preserved. A brass thimble, a safety pin, and a straight pin were found in the pit, a reminder that people frequently sewed and mended their own clothing. Four jewelry fragments including several brass hoop earrings and a blue bead were recovered.

Figure 12.10. A sponge-printed plate from an American Territorial period borrow pit, Feature 376 (FN 2594) at the Tucson Presidio, AZ BB:13:13 (ASM).

Figure 12.11. A decorative English bowl with a fish design found in an American Territorial period borrow pit, Feature 376 (FN 2523) at the Tucson Presidio, AZ BB:13:13 (ASM).

Personal artifacts included a couple of umbrella parts, a bone-handled penknife, and two corroded copper coins. Hygiene artifacts were 44 fragments from a plain whiteware washbasin, 16 pieces from at least two combs, and a bone toothbrush. Pieces from at least three medicine bottles were also recovered.

Three tobacco or snuff cans were found in the feature, along with two fragments of clay pipes. Most of the men living in Tucson during the American Territorial period probably used tobacco, either smoking it, or as "chew" or snuff. While pipe smoking was popular in other areas, cigarettes and cigars were favored in late nineteenth century Tucson. A bar tab for Solomon Warner survives, and shows that cigars cost 50 cents each in the 1870s.

Activity artifacts found in the pit included a paint can, a bucket, tool handles, 10 washers, 4 bolts, a lead sinker, 2 wheels, and a number of pieces of hardware. Fragments of school slates were common, with 38 pieces collected. Eighteen pencil leads and eight fragments from glass or stoneware ink bottles indicate the people who discarded trash into the pit were literate—a skill that was becoming increasingly widespread.

The toys found in the pit suggest that both boys and girls lived in the households that contributed trash to the pit. The items included two ceramic and one polychrome glass marble. Five fragments of doll dishes, including one made in Mexico, were probably used by little girls having tea parties. The 19 doll fragments were mostly from inexpensive heads and limbs that were once attached to cloth bodies. Two complete heads were found, both with black hair and blue eyes. Among the other pieces were a pair of legs with green shoes.

Transportation artifacts included five railroad spikes, wagon parts, five horseshoes, many harness buckles and rings, and a chain. The families who contributed refuse to the pit likely owned at least one horse.

Feature 359 and 437, Borrow Pit

Only a small portion of a large American Territorial period borrow pit in the center of the lot was excavated. Even this small exposure resulted in the recovery of 5,717 artifacts (see Table 12.2). Datable items suggest the pit was filled between the late 1880s and the early 1900s, probably by the earliest residents of the nearby boarding house. Three fragments of a Mexican mixing bowl were in the pit. Food-service items included bowls, cups, a glass lid, plates, several Chinese rice bowls, saucers, a goblet or wine glass, and a shot glass.

Food containers included 1,544 fragments from at least 11 tin cans. Nine baby food bottles and a spice jar were also recovered from the pit, as was a fragment of a gray stoneware crock and a fragment of a Chinese stoneware jar that once held imported foods or sauces.

Alcoholic beverage bottles were represented by 123 fragments of five beer, champagne, and liquor bottles. Several fragments of an aqua beer or soda bottle and one crown cap were also collected.

Architectural items found in the excavated portion of the pit included 1,210 nail fragments, 168 window glass pieces, wire, and a door lock. Several lamp burner pieces and lamp chimney fragments indicate residents of the boarding house lit their rooms with kerosene lamps. The overall number was surprisingly low, when compared with other nearby sites. The internal workings of a clock were also found.

A bullet and three cartridges were in the pit. Clothing artifacts found in the pit included a silver-plated belt buckle with a design etched around its edge, a brass suspender buckle, 36 buttons, a garter snap, a pair of brass rivets, and 30 fragments of shoe leather. Clothing maintenance items found in this feature consisted of pieces of four brass safety pins. Accessories found in the pit included a clear bead, a pin, a pair of brass rings, a small jingle bell, a piece of decorative brass, perhaps from a coin purse, and two hairpins.

Personal artifacts included a small brass chain, pieces of a pair of spectacles, a dime, and two keys. Hygiene artifacts included pieces of a wash basin, a yellowware children's chamber pot, and a whiteware pitcher with a purple transfer-print foliage design. Pieces from two bone toothbrushes were collected, as was a fragment from a kaolin pipe.

Several medicine bottles were present in the pit. One was labeled TRASK'S MAGNETIC OINTMENT. This was advertised as "The Discovery of the Age, a remedy for internal and external pain, nervous headaches, inflammation of the bowels, affections of the spine, in face or breast, burns, fever sores…" (Fike 1987:198). It is doubtful the substance provided any of these benefits. Another bottle was labeled DR. KING'S NEW DISCOVERY FOR CONSUMPTION. This was a medicine that was supposed to cure "any trouble of the throat, chest and lungs" and was touted as "the only sure cure for consumption in the world" (Adams 1906:46). Studies by government chemists in the early 1900s revealed that the bottled substance contained morphine and chloroform, neither of which were particularly helpful to a person with tuberculosis. One investigator noted that the "medicine" was a "combination … admirably designed to shorten [the] life of any consumptive who takes it steadily" (Adams 1906:45-47).

A handful of Chinese artifacts were found in the borrow pit, including a pair of Chinese coins and a piece from an opium pipe. A Chinese man probably lived at the boarding house at one time, perhaps working as a servant.

Activity artifacts included 2 paintbrush handles, 2 bolts, 3 washers, a pulley, 2 screws, and other hardware. Toys found in the pit included 3 doll fragments (Figure 12.12), a toy cat, 3 parts of gaming pieces, a lead wagon wheel, and 1 ceramic and 1 glass marble. A blue poker chip suggests poker or some other card game was played at the boarding house, and two harmonicas may have been used by either adults or children. Four pieces of school slate, two pencils, and a piece from a brown stoneware ink bottle were also found in the pit.

Transportation items were limited to three railroad spikes, two horseshoes, and a wagon part.

Feature 360, Outhouse

This early twentieth century outhouse, which was partially looted in the 1950s, yielded 3,736 artifacts in the excavated portion (see Table 12.2). An unknown number of artifacts were removed from the feature by the earlier bottle hunters. The outhouse had been filled in the 1900s to the early 1920s. A piece from a Mexican glazed bowl was the only food preparation artifact found. Food-service artifacts included a Japanese bowl, several decal-printed bowls, cups, a pitcher, a platter, 1 piece from a Chinese rice bowl, 5 saucers, 3 tumblers, and a piece of stemware.

Food containers from the feature included two wide-mouthed food jars, 777 fragments from at least 10 cans, a hole-in-cap milk can, and a canning jar and lid. Beer, champagne, and liquor bottle fragments totaled 101, representing at least 15 different bottles. Five aqua beer or soda bottles were present, as were 32 crown cap closures. Soda and beer bottles were probably returned for a deposit, which would explain why there were more crown caps than bottles.

Architectural artifacts from the outhouse included 943 nails, 347 pieces of window glass, brick, wire, and 2 hinges. An electrical insulator found in the pit indicates the boarding house had electricity by the 1910s. Furniture-related items included a decorative bowl (Figure 12.13), 14 fragments of lamp chimneys, and a chandelier or lamp fob. A lead bullet and 83 cartridges were also collected from the feature.

Clothing artifacts found in the pit included 5 buckles from suspenders and shoes, 29 buttons, 2 white milk glass collar buttons, an eye hook, 12 eyelets, cloth, 10 garter snaps, and 4 pieces of shoe leather. Accessories included a pinkish-orange bead and two jewelry fragments. Two brass straight pins and pieces from four safety pins were found in the feature.

A Boy Scout shoe token from 1919 and a 1942 penny were found in the pit. The penny was dropped in when the upper portion of the pit was filled in. Several VASELINE and mentholatum bottles and a fragmentary bottle that once contained worm medicine

Figure 12.12. Bisque porcelain children's toys recovered from an American Territorial borrow pit, Feature 359 (FN 2678) at the Tucson Presidio, AZ BB:13:13 (ASM).

Figure 12.13. A decorative bowl found in an American Territorial period well, Feature 360 (FN 2983 and FN 3024) at the Tucson Presidio, AZ BB:13:13 (ASM).

were found in the outhouse pit. A perfume bottle with a decorative stopper, a cosmetic jar, a chamber pot and pitcher, a bucket, and four combs were present. A bone toothbrush reveals a concern with dental hygiene. A clear eyeglass lens indicates the presence of a person who needed their sight corrected. A clay pipe was also found.

Seven fragments from two different porcelain-headed dolls and a stoneware marble were found in the outhouse pit. Other activity artifacts included miscellaneous hardware, 6 screws, 3 staples, 3 washers, 1 bolt, and copper wire. A clear glass ink bottle, 2 pencil erasers, 6 pencil leads, and 3 pieces of school slate were also present.

Transportation artifacts found in the outhouse pit included two railroad spikes, several wagon parts, two horseshoes, a horseshoe nail, and a harness buckle.

Feature 408, Outhouse

The 4,403 artifacts from another outhouse pit, Feature 408 were generated by the residents of the boarding house (see Table 12.2). Datable items suggest the pit was filled between 1900 and 1910. Kitchen artifacts found in the pit included a pair of cooking pots and the handle from a third pot. Food-service items included bowls, a butter pat, a coffee pot, cups, serving dish lids, plates, a platter, pieces from two Chinese rice bowls, saucers, a salt or pepper shaker, a serving spoon, glass stemware, and pieces from a tureen.

Food containers found in the outhouse included several wide-mouth bottles that could have held olives or pickles, an olive oil bottle with a partially intact paper label, 1,289 fragments from at least 26 cans, a sardine tin, pieces from a brown stoneware crock, a fragment of a gray stoneware crock, and several stoppers. Alcoholic beverage bottles were represented by 107 fragments from at least nine bottles. These included beer, champagne, and several liquor bottles. Another 34 pieces from beverage bottles probably represent several soda bottles.

Architectural items from the outhouse pit included 678 nail fragments, 39 pieces of window glass, 3 hinges, and electrical wire. A complete kitchen sink was also pulled from the pit. A lightbulb and pieces of kerosene lamps suggest that, by the 1910s, electricity had been installed in the boarding house and residents were switching from the old-fashioned lamps to the brighter electric lights.

Eighteen pieces of ammunition were found in the outhouse; two were from a 22-caliber short rifle.

Clothing artifacts were common in the feature. These included 2 brass buckles; 3 brass suspender buckles, 1 with black and white cloth attached; 36 buttons; 3 eyelets; cloth; 4 garter snaps; and 3 poorly preserved leather shoes. A shoe polish bottle and a pair of brass safety pins were found in the outhouse pit, as was a bottle of SPERM SEWING MACHINE OIL, presumably refined from sperm whale blubber. A small brass crucifix was recovered. This was the only religious artifact found in the American Territorial period features and probably indicates at least one resident of the boarding house was Catholic.

A Chinese coin and a token from a Los Angeles store were found. Hygiene artifacts included fragments from a wash basin, pitcher, and a chamber pot; a cologne bottle; a comb; and a ceramic toothpaste jar lid. Several medicine bottles were found in the outhouse pit. They included bottles labeled VASELINE, KIDD'S COUGH SYRUP, AYER'S CHERRY PECTORAL, PITCHERS CASTORIA, and DR. A. BOSCHEE'S GERMAN SYRUP. Castoria was a cod liver oil preparation often used as a laxative or as a nutritional supplement. The Kidd's and Ayer's products were cough medicines, with Ayer's also advertised "to cure colds, coughs, sore throat, asthma, bronchitis, hoarse" (Fike 1987:199).

Toys found in the excavated portion of the outhouse pit included eight ceramic marbles, six fragments from porcelain dolls, and a small porcelain toy teapot lid. Adult entertainment items included a tobacco tin and a clay pipe.

A kerosene can, a whetstone, a bracket, three bolts, and other miscellaneous hardware were found. Chalk, eight pieces of school slate, and parts from three pencils were also found. A carriage part, several pieces of horse harnesses, wagon parts, and a bicycle tire were transportation artifacts found in the outhouse.

Artifact Analysis

Functional

A common practice of historical archaeologists is to categorize artifacts into functional categories based on how the items were used, and then to examine how the percentages of these categories changed through time, or among households of differing ethnicity or income. The four American Territorial period features from Lot 1 of Block 181 yielding large sets of artifacts were studied in this manner. Feature 376 was the oldest, followed by Feature 359 and 437, then Feature 360, with Feature 408 the most recent feature (Table 12.3).

The kitchen and architectural categories typically represent the highest percentages of artifacts, and this proved to be the case at Lot 1 of Block 181. The kitchen artifacts from Feature 376 comprised 72 percent of the items found in that borrow pit, with only 13 percent architectural items. Later features had proportionally fewer kitchen artifacts and more architectural

Table 12.3. Percentages of functional categories of artifacts from selected American Territorial period features at the Tucson Presidio, AZ BB:13:13 (ASM).

	Features			
	376 (1870s-1890s)	359 and 437 (1880s-1900s)	360 (1900s-1910s)	408 (1910s-1920s)
Kitchen	72	60	48	57
Architectural	13	26	35	17
Furniture	–	–	1	4
Arms	–	–	2	–
Clothing	3	2	2	1
Personal	1	4	2	2
Activities	2	1	2	3
Transportation	1	–	–	1
Unidentified	8	8	6	12

items. The smaller number of architectural artifacts in Feature 376 is explained by the fact that the earliest house on the block was built of adobe and probably had a traditional flat roof and tamped-earth floor. As a result, the structure had few nails and perhaps only one or two glass windows. As the railroad brought in more lumber and pre-manufactured windows, the costs of these goods rapidly declined. Later structures on the block incorporated new building materials. This change is seen by examining the changing percentages of nails, which increased from 11 percent of the artifacts in Feature 376, to 25 percent in the Feature 360 outhouse.

Other artifact categories had much smaller numbers of items, and no trends are visible. There were more furniture artifacts in the Feature 408 outhouse, but most of these items were springs from a single mattress. In general, clothing, personal, and activities artifacts each represented about 2 percent of the items from individual features. The overall frequency of these items did not change through time because they were small, easily imported, and were probably discarded at the same rate as they were worn out, used up, or lost.

Ceramics

Styles changed in the past, just like they do today. Photographs, magazines, newspapers, and catalogues all document these changes at national, regional, and local levels. Artifacts, especially ceramics, can show if residents of a particular household were closely following consumer trends.

The types of kitchen (service dishes and crockery) and hygiene (pitchers, basins, and chamberpots) ceramics found in the four features are summarized in Table 12.4.

The most notable trend is the decline in frequency of Native American ceramics. Of the ceramics found in the borrow pit Feature 376, about 60 percent were manufactured by local Papago (Tohono O'odham) potters. By the 1910s-1920s, the ceramics discarded into outhouse Feature 408 included only 15 percent Papago sherds.

The decline in the amount of Native American pottery can be attributed to several factors. The construction of water lines through the neighborhood and the installation of running water meant that *ollas* were no longer needed to store water. The construction of the boarding house in the 1890s brought new residents to the lot, mostly Euro-Americans who typically used less Native American pottery than their Mexican neighbors. Finally, the two borrow pits contained dirt swept up from surrounding areas, which included soil containing prehistoric and presidio-occupation artifacts. Much of the Native American pottery found in the two large pits, as well as the Mexican majolica sherds recovered, had been originally discarded long before the residents of the lots began to use the borrow pits as a place for their trash.

Hard-paste earthenware ceramics, also known as whitewares, were favored by people living on the block in the late nineteenth and early twentieth centuries. Vessels of this durable type of ceramic were used to serve meals on. Bathroom sets—wash basins, pitchers, and chamber pots—were also present. Many of the vessels were undecorated and therefore inexpensive. Undecorated sherds represented 87 percent of the whiteware fragments recovered from Feature 360, 76 percent found in Feature 376 and Feature 408, but only 40 percent in Feature 359/437. Most of the meals eaten at the old adobe house and the later boarding house were clearly served on plain dishes.

Table 12.4. Number of ceramic sherds of different decorative types from selected American Territorial period features at the Tucson Presidio, AZ BB:13:13 (ASM).

	Features			
	376 (1870s-1890s)	359 and 437 (1880s-1890s)	360 (1900s-1910s)	408 (1910s-1920s)
Whiteware				
Plain	493	76	212	307
Transfer-print and flow blue	26	89	8	39
Decal	–	10	10	31
Annular/Sponge	45	3	2	2
Hand-painted	69	10	4	4
Gilt	–	–	4	16
Tinted	–	2	2	3
Mocha	4	–	–	–
Shell edged	2	–	–	–
Solid color	1	–	1	–
Majolica				
Mexican	123	14	2	2
European	–	–	–	–
Porcelain				
Plain	1	19	13	19
Hand-painted	–	9	36	20
Decal	–	16	–	9
Tinted	1	2	4	1
Gilt	–	4	2	7
Flashed	–	–	1	–
Chinese	15	7	1	2
Japanese	–	4	–	1
Other				
Yellowware	3	33	2	–
Stoneware	1	1	1	4
Mexican glazed	77	3	1	1
Chinese earthenware	–	1	–	–
Native American	1,319	397	47	86
Total	2,180	700	353	554

Residents also had a small number of decorated vessels, however. The earliest occupants, as shown by sherds found in Feature 376, had a few dishes with brightly colored annular bands on their outside, as well as some dishes with sponge-stamped designs. Hand-painted gaudy dutch or peasantware vessels were also common. A small number of transfer-print dishes bore scenes of castles and cathedrals in bright colors. These dishes added a splash of color. The decorated vessels were often smaller bowls and cups and may have been favored possessions.

The people who discarded trash into Feature 359/437 in the 1890s tossed out many fragments from transfer-printed dishes, but were also beginning to use decal-printed vessels. The decal-print method became popular around the turn of the nineteenth century and allowed for multicolored vessels. Consumers in Tucson quickly purchased dishes from local stores sporting pink and yellow roses surrounded by green foliage. As old-fashioned annular, sponge-, and hand-painted ceramic vessels broke, they were increasingly replaced with the decal-printed vessels.

After 1900, these trends continued, as shown by dishes found in Features 360 and 408. A small number have gilt decoration, which became more common in the early 1900s. The end of the Victorian era saw a movement away from profuse decoration, and white vessels with thin gilt bands close to the rim may mark this desire for greater simplicity. Residents of Lot 1 also used more porcelain dishes in the 1890s, most of which were decorated in various ways.

The Telles and other families living on the lot in the 1870s and 1880s, and the residents of the boarding house from the 1890s onward, spent little money on dishes for their cupboards. The overall impression when examining the ceramics found at the site is that residents bought vessels piecemeal, one at a time at local stores, rather than complete sets. Examination of all the decorated vessels revealed only a handful with matching patterns. Most vessels were inexpensive, plain whitewares, with a smaller amount of decorated vessels. However, these included some examples bearing the latest designs available in local stores. While residents were relatively poor, they did attempt to keep up with the newest styles and have a few pretty dishes to enliven their meals.

Ethnicity

Documents suggest a Mexican family, the Telles, were the initial occupants of Lot 1 and that Euro-Americans later occupied the boarding house. Do the artifacts found at the site support the surviving records?

The vast majority of American Territorial period artifacts found at the site were created in factories in the eastern United States or Europe. By the time the Telles family lived on the block in the 1870s, large amounts of American and European goods were brought from southern California to Tucson via freight wagons. This trend accelerated when the railroad arrived, with the variety of American and European goods increasing and their prices decreasing. A visitor to a Mexican-American household in Tucson in the 1880s would have found relatively few distinctly Mexican artifacts, and many of these would have been perishable materials—clothing, leathergoods, and foodstuffs—that leave little evidence in the archaeological record.

Some artifacts found on Lot 1 of Block 181 suggest persons of differing ethnicity once lived there. Small numbers of artifacts from Mexico, China, and from the Tucson area were found during the excavations. As noted above, Native American pottery was recovered from the two borrow pits and two outhouses. It was most common in Feature 376, which dated from the 1870s-1890s, and probably contained trash discarded by the Telles family and other Mexican-American households. This hypothesis is strengthened by the presence of pieces of at least eight ceramic vessels made in Mexico—large serving or cooking bowls and a reconstructible canteen. The other three features had only a handful of Mexican sherds. Mexican ceramics are uncommon at contemporary sites occupied by Euro-American households.

Chinese artifacts were uncommon at the site. Those found included fragments of rice bowls, a piece from a food jar, and a fragment from an opium pipe. They may signal the presence of at least one Chinese person living at the site, perhaps working as a servant at the boarding house. Euro-American and Mexican-American households rarely used Chinese ceramics and would not have used Chinese foods or smoked opium. The overall low number of Chinese artifacts also raises the possibility that some of the artifacts were brought in with dirt used to fill existing holes.

The artifacts found in the features suggest the residents of the block switched from primarily Mexican-American to Euro-American in the 1880s or 1890s, probably when the single family house was demolished and the boarding house was constructed. Documents such as deeds, census records, and city directories support this conclusion. None of these documents indicate Chinese men lived on the block, although the presence of a handful of Chinese artifacts suggests one or more may have been present.

ARTIFACTS FROM THE CHINESE WELL

Trash deposited during the 1890s in the Chinese well, Feature 4 at the Mission locus of the Clearwater site, included 2,388 artifacts manufactured in China, the United States, Mexico, or Europe, as well as 664 pieces of locally made Native American ceramics, most of which were prehistoric sherds incidentally included in the fill. During analysis, an attempt was made to identify how each item was used and to determine the minimum number of each type of artifact present in the well (Table 12.5). It was not possible to identify everything found; some artifacts, such as tin cans, were very poorly preserved. Iron objects were often too rusty to be identified.

Kitchen

Artifacts used to store, prepare, and serve food are usually the most common functional category found at historic-era sites in southern Arizona. This was the case for the well, where kitchen artifacts represented approximately 59 percent of the artifacts, excluding Native American ceramics.

Like most recent immigrants, the Chinese who came to Tucson in the 1880s wished to recreate the food customs they had known in China. Not surprisingly, many of the kitchen-related artifacts were Chinese in origin and showed that the farmers purchased

Table 12.5. The number of fragments and minimum number of artifacts from the Chinese well, Feature 4, the Clearwater site, AZ BB:13:6 (ASM).

Artifact	Number of Fragments	Minimum Number
Kitchen		
Mexican glazed bowl	35	5
Wok	1	1
Iron pot	6	1
Pan	3	1
Chinese bowl	21	1
Chinese sauce dish	2	1
Chinese soup spoon	18	6
Chinese wine cup	5	3
Chinese teapot and lid	12	1
Celadon rice bowl	25	3
Bamboo rice bowl	14	1
Brass oval bowl	1	1
Tinware plate	3	1
Whiteware bowl	20	3
Whiteware butter pat	1	1
Whiteware cup	2	1
Glass goblet	4	2
Tumbler	4	2
Miscellaneous small vessel fragments	6	0
Bottle cork	2	2
Glass food bottles	113	3
Tin cans	112	5
Chinese stoneware jars	302	21
Chinese stoneware fragments	210	0
Chinese jar lids	17	7
Alcoholic beverage bottles	271	18
Chinese alcoholic beverage bottle	5	1
Beverage bottle	7	2
Unidentified bottle glass	142	5
Barrel hoop	25	1
Architecture		
Fired brick	1	1
Adobe bricks	8	4
Wall plaster	3	1
Window glass	97	1
Nails	132	132
Spikes	5	5
Bracket	1	1
Hinge	2	1
Furniture		
Lamp chimneys	395	5
Lamp parts	3	3
Arms and Ammunition		
Cartridge shells	20	20
Clothing		
Buckle	1	1
Shoe buckle	1	1
Buttons	50	50
Eyelet and rivets	34	28
Shoe fragments	27	6
Washtub	5	1
Safety pin	1	1
Personal		
Coin	1	1
Chinese coins	3	3
Toothpaste jar	1	1
Toothbrushes	7	3
Opium lamp	4	2
Opium pipe bowls	2	2
Chinese medicine bottle	4	3
Medicine bottle	1	1
Vaseline jar	1	1
Activity		
Bucket	52	2
Large rectangular container	48	4
Honing stone	1	1
Fan tan gaming piece	6	6
Bolt	1	1
Washer	2	2
Iron pipe	2	2
Machinery part	1	1
Unidentified		
Unidentified	76	32

imported foodstuffs, preparing them in traditional ways, and served foods and beverages in the same kinds of vessels used in their homeland.

Food preparation artifacts included a complete wok (Figure 12.14), a deep pot, a pan, and fragments from four Mexican bowls (Figure 12.15). The wok was

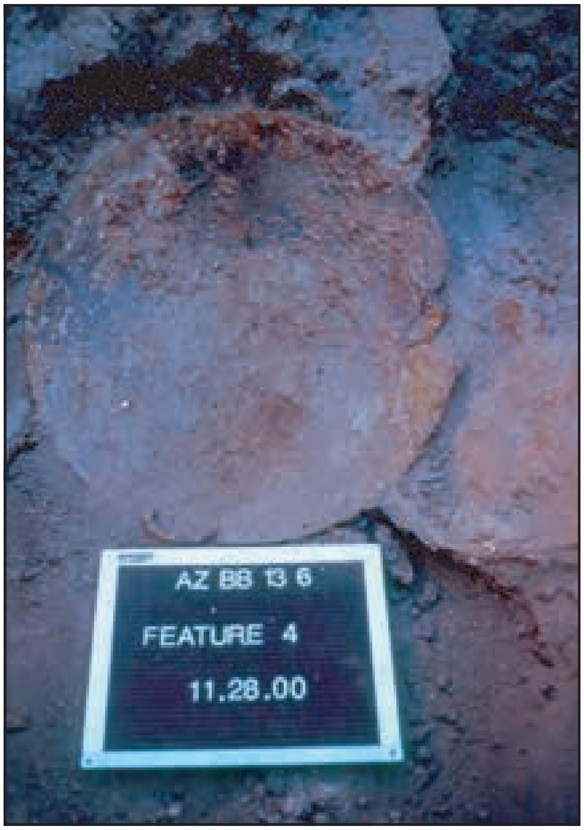

Figure 12.14. An iron wok found in the Chinese well, Feature 4, at the Clearwater site, AZ BB:13:6 (ASM).

found lying on its side, pressed up against the wall of the well. It had two looped iron handles soldered to the outside of its large iron bowl. It appeared very similar to modern woks. The wok did not appear to be broken, and it is unknown why it would have been discarded. Similarly, the pot and pan did not appear damaged or worn out. These items may have been discarded when households changed or when their owners died.

Four ceramic bowls found in the well were made from coarse earthenware; these were imported from Mexico. Each had a rounded strap handle attached to one side of the rim, with the opposite side having a series of fingerprint indentations, perhaps to help when handling the bowl. The interiors were glazed green and brown. Only the upper rims of the exteriors were glazed, and several of these bowls had sooting on their exteriors, indicating they were used to cook or warm foods directly over fires.

The nearby Carrillo House had an indoor corner fireplace, and some cooking likely occurred there. An outdoor hearth or brazier was probably set up in the summer, and cooking was done outside, similar to what happened at the households of local Mexican-Americans.

Figure 12.15. A Mexican earthenware bowl found in the Chinese well, Feature 4 (FN 5450, FN 6303, and FN 6317) at the Clearwater site, AZ BB:13:6 (ASM).

Dishes used to serve meals were found in relatively large numbers in the well. In China, four ceramic forms typically saw daily use: a teacup, a rice-soup bowl, a saucer, and a soup spoon (Lister and Lister 1989:48). Excavations at the Spruce Street Chinese gardeners' compound and the Tucson Urban Renewal project indicated that saucers were rarely used by local Chinese and that teacups were also rare (Lister and Lister 1989:48; Thiel 1997).

Four different styles of Chinese ceramic tablewares were recovered. All would have been used by Chinese commoners during the closing years of the Qing Dynasty, which lasted from 1644 to 1911. These dishes were exported from China and transported across the Pacific Ocean in the holds of ships. From the west coast of the United States, they were carried to Tucson by Chinese immigrants, or they were imported and sold in local stores.

The most common style found in the well was Celadon or Winter Green (*ch'ing*), which has a light green glaze on the exterior and either a white or lighter green glaze on the interior. In China, this style of porcelain was mold-made, mass-produced, and marketed to commoners. In Tucson, Winter Green vessels have been found in a variety of forms, including rice bowls, teacups, and soup spoons (Lister and Lister 1989:50).

Four Flowers or Four Seasons (*szu hua*) vessels are mold-made, porcelain, and have four hand-painted floral designs on a light green or white background. Four Flowers vessels come in a wider variety of forms, including different-sized bowls and cups, plates, soup spoons, saucers, sauce dishes, and larger serving dishes (Lister and Lister 1989:50).

Bamboo (*chu hua*) vessels, also known as Swatow, Three Circles and a Dragonfly, or Three Circles and

Longevity, have a light blue or blue-gray glaze over a coarse gray stoneware body and they are decorated with dark blue or dark green hand-painted designs. This style is found on rice bowls and a saucer in Tucson (Lister and Lister 1989:49-50).

Finally, a handful of plain white vessels were present. Undecorated porcelain vessels were not found in the excavations at Spruce Street or during the Tucson Urban Renewal project.

Figure 12.16. Celadon and Bamboo rice bowls from the Chinese well at the Clearwater site, AZ BB:13:6 (ASM). Left: Feature 4 (FN 5137 and FN 5311); right: Feature 4 (FN 5311, FN 6418, and FN 6461).

The serving vessels found in the well were mainly manufactured in China. Rice bowls (*fan wan*) were represented by two Bamboo and two Celadon examples (Figure 12.16). These bowls would have held sauces or stews, which would have been eaten with the five Four Seasons and one Celadon soup spoons found in the well. A large Four Seasons serving bowl would have conveyed food to the dining area.

The Chinese often seasoned meals with imported sauces and spices. Two small sauce bowls—one decorated in the Four Seasons pattern and one small, plain white example—were found (Figure 12.17).

A plain white teapot had a brass handle and a white lid. The spout curved elegantly outward and may have been used to pour tea into the two Celadon and one Four Flowers cups. These cups could also have been used to hold wine or liquor.

A handful of ceramic vessels manufactured in Europe were found in the well. A butter pat and a small round bowl may have been substitutes for sauce dishes. A larger oval bowl was probably used as a small platter. A plain white cup, missing its handle, was found, as were fragments of another plain dish. Two glass goblets and fragments of one or two glass tumblers were also found. Small fragments of two other dishes, a majolica plate and a flow blue plate, probably represent vessels used by the Gallardo or Carrillo families prior to the arrival of the Chinese farmers.

Chinese ceramic food and beverage containers were also common. Unbroken Chinese sauce jugs were recovered from the well. The jugs were similar to the catsup bottles of today; that is, the gardeners were more interested in the contents than in the container. These somewhat sturdy ceramic vessels held foods and beverages prepared in China, shipped in boats across the Pacific, and then sent by train to local Chinese grocery stores. Farmers probably traded fresh produce for a variety of imported foodstuffs.

Figure 12.17. Four Seasons sauce bowl from the Chinese well, Feature 4 (FN 5308) at the Clearwater site, AZ BB:13:6 (ASM).

Sixteen spouted jars (*Nga Hu*) once held soy sauce, black vinegar, or peanut oil (Yang and Hellmann 1996). They have a small spout projecting from one side and a narrow opening at the top that would have been closed with a cork or wooden stopper. The spout was also sealed with a plug of clay (Lister and Lister 1989:40).

Six wide-mouthed jars (*Fut How Nga Peng*) of varying sizes once held tofu, sweet bean paste, beans, pickled turnips, cabbage, shrimp paste, sugar, or condiments (Yang and Hellmann 1996) (Figure 12.18). Most of the jars had brown glaze on their interior and exterior, although the exterior base was usually

Figure 12.18. Food and sauce jars from the Chinese well at Clearwater, AZ BB:13:6 (ASM). All are from Feature 4: lid, FN 6303; small brown jar, FN 6303 and 5450; green jar, FN 6303 and 6359; large brown jar, FN 5121.

unglazed. One smaller jar has a lovely green glaze on the outside. Seven glazed and unglazed jar lids once capped these food containers, originally sealed in place with white clay or some other substance (Lister and Lister 1989:40-41).

The Chinese farmers also purchased some foods bottled and canned in the United States or elsewhere. A clear, wide-mouthed jar; a light blue pickle or olive bottle; and a blue peppersauce bottle were found in the well. At least four tin cans were also present. The number was probably much higher originally, but iron artifacts were extremely poorly preserved in the well, preventing an accurate count of the number of cans present.

Alcoholic beverages were regularly consumed by the Chinese gardeners. Two Chinese brown stoneware liquor bottles (*Tsao Tsun*) were also recovered (Yang and Hellmann 1996). These bottles are glazed on the interior and most of the exterior and have a narrow opening that could be plugged with a cork or stopper. Much more common were liquor and beer bottles manufactured and filled in the United States or Europe. These glass bottles can be identified due to their distinctive shapes, types of top or finish present, and, in some cases, by the presence of a kick-up base. Eight brown glass beer or liquor bottles, one clear glass picnic flask, and 10 olive green bottles, which would have held wine or champagne, were present in the well. Two of the brown beer bottles were marked "F. H. G. W." on their bases. This mark was from the Frederick Hampson Glass Works of England and was made after 1880 (Toulouse 1971:202). One of the olive green bottles was marked "L. B. S. 5" and probably dates from 1880 to 1900 (Toulouse 1971:319-320). Work during the Tucson Urban Renewal project also indicated that the urban Chinese drank more American alcoholic beverages, with imported spirits probably reserved for special occasions (Lister and Lister 1989:77-79).

The Chinese farmers obtained water from the well before it fell out of use, and they probably got water from a nearby canal in the 1890s. Water was probably stored in large tinned containers or in wooden barrels. A large barrel hoop found in the well may have originated from one such barrel used to hold well or rain water. Excavations at the gardeners' compound beneath Spruce Street resulted in the discovery of two water barrels partially set into the ground (Thiel 1997).

The farmers' Mexican-American and Euro-American neighbors stored water in large *ollas* made by the local Tohono O'odham. However, the Chinese farmers who lived on the Carrillo property do not appear to have followed this custom. Although 664 Native American sherds were found in the well, none were reconstructible, and many of the sherds appear to be small pieces that were incidentally included in the dirt that filled the well.

The kitchen category also includes unidentified bottle glass; 149 pieces were recovered from the well. Some of this glass probably came from bottles and jars that once held beverages and foods, but some may have originated from bottles that held nonfood substances, such as medicines or oil.

Architectural

Architectural artifacts are those used to build, maintain, and illuminate structures. They are commonly found in historic-era features in southern Arizona, and the Chinese well was no exception. Building materials were represented by 1 fired brick, 8 fragments from four adobe bricks, and 2 pieces of wall plaster. At least one window pane was found, broken into 97 pieces. Nails are usually the most common architectural artifact, and 132 nails and five spikes were found in the well. However, some of these could have come from packing crates, furniture, or equipment such as wagons. It is impossible to differentiate nails that were used for these different purposes. A bracket and two pieces from a hinge were also found.

Some of these artifacts may have come from the Carrillo House, discarded as items wore out or repairs were made. The Carrillo House, in which the Chinese men probably lived, was extensively documented by Frederick Nichols of the Historic American Buildings Survey in 1939. Built in the late 1860s, the home had two rooms—a kitchen and a living room that was probably also used as a bedroom. Cooking may have been done inside the kitchen or on outside hearths during the summer. Likewise, the Chinese men probably slept outside during the summer, a common practice in Tucson until the 1920s, when evaporative cooling was invented and became widely adopted.

The Chinese men used kerosene lamps to provide light at night. Fragile lamp chimneys often broke, and 395 fragments were collected, representing a minimum of five individual chimneys. Three brass burner fragments were also found. While both electricity (used for lighting) and telephone service were present in the 1880s in Tucson, the farmers probably did not have these luxuries. In contrast, early Tucson City Directories suggest that the urban Chinese storekeepers and laundries had installed these conveniences soon after they became available.

Arms and Ammunition

Newspaper accounts indicate Chinese residents of Tucson frequently carried firearms. Many merchants acquired pistols and rifles to protect their stores from robbery. Other Chinese men may have carried them for personal protection, a necessity due to the violence common between the men of the Chinese and Mexican communities. The excavation of the Chinese gardeners' household beneath Spruce Street recovered ammunition from a variety of weapons, with at least nine different pistols and shotguns present (Thiel 1997).

Twenty cartridges were found in the well. Cartridges are often stamped with the name of the manufacturer on their heads. Unfortunately, most of the cartridges were too corroded to be read, and efforts to clean them proved futile. Eight of the cartridges were for a 32-gauge rifle, 1 was for a .22-short rimfire marked "H" manufactured by the Winchester Repeating Arms Company (Hull-Walski and Ayres 1989:138), 10 were for a 410-caliber shotgun, and 1 was for an 8-gauge shotgun.

At least four different firearms were used by the farmers. In addition to personal protection, the rifle and shotguns may have been used for hunting. The nearby Warner's Lake attracted a variety of wildfowl. Rabbits were also readily available in the desert, as well as in field areas.

Clothing

Chinese men arrived in the western United States with their traditional clothing, although they soon adopted western attire for several reasons. A primary reason was the desire to be less conspicuous. The U.S. government had passed the Chinese Exclusion Act in 1882 and renewed it in 1892. These laws required that the Chinese in the U.S. carry identification papers, issued by the government. Chinese without these documents could be detained and deported. The laws attempted to discourage immigration to the U.S., but Chinese men still arrived in search of opportunities. New arrivals quickly donned Western attire, which was unfamiliar to the men. Chinese inspectors, who were trained to spot and detain new immigrants, often recognized them due to the way they walked in their ill-fitting new wardrobes (Perkins 1976).

Intact clothing is rarely found in archaeological excavations because cloth and leather typically deteriorate. This can make it difficult to interpret the portions that survive. Fifty buttons were found in the well—3 made from bone, 2 from brass, 2 from iron, 5 from shell, and 22 from milk glass, including several with transfer-printed calico designs. Two buttons were made from round porcelain pieces set into brass shanks. Fourteen small, round-shanked brass buttons came from a traditional Chinese jacket. Identical buttons were found at the Spruce Street gardeners' compound (Thiel and Diehl 1997:69-71). The buttons from the well came in a range of sizes that would have been used for shirts, underwear, and even coats. Their variety suggests clothing was purchased piecemeal, with some items probably bought second-hand. The hard manual labor the farmers performed likely resulted in the need to replace worn clothing on a regular basis.

Twenty-seven pants' rivets were also found, as were two small brass buckles, perhaps used in a pair of suspenders. The rivets came from western-style denim pants, which were sturdy enough to sustain heavy use. Pieces from four or five leather shoes, including soles, heels, and six eyelets, indicate western footwear was used by the farmers.

Many of the Chinese men who settled in Tucson established laundries. This type of business required little overhead; a launderer merely had to purchase a washtub, scrub board, and soap to go into business. The Carleton Watkins photograph of Tucson, taken in April 1880 from A-Mountain, shows drying sheets and clothing draped over the bushes lining the canals. The Chinese gardeners may have traded produce for laundry services, including mending. Relatively few clothing maintenance artifacts were found in the well—only pieces of one tinned washtub and one safety pin were recovered.

Personal

Personal items are those likely to be owned and used by a single individual, sometimes for extended periods of time (such as a toothbrush), or sometimes for a short period (such as a coin).

Three poorly preserved Chinese coins were found in the well. These coins are round, have a square hole in the center, and have four Chinese characters on one face. Due to their corrosion, it was impossible to determine the dates of the coins. They were imported from China and were used extensively within the immigrant community for purchasing items within the Chinese community, for use in secret societies, and sometimes for gambling (Lister and Lister 1989:76). Coins were also found at the Spruce Street compound and several locations in downtown Tucson during the Tucson Urban Renewal project (Lister and Lister 1989:76; Thiel and Diehl 1997:73). One copper coin or token was also found, but it was illegible due to corrosion.

The Chinese farmers probably relied on traditional folk medicines when they had health problems. By 1900, there were three Chinese doctors and three druggists in Tucson, and local stores carried a variety of medicines. During the Tucson Urban Renewal project, a large number of medicinal products were collected from standing structures. Most of these were packaged in paper containers that leave no archaeological evidence. A few small, hand-blown glass bottles were also found during that earlier project, one of which had a paper label indicating it had contained medicine to relieve sunstroke, cholera, or fever (Lister and Lister 1989:69). More recent excavations resulted in the recovery of five of these bottles at the Spruce Street compound and five examples from a trash-filled borrow pit in the Barrio Libre. One of the latter bottles had a paper label revealing the small bottle had held an oil used for headaches, sinus problems, or mosquito bites (Thiel 2002:44; Thiel and Diehl 1997:94-95).

Two Chinese medicine bottles were present in the well. These bottles were hand-blown, with a narrow neck and a wider body. They are light blue and would have held a small amount of traditional medicine within a concavity running down the length of the bottle.

A few medicines manufactured in the U.S. were also used by the farmers. One small, hand-blown, light blue medicine bottle was unmarked, and its contents are unknown. Another small clear bottle was embossed "CHEESEBROUGH MFG CO. VASELINE" and once held a product used as a skin balm. Fragments from at least one other light blue medicine bottle were present in the well. The small number of Euro-American medicinal products in the well contrasts strongly with contemporary households in Tucson, as Euro-Americans and Mexican-Americans purchased large numbers of over-the-counter and prescription medicines. The gardeners probably relied heavily on traditional Chinese medicines, including those packaged in paper that have left no trace.

Prior to the 1920s, few people in the U.S. regularly brushed their teeth. Poor dental hygiene contributed to early tooth loss, and dentists in Tucson had a thriving business pulling teeth and filling cavities. The Chinese farmers appear to have been more concerned with dental health than the average person living in the community. Three bone toothbrushes and one whiteware toothpaste container were discovered in the well. During the Tucson Urban Renewal project, bone-handled toothbrushes were frequently discovered in Chinese features (Lister and Lister 1989:106-107).

Activity

The activity category includes items used during work-related tasks or for recreation; recovered items are 58 fragments from two large tinned metal buckets. Several accounts of Chinese farmers note that they carried water to their crops using buckets hung from a shoulder yoke. The farmer would dip the buckets into water and walk down the rows of plants, tipping the water where necessary. The 48 fragments of four large square containers found in the well may have served a similar purpose.

While the farmers likely used a variety of tools in their daily tasks, none were found in the well. A honing stone was recovered, perhaps used to sharpen the knives used to cut and trim the produce before it was taken to market.

The gardeners found time to play games and gamble. Although playing cards were probably used in the household, none were found. Instead, two black and four white *fantan* gaming pieces were present in the well. These pieces, or counters, were used in gambling games. In one version of *fantan*, playing cards are placed in sets on a table, and if a person cannot play a card, they add a chip or piece to the pot. The winner, the first person to play all their cards, received the entire pot. "White pearls" were reported to have counted as 100 and "black pearls" as 500 (Lister and Lister 1989:75).

Alcohol and opium use were common among the overseas Chinese. As noted earlier, numerous alcoholic beverage bottles were found in the well. Social drinking allowed the farmers to relax after a hard day in the fields, as did the use of opium. A complete black ceramic opium pipe and a fragment from a second orange ceramic pipe indicate opium smoking occurred

Figure 12.19. Glass opium lamp from the well, Feature 4, disk (FN 5119); globe (FN 5289) at the Clearwater site, AZ BB:13:6 (ASM).

within the farmers' household. Two glass opium lamps were also present (Figure 12.19). These lamps have a glass base, a glass reservoir, and a circular pierced glass disk that caps the reservoir. Two reservoirs and one disk were found in the well.

Opium was introduced into China by Western European countries in the 1700s in an effort to force China to trade with the outside world. At that time, opium was a legal drug, and like tobacco and alcohol, had very addictive qualities. It is manufactured from poppy seeds and is a thick viscous black material. A flame is placed near the material and, when heated, a smoke is produced, which was inhaled by the user. Smoking opium produced a muscle-relaxing effect, similar to drinking several beers. It also produced a feeling of calmness and could make a person feel drowsy.

The U.S. government made the smoking of opium illegal in 1881, although it remained legal in Tucson until 1906. Contemporary accounts suggest members of the Chinese community did not abuse alcohol or opium, but this did not stop the police from occasionally raiding opium dens (Thiel and Diehl 1997:97-98). These raids did not prevent the use of the substance; instead, it drove it underground. During the Tucson Urban Renewal project, archaeologists occasionally found opium paraphernalia hidden from prying eyes above ceilings or in other places (Lister and Lister 1989:81).

Other activity artifacts included two bolts, two washers, and a piece of iron pipe. It is unknown how these particular items were used by the farmers.

For various reasons, including corrosion or fragmentation, 55 artifacts could not be identified. This is a rather small number compared with other historic-era sites. These items included 10 brass screws and bolts with iron washers attached, probably pieces from a larger item; 2 pieces of wood with brass caps; 2 pieces of carved bone that may be from an umbrella; 22 iron strips; 2 pieces of lead; and 7 fragments of hard rubber.

Summary

The artifacts from the Chinese well indicate the gardeners living at the Carrillo House during the 1890s attempted to maintain their accustomed lifestyle. The men ate meals flavored with Chinese sauces and containing imported foods, wore some traditional clothing, and smoked opium and played Chinese games in their spare time. They acquired and used many goods and foods made in the United States and Europe, although they retained a strong inclination to remain separate and not blend in with their neighbors.

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CHAPTER 13

FAUNAL REMAINS

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Large numbers of animal bones were found during the Rio Nuevo Archaeology project. Analysts examined a sample of the bones to determine how humans utilized animals over the course of the last 4,000 years. Cameron studied animal bone from Early Agricultural, Early Ceramic, and Hohokam contexts, while Waters identified bone recovered from the Tucson Presidio, AZ BB:13:13 (ASM), and from a Chinese gardeners' well at the San Agustín Mission locus of the Clearwater site, AZ BB:13:6 (ASM). Pavao-Zuckerman and LaMotta analyzed bone from Pima features at the San Agustín Mission locus, Clearwater site, and Schulz identified the fish bone recovered from the Chinese gardener's well.

FAUNAL REMAINS FROM PREHISTORIC CONTEXTS

Approximately 4,000 bones recovered during investigations of prehistoric contexts at the Clearwater site and the Tucson Presidio of the Rio Nuevo project in downtown Tucson were analyzed. The contexts covered a wide temporal range, from the unnamed phase of the Early Agricultural period to the Hohokam Classic period, a range from about 2100 B.C. to A.D. 1450. Mammal remains dominated the assemblages, with a few bird, amphibian, and reptile remains also present. This section provides a general description of the faunal remains collected from prehistoric contexts at the sites and assesses patterns of faunal exploitation when adequate sample sizes allow.

Methodology

Laboratory Procedures

All of the analyses presented here were conducted following the standard faunal coding procedures used by Desert Archaeology, Inc. Several types of data were recorded for each bone, including: species and element type, side, degree and origin of fragmentation, degree of epiphyseal fusion, and the presence or absence of butchering marks, burning, and gnawmarks. The presence or absence of natural environmental modification (such as caliche-coating and root-etching) on each bone also was noted.

Taxonomic identifications were based on comparisons with a comparative collection, as well as with the aid of published keys (for mammal bones, Gilbert 1980; Olsen 1964; for bird bones, Cohen and Serjeantson 1996; Gilbert et al. 1981; Olsen 1979). Taxonomic information on fragments that could not be identified to order or below consisted primarily of the definition of size categories within classes. The size categories for mammals were defined as follows: small mammal fragments were woodrat- to rabbit-sized, medium mammal fragments were bobcat-/canid-sized, and large mammal fragments were deer-sized. Elements that fell in size between canid and jackrabbit were placed in a medium-small mammal category. A large-medium mammal category contained elements that were definitely larger than jackrabbit, but that were clearly not medium mammal or deer-sized. Many of the mammal bones were too fragmented to be placed in any of the size categories and were simply coded as mammal. A single bird bone could also not be identified below class, and it was placed in a medium-small bird category (it was larger than quail but smaller than hawk in size). One bone could not be identified to class and was categorized as unknown animal (indeterminate vertebrate).

Degree and origin of fragmentation was used to assess completeness of a bone, and, for incomplete elements, when the breakage occurred (did the bone exhibit a fresh break, or was it broken at some time prior to excavation, or both). Bones can be fractured for a number of reasons, including marrow extraction (Enloe 1993; Kent 1993; O'Connell et al. 1992), cooking (e.g., breaking of bones so that they fit into a pot for boiling) (Gifford-Gonzalez 1993; Kent 1993; Oliver 1993; Yellen 1977), and postdepositional processes (e.g., trampling, excavation procedures) (Andrews 1990; Gifford-Gonzalez et al. 1985; Haynes 1991; Olsen and Shipman 1988). All of these processes can result in faunal elements being found anywhere from whole to highly fragmented. The faunal elements were coded as complete, more than three-quarters complete, between three-quarters and half complete, between half and one-quarter complete, or less than one-quarter complete. The portion (e.g., proximal end, distal end, and so forth) of the element that was recovered was also coded.

Degree of epiphyseal fusion was coded as fused, unfused, or partially fused (i.e., the epiphyseal lines were still visible). Degree of epiphyseal fusion was recorded for both the proximal and distal (or dorsal and ventral) portions of an element, when both ends were present. This information was used to determine the approximate age of the animals recovered from the site (fetal, juvenile, adult).

Burned bones were coded as calcined (white appearance), charred (blackened appearance), partially charred, blue/gray, and light brown. A few bones had a combination of burning patterns and were coded as brown/calcined or charred/calcined. Burned bones have frequently been interpreted as evidence for roasting, but bones can become burned through disposal in a fire, use as fuel, or by natural processes, such as brush fires (Lyman 1994b). These issues are addressed more fully below.

Gnawed bone was coded as rodent gnawed, carnivore gnawed, and indeterminate gnawing. Several studies have shown that carnivores can transport bones out of a site area, as well as consume all or parts of bones (Binford and Bertram 1977; Hudson 1993; Kent 1981, 1993; Lyon 1970; Marean and Spencer 1991). Studies of the impact of carnivores on faunal assemblages have revealed that the presence of gnawmarks varied with the frequency that dogs received bones, as well as with bone size and density (see Kent 1981). Other studies have also noted that rodents may play a role in the deposition of bones in a site (Cameron 1994).

Each bone was also examined for natural environmental modification. Environmentally modified categories included root-etched, eroded, sunbleached, and caliche-coated. Degrees of natural modification were recorded only for Caliche-coating. The data on environmental modification were used to assess preservation. Bone preservation is affected by soil conditions and by the length of time bones are exposed to the natural elements (Andrews 1990; Behrensmeyer 1978; Lyman 1984, 1985, 1994b; Lyman and Fox 1989).

Quantification

Many different techniques have been developed to quantify faunal remains (see Lyman 1994a). The most common quantification method has been the number of identifiable specimens (NISP); that is, the number of bones and fragments of bones recovered from a site. The NISP is the primary quantification procedure used in this report. Because NISP can be greatly influenced by preservation, bone breakage, and recovery procedures, these issues are also addressed. Further, to minimize the inflation of NISP due to postdepositional bone damage, all bones with fresh breaks that could be refit were counted as one element. The refitting occurred only within specimen bags; no attempts were made to match or refit bones between different specimen bags.

ASSEMBLAGE COMPOSITION

The Clearwater Site, AZ BB:13:6 (ASM)

A total of 3,932 faunal remains collected from three loci at the Clearwater site were analyzed. The contexts ranged in date from circa 2100 B.C. to A.D. 1700, with most of the remains from Cienega phase features. The loci are located within a few hundred meters of each other, and the site itself is located on the Holocene floodplain of the western bank of the Santa Cruz River. Portions of a late eighteenth century mission overlay some of the loci from which prehistoric fauna were recovered, while other areas lay below an undeveloped former agricultural field and a historic-era brickyard. Because one of the goals of the project was to examine temporal trends, the following description of the faunal assemblage from this site is organized around the various temporal periods rather than the different loci. However, any major spatial differences or trends within temporal phases are noted as necessary. One bone, an unburned, unsized mammal indeterminate element fragment, was recovered from a nonfeature context that was not assigned to any temporal period.

Unnamed Phase of the Early Agricultural Period (2100-1200 B.C.)

Twenty-seven faunal remains recovered from strata 503 and 504 contexts dating to the unnamed phase of the Early Agricultural period were analyzed, including 24 unworked remains (Table 13.1) and

Table 13.1. Unworked taxa recovered from Stratum 504 contexts at the Clearwater site, AZ BB:13:6 (ASM).

Taxa	*n* (%)
Identifiable mammal (Mammalia)	
Black-tailed jackrabbit (*Lepus californicus*)	5 (20.8)
Cottontail (*Sylvilagus* sp.)	1 (4.2)
Medium rodent	2 (8.3)
Unidentifiable mammal	
Unsized mammal	8 (33.3)
Small mammal	7 (29.2)
Large-medium mammal	1 (4.2)
Total	24 (100.0)

Table 13.2. Worked bone artifacts recovered from the Clearwater site, AZ BB:13:6 (ASM) (all time periods).

Bag No.	Taxa	Element	Artifact	Feature	Comments[a]
Stratum 503 (circa 1500 B.C.)					
9271	Large-medium mammal	Indeterminate	Awl shaft (?)	3368	Calcined (L = 1.3)
Stratum 504 (circa 2100 B.C.)					
9267	Large mammal	Indeterminate	Awl shaft	3364	Charred/Calcined (L = 1.4)
9278	Large-medium mammal	Shaft fragment	Awl shaft	3368	Partially charred (L = 6.5)
Cienega phase					
5853	Large mammal	Indeterminate	Awl shaft	15	Unburned (L = 2.7)
6004	Large-medium mammal	Indeterminate	Polished (awl?)	15	Charred (L = 1.4)
6148	Medium artiodactyl	Metapodial	Awl handle	15	Charred (L = 5.4)
6173	Mammal	Indeterminate	Worked	57	Unburned (L = 1.9), fragment with shaped edge
6111	Large mammal	Indeterminate	Awl shaft	65	Partially charred (L = 7.3)
6440	Large-medium mammal	Indeterminate	Awl shaft (?)	121	Charred (L = 2.2)
6278	Large mammal	Shaft fragment	Awl shaft	126	Charred (L = 2.9)
6279	Large mammal	Shaft fragment	Worked	126	Unburned (L = 3.8 cm; D = 2.5), beveled edge, bead fragment?
6583	Large mammal	Indeterminate	Awl shaft (?)	128	Unburned (L = 5.1)
6650	Large mammal	Indeterminate	Awl shaft (?)	128	Charred (L = 1.6)
8669	Large mammal	Indeterminate	Worked	3270	Unburned (L = 3.0), shaped edges, one side flattened
8769	Large mammal	Indeterminate	Awl shaft (?)	3294	Calcined (L = 1.9)
8775	Large mammal	Shaft fragment	Awl shaft	3294	Charred (L = 4.7)
9069	Large mammal	Indeterminate	Awl shaft	3327	Charred (L = 1.6)
8368	Large mammal	Indeterminate	Worked	9357	Partially charred (L = 1.9), polished fragment
Early Ceramic period					
8172	Large-medium mammal	Shaft fragment	Worked (awl?)	3014	Partially charred (L = 2.5)
Hohokam periods					
9050	Large mammal	Indeterminate	Awl shaft	3293	Charred (L = 5.8)
9050	Large-medium mammal	Indeterminate	Awl tip	3293	Charred (L = 1.7 cm; T = 1.5 mm)

[a] L = Length measurement; T = tip measurement, tip measurement taken 2 mm from tip end; D = diameter measurement; all measurements in cm unless otherwise indicated.

three worked bones (Table 13.2). The remains were collected from several pithouses and small pit features in Stratum 504 at the Congress Street locus, and all but one—a worked bone—were found in Stratum 504 features that dated to circa 2100 B.C. Most of the unworked bones in this assemblage were highly fragmented, with most being less than one-quarter complete (*n* = 20, 83.3 percent). Nearly two-thirds of the unworked bones exhibited a combination of past and recent breakage (*n* = 15, 62.5 percent), which suggests recovery procedures and more recent bone handling had some impact on the degree of bone fragmentation in the assemblage. Slightly more than 30 percent of the bones exhibited evidence of only past breakage (*n* = 8, 33.3 percent). None of the bones were unbroken, and one had fresh breaks only.

Environmental modification was common, with more than three-quarters of the unworked bones covered to varying degrees with a hard, unidentifiable sedimentary substance (*n* = 20, 83.3 percent). No gnawed bones were noted, which suggests carnivores had relatively little impact on the assemblage. The majority of the bones were also burned (*n* = 13, 54.2 percent), with roughly equal proportions of charred (*n* = 5, 38 percent) and partially charred (*n* = 7, 54 percent) bones. One bone was calcined. Most of the burned remains were unidentifiable mammal (*n* = 4, 31 percent), small mammal (*n* = 5, 38 percent), and large-medium mammal (*n* = 1, 8 percent) bones. Burned bones were recovered from four of the seven features, with eight of the burned remains collected from pithouse Feature 3364. Small sample sizes from individual features (all but Feature 3364 had less than five elements) preclude any interpretations of burned taxa recovered in the different features.

All of the remains in the analyzed Stratum 504 assemblage were identified as mammals. One-third of the unworked remains were identifiable below class, the majority of these being rabbit (see Table 13.1). Two species of jackrabbit—antelope jackrabbit (*Lepus alleni*) and black-tailed jackrabbit (*L. californicus*)—and two species of cottontail—eastern cottontail (*Sylvilagus floridanus*) and desert cottontail (*S. audubonii*)—currently reside in the area (Hoffmeister 1986). Due to the difficulties in distinguishing cottontail species based on postcranial material and the fragmentary condition of most of the cranial bones, cottontail elements were not identified below genus throughout the analyses. Antelope jackrabbit and black-tailed jackrabbit can be distinguished by size, with antelope jackrabbit elements generally being larger. All elements that were significantly larger than the black-tailed jackrabbit in the comparative collection were identified as antelope jackrabbit. For elements that were only slightly larger than the black-tailed jackrabbit in the comparative collection, a more conservative classification of indeterminate jackrabbit (*Lepus* sp.) was used.

All the jackrabbit bones recovered from Stratum 504 contexts were identified as black-tailed jackrabbit. These elements included fragments of a charred mandible, a partially charred radius, and three unburned tibiae recovered from pithouse Features 3359 and 3364 and pit Feature 622, respectively. All but one of the jackrabbit bones were less than one-quarter complete, with some of the breakage occurring recently on many of the elements. A charred cottontail humerus was also recovered from Feature 3364. This element was greater than three-quarters complete, with some of the breakage occurring recently. All of the jackrabbit and cottontail bones were covered with a hard sedimentary substance. Due to the small number of rabbit bones recovered, patterns of rabbit exploitation cannot be assessed for this time period.

Additional identifiable remains included two unburned medium rodent (woodrat-sized) bones—an innominate and a femur collected from pit Features 622 and 3360, respectively. Both of these elements were between one-quarter and three-quarters complete, with some of the breakage occurring recently. Both elements were also covered with a hard sedimentary substance. These remains likely represent natural deposits, although archaeological and ethnographic evidence has shown that rodents were occasionally consumed in the region. This issue is addressed more thoroughly in the "Cienega Phase" section below.

Three worked bones also were noted. All of the worked bones are small awl or probable awl fragments made from large- or large-medium-sized mammals (see Table 13.2). Two of the fragments were recovered from pithouse contexts, Features 3364 and 3371, that date to approximately 2100 B.C. The third artifact was collected from Feature 3368, a small pit, that has been dated to 1500 B.C. Due to the small size of the fragments, as well as the presence of a hard sedimentary substance that obscured any polish or striations on two of the tools, conclusions about the specific function of these artifacts could not be made.

Cienega Phase (800 B.C.-A. D. 50)

A total of 3,858 faunal remains, including 3,843 unworked bones (Table 13.3) and 15 worked bones (see Table 3.2), recovered from Cienega phase contexts was analyzed. These remains were collected from nearly 60 features and intramural features located in the San Agustín Mission locus (*n* = 26) and the Brickyard locus (*n* = 33). Most of the features from which fauna were recovered were pithouses (*n* = 30, 50 percent) or postholes (*n* = 15, 25 percent) and pits (*n* = 10, 17 percent) located in the pithouses.

More than 60 percent of the assemblage was collected from Feature 9357, likely due to this feature's relatively large volume as compared with other Cienega phase features. Feature 9357 is a large, deep pit structure located in area RNA 8. The structure was probably originally used for communal ceremonies and was later used for trash disposal. Only three other features (pithouse Features 57, 3264, and 3294) yielded more than 100 bones, and none of these had more than 200 elements. Most features (*n* = 38, 63 percent) had assemblages of fewer than 20 bones. Due to the unequal distribution of fauna in features, detailed assessments about the faunal types in specific features were not made. Both loci yielded similar proportions of major taxa, indicating the recovered assemblages are comparable (see Table 13.3).

Table 13.3. Unworked taxa recovered from Cienega phase contexts at the Clearwater site, AZ BB:13:6 (ASM).

Taxa	San Agustín Mission Locus [*n* (%)]	Brickyard Locus [*n* (%)]	Total [*n* (%)]
Amphibian (Amphibia)			
Toad/Frog (Salientia)	–	1 (0.0)	1 (0.0)
Reptile (Reptilia)			
Snake (Serpentes)	–	1 (0.0)	1 (0.0)
Turtle (Testudinata)	1 (0.2)	10 (0.3)	11 (0.3)
Bird (Aves)			
Raven or crow (*Corvus* sp.)	1 (0.2)	–	1 (0.0)
Total non-mammals	2 (0.4)	12 (0.4)	14 (0.4)
Identifiable mammal (Mammalia)			
Rabbit or hare (Leporidae)	2 (0.4)	18 (0.5)	20 (0.5)
Jackrabbit (*Lepus* sp.)	5 (0.9)	35 (1.1)	40 (1.0)
Antelope jackrabbit (*L. alleni*)	7 (1.3)	25 (0.8)	32 (0.8)
Black-tailed jackrabbit (*L. californicus*)	78 (14.1)	656 (20.0)	734 (19.1)
Cottontail (*Sylvilagus* sp.)	25 (4.5)	109 (3.3)	134 (3.5)
Small rodent	1 (0.2)	2 (0.1)	3 (0.1)
Medium rodent	6 (1.1)	4 (0.1)	10 (0.3)
Pocket gopher (*Thomomys* sp.)	4 (0.7)	3 (0.1)	7 (0.2)
Woodrat (*Neotoma* sp.)	3 (0.5)	–	3 (0.1)
Muskrat (*Ondatra zibethicus*)	–	1 (0.0)	1 (0.0)
Small carnivore	–	2 (0.1)	2 (0.1)
Medium carnivore	–	4 (0.1)	4 (0.1)
Wolves, dog/coyote, foxes (Canidae)	–	3 (0.1)	3 (0.1)
Dog/Coyote (*Canis* sp.)	2 (0.4)	24 (0.7)	26 (0.7)
Fox (*Vulpes/Urocyon*)	1 (0.2)	9 (0.3)	10 (0.3)
Unsized artiodactyl	4 (0.7)	–	4 (0.1)
Medium artiodactyl (deer-sized)	7 (1.3)	64 (1.9)	71 (1.8)
Deer, elk, or ally (Cervidae)	1 (0.2)	2 (0.1)	3 (0.1)
Deer (*Odocoileus* sp.)	6 (1.1)	32 (1.0)	38 (1.0)
Total identifiable mammals	152 (27.4)	993 (30.2)	1,145 (29.8)
Unidentifiable mammal			
Unsized mammal	179 (32.3)	1,169 (35.6)	1,348 (35.1)
Small mammal	116 (20.9)	601 (18.3)	717 (18.7)
Medium-small mammal	3 (0.5)	5 (0.2)	8 (0.2)
Medium mammal	1 (0.2)	2 (0.1)	3 (0.1)
Large-medium mammal	46 (8.3)	272 (8.3)	318 (8.3)
Large mammal	51 (9.2)	234 (7.1)	285 (7.4)
Very large mammal	5 (0.9)	–	5 (0.1)
Total unidentifiable mammal	401 (72.3)	2,283 (69.4)	2,684 (69.8)
Total (% of assemblage)	555 (14.4)	3,288 (85.6)	3,843 (100.0)

Similar to the strata 503/504 assemblage, most of the unworked bone in the Cienega assemblage was highly fragmented, with many being less than one-quarter complete (*n* = 3,188, 83.0 percent). Slightly more than half of the unworked bones exhibited a combination of past and recent breakage (*n* = 2,103, 54.7 percent), which suggests recovery procedures and more recent bone handling had some impact on the degree of bone fragmentation in the assemblage. Approximately 40 percent of the bones exhibited evidence of only past breakage (*n* = 1,498, 39.0 percent). Less than 5 percent (*n* = 178, 4.6 percent) of the bones had only recent breakage, and about 2 percent (*n* = 64, 1.7 percent) were unbroken.

Nearly 90 percent of the unworked remains were environmentally modified (*n* = 3,449, 89.7 percent). The majority of the environmentally modified bones were covered, to varying degrees, by a hard, unidentifiable sedimentary substance (*n* = 3,193, 92.6 percent). Other environmental modifications to the bones were erosion (*n* = 193, 5.6 percent), root-etching (*n* = 33, 1.0 percent), or a combination of environmental modifications (*n* = 29, 0.8 percent). One bone was stained. The types and proportions of environmentally modified bones were comparable in both loci. A few bones were rodent gnawed, including a cottontail bone, two jackrabbit elements, and a medium artiodactyl fragment. A large mammal bone and a large-medium mammal element were carnivore gnawed, indicating carnivores had some impact on the assemblage.

Approximately 40 percent of the unworked bones were burned (*n* = 1,534, 39.9 percent), with the majority being partially charred (*n* = 755, 49.2 percent) or charred (*n* = 586, 38.2 percent). Slightly more than 10 percent of the burned bones were calcined (*n* = 124, 8.1 percent) or blue/gray in color (*n* = 59, 3.8 percent), suggesting they had been exposed to relatively high temperatures, or had relatively little meat on them when exposed to heat, or both. A few bones were light brown in color (*n* = 3) or had a combination of burning patterns (*n* = 7). Most of the burned remains were unidentifiable mammal (*n* = 452), small mammal (*n* = 342), and large-medium mammal (*n* = 117) bones about which little else can be said. Patterns of burning for identifiable taxa are assessed below.

Burned bones were recovered from all 21 features, with more than 20 analyzed elements. The proportions of burned bones in these features ranged from 5 percent to 95 percent, with most between 20 percent and 40 percent. A few features, however, had relatively high proportions of burned remains (>70 percent). Several of these features exhibited evidence of burning; therefore, some of the burned faunal remains may have burned at the times the features burned. This may be particularly true for the remains recovered from pithouse Features 15 and 3273, which appear to have burned during use. The faunal remains recovered from these two structures were found primarily in the roof/wall collapse strata.

Other features with high proportions of burned faunal remains—including pithouse Features 112, 121, 128, and 9372—appear to have been cleaned out prior to burning and were later used for trash disposal. Pithouse Feature 151 and intramural pit Feature 191.01, although they also had high proportions of burned remains, did not have any evidence of burning. The evidence on feature burning, combined with the distribution of burned remains throughout the Cienega phase contexts and the intermixing of these bones with a number of unburned bones generally indicates that, with the possible exception of many of the remains in Features 15 and 3273, the burned faunal bones are in secondary contexts and are not the result of a single event.

The majority of the faunal remains analyzed from Cienega phase contexts were identified as mammal (see Table 13.3). Non-mammalian remains included an unburned frog/toad (Salientia) humerus collected from pithouse Feature 9357, and an unburned, unbroken *Corvus* sp., possibly crow, wing phalanx recovered from pithouse Feature 57. The frog/toad element was more than half complete and probably represents a natural deposit. Both the amphibian and the bird bones were partially covered with a hard sedimentary substance.

A number of reptile remains were recovered, including an unburned, unidentifiable snake vertebra from pithouse Feature 3270 and several Testudinata (turtle or tortoise) carapace fragments collected from pithouse Features 121, 9168, and 9357. The snake element was less than one-quarter complete and probably represents a natural deposit. Due to the fragmentary condition of the carapace fragments, as well as an absence of comparative material for some of the turtle taxa in the area, none of the carapace fragments could be identified below order. However, based on size, many of the unidentifiable carapace elements probably represent Sonoran mud turtle (*Kinosternon sonoriense*). One of the unidentifiable carapace fragments is thicker than the others, and it may represent desert tortoise (*Gopherus agassizii*). Desert tortoise remains have been noted at other sites in the Tucson region, including the Dairy site, AZ AA:12:285 (ASM), an Early Agricultural period Hohokam site located in the northern Tucson Basin, and the Yuma Wash site, AZ CC:2:7 (ASM), a Hohokam site near Marana (Cameron 2003a, 2003c).

Five of the turtle remains were burned, including two charred and three partially charred fragments; these were recovered from all the features that yielded turtle remains. Most of the turtle remains were environmentally modified; many (*n* = 7, 63.6

percent) were covered with a hard sedimentary substance. One carapace fragment had an eroded surface area. None of the turtle fragments exhibited evidence of cultural modification, although turtle shells were commonly used to make rattles by later Southwestern groups (Henderson and Harrington 1914; Lange 1959; Whitman 1947), and some worked turtle remains have been recovered in archaeological (Hohokam) contexts (Gillespie 1987; James 1989) in southeastern Arizona. It is currently unclear to what extent turtles were used as food.

Rabbits were the most common identifiable remain recovered, and they constituted one-quarter of the Cienega phase assemblage (*n* = 960, 25.0 percent) (see Table 13.3). More than 75 percent of the rabbit elements were identified as black-tailed jackrabbit. Antelope jackrabbit and indeterminate jackrabbit elements each accounted for less than 5 percent of the lagomorph total. Antelope jackrabbit remains are not generally common in assemblages in the region, but they have been recovered from both earlier and later sites (Cameron 2003c; Gillespie 1987; James 1987; Szuter and Brown 1986). Cottontail remains constituted approximately 15 percent of the rabbit bones.

The remaining rabbit elements could not be identified below order and included fragments of 2 crania, a mandible, a lumbar vertebra, a sternebra, 2 scapulae, a humerus, 3 radii, an innominate, a femur, 4 tibiae, and 3 mid-sized phalanges. A few of these elements were from immature or fetal individuals. More than 85 percent of all identifiable and unidentifiable rabbit bones were environmentally modified—most covered by a hard sedimentary substance.

Black-tailed jackrabbit bones were distributed throughout the two loci and were recovered from all of the features that yielded more than 10 faunal remains. They were also found in 50 percent of the features with 10 elements or less. In RNA 8, all of the features with assemblages with 40 or more bones yielded comparable proportions of black-tailed jackrabbit remains (about 20 percent), indicating there were no unusual concentrations of bones for this taxa in that locus. In RNA 2, the proportions of black-tailed jackrabbit bones in features with total assemblages of more than 40 elements were more variable, ranging from 3-16 percent. It is not clear why the features in this locus yielded lower proportions of this taxa compared with RNA 8, or why the proportions are relatively variable.

Cottontail remains were not as widely distributed as the black-tailed jackrabbit remains and were recovered from only 23 features. Most of the features without cottontail remains had less than 10 elements, although five features with more than 20 remains also did not yield cottontail bones. The relatively small sample size of cottontail remains compared with black-tailed jackrabbit elements probably accounts for many of the differences noted in the distributions of the two taxa. No concentrations of cottontail bones were noted in specific features, and overall, the proportion of cottontail remains from the two loci is comparable. The sample sizes for antelope jackrabbit and indeterminate jackrabbit were too small to assess general feature distribution patterns.

Jackrabbit and cottontail element types are listed in Tables 13.4 and 13.5, respectively. The majority of element types are present, although many, particularly crania, vertebrae, and foot bones, are under-

Table 13.4. Jackrabbit elements recovered from Cienega phase contexts at the Clearwater site, AZ BB:13:6 (ASM).

Element	Jackrabbit [*n* (%)]	Antelope Jackrabbit [*n* (%)]	Black-tailed Jackrabbit [*n* (%)]
Crania	–	–	1 (0.1)
Premaxillae	–	–	6 (0.8)
Maxillae	1 (2.5)	–	6 (0.8)
Mandibles	–	–	12 (1.6)
Teeth	–	–	7 (1.0)
Atlases	–	–	2 (0.3)
Cervical vertebrae	–	–	2 (0.3)
Thoracic vertebrae	–	–	2 (0.3)
Lumbar vertebrae	–	–	14 (1.9)
Sacra	–	–	1 (0.1)
Ribs	2 (5.0)	–	7 (1.0)
Sternebrae	–	–	2 (0.3)
Scapulae	6 (15.0)	2 (6.3)	57 (7.8)
Humeri	2 (5.0)	13 (40.6)	63 (8.6)
Radii	–	2 (6.3)	84 (11.4)
Ulnae	3 (7.5)	5 (15.6)	44 (6.0)
Metacarpals	–	–	15 (2.0)
Innominates	3 (7.5)	2 (6.3)	70 (9.5)
Femora	6 (15.0)	1 (3.1)	58 (7.9)
Tibiae	3 (7.5)	3 (9.4)	71 (9.7)
Astragali	1 (2.5)	–	8 (1.1)
Calcanea	1 (2.5)	4 (12.5)	62 (8.4)
Tarsals	–	–	10 (1.4)
Metatarsals	2 (5.0)	–	63 (8.6)
Phalanges	8 (20.0)	–	36 (4.9)
Metapodials, indeterminate	2 (5.0)	–	29 (4.0)
Long bone fragments	–	–	2 (0.3)
Total	40	32	734

Table 13.5. Cottontail elements recovered from Cienega phase contexts at the Clearwater site, AZ BB:13:6 (ASM).

Element	*n* (%)
Premaxillae	1 (0.7)
Maxillaee	4 (3.0)
Premaxillae/Maxillae	1 (0.7)
Mandibles	8 (6.0)
Lumbar vertebrae	4 (3.0)
Ribs	1 (0.7)
Sternebrae	1 (0.7)
Scapulae	10 (7.5)
Humeri	11 (8.2)
Radii	8 (6.0)
Ulnae	6 (4.5)
Innominates	22 (16.4)
Femora	14 (10.4)
Tibiae	22 (16.4)
Astragali	1 (0.7)
Calcanea	13 (9.7)
Metatarsals	3 (2.2)
Phalanges	2 (1.5)
Metapodials, indeterminate	2 (1.5)
Total	134

represented. Element types may be underrepresented for a variety of reasons, including prehistoric behavioral practices (such as butchering or disposal practices), bone preservation (elements such as vertebrae are often less dense and do not preserve as well), and difficulties in identifying certain elements in highly fragmented form (such as vertebra and skull fragments). Recovery procedures, particularly screen size, can also play a role, and numerous studies have shown that smaller elements, such as cottontail foot bones, as well as highly fragmented elements, often fall through ¼-inch mesh, the primary screen size used in this project (see Cameron 2002; James 1997; Shaffer 1992; Shaffer and Sanchez 1994; Thomas 1969).

Data on fragmentation indicate the rabbit bones were highly fragmented, with more than 70 percent of the bones for all of the rabbit taxonomic categories less than half complete and 40-55 percent less than one-quarter complete. These data suggest some elements may have been lost during the excavation process. Despite the underrepresentation of certain elements, however, complete carcasses were likely primarily butchered at the site, given the relatively small size of rabbits.

Proximal or distal ends were present on slightly more than 50 percent of the black-tailed jackrabbit, antelope jackrabbit, and cottontail remains, and more than 85 percent of these remains had fused epiphyses. Slightly less than 10 percent of the elements for these three taxa had unfused epiphyses. As noted above, a few immature and fetal unidentifiable rabbit remains were also recovered. These patterns indicate that, although most rabbits were adults, a few younger individuals also appear to have been utilized.

Approximately 40-45 percent of all the rabbit taxa bones were burned. The types of burned black-tailed jackrabbit and cottontail bones are listed in Tables 13.6 and 13.7, respectively. Burned antelope jackrabbit remains included: a partially charred humerus, ulna, femur, and 3 tibiae; 3 charred humeri, a radius, and an ulna; and a calcined humerus. Burned indeterminate jackrabbit remains included: a partially charred rib, 2 scapulae, 4 femora, a calcaneus, a metatarsal, and a metapodial; 2 charred innominates, 2 femora, 2 tibiae, an astragalus, and a metatarsal; and a calcined ulna. Burned unidentifiable rabbit remains included a charred lumbar vertebra, 2 scapulae, a radius, and a tibia; and a calcined radius and 2 tibiae. More than 60 percent of the black-tailed jackrabbit burned elements and 50 percent of the cottontail burned bones are peripheral or cranial elements that contain relatively little meat. These elements may have fallen into the fire during roasting, or were possibly tossed into the fire while preparing the animal for cooking.

The relatively high proportion of partially charred and charred bones for all of the rabbit taxa indicates many of the elements may have had some flesh attached when exposed to the heat, or they were exposed to heat of low intensity or for a short duration. This pattern has been noted elsewhere (Cameron 1998, 2003a, 2003c). No concentrations of burned rabbit bones were noted, and burned remains for all rabbit taxa were recovered from several features located in both loci.

The ratio of cottontails to the total lagomorph assemblage from a site (called the lagomorph ratio) has been previously used to address issues such as differences in cottontail and jackrabbit utilization at upland and lowland sites (Bayham and Hatch 1985a, 1985b), as well as to assess environmental modifications at different site types (Cameron 1998; Szuter 1991) and across time (Bayham and Hatch 1985b). Interpretations of this lagomorph ratio are based on ecological studies that have shown that cottontails prefer a more vegetated environment in which they can hide from predators, while jackrabbits prefer a more open environment in which they can flee from predators (Legler 1970; Madsen 1974).

Table 13.6. Burned black-tailed jackrabbit elements recovered from Cienega phase contexts at the Clearwater site, AZ BB:13:6 (ASM).

Element	Calcined [*n* (%)[a]]	Charred [*n* (%)[a]]	Partially Charred [*n* (%)[a]]	Total [*n* (%)[a]]
Crania	–	–	–	0 (0.0)
Premaxillae	–	1 (16.7)	–	1 (16.7)
Maxillae	–	3 (50.0)	–	3 (50.0)
Mandibles	–	1 (8.3)	1 (8.3)	2 (16.7)
Teeth	–	–	1 (14.3)	1 (14.3)
Atlases	–	–	–	0 (0.0)
Cervical vertebrae	–	–	–	0 (0.0)
Thoracic vertebrae	–	–	–	0 (0.0)
Lumbar vertebrae	–	2 (14.3)	3 (21.4)	5 (35.7)
Sacra	–	–	–	0 (0.0)
Ribs	–	–	1 (14.3)	1 (14.3)
Sternebrae	–	–	–	0 (0.0)
Scapulae	1 (1.8)	16 (28.1)	11 (19.3)	28 (49.1)
Humeri	4 (6.3)	5 (7.9)	16 (25.4)	25 (39.7)
Radii	4 (4.8)	15 (17.9)	17 (20.2)	36 (42.9)
Ulnae	1 (2.3)	4 (9.1)	11 (25.0)	16 (36.4)
Metacarpals	–	2 (13.3)	7 (46.7)	9 (60.0)
Innominates	1 (1.4)	23 (32.9)	13 (18.6)	37 (52.9)
Femora	2 (3.4)	3 (5.2)	12 (20.7)	17 (29.3)
Tibiae	4 (5.6)	15 (21.1)	12 (16.9)	31 (43.7)
Astragali	–	1 (12.5)	3 (37.5)	4 (50.0)
Calcanea	5 (8.1)	10 (16.1)	19 (30.6)	34 (54.8)
Tarsals	–	5 (50.0)	–	5 (50.0)
Metatarsals	1 (1.6)	10 (15.9)	14 (22.2)	25 (39.7)
Phalanges	–	7 (19.4)	11 (30.6)	18 (50.0)
Metapodials, indeterminate	–	6 (20.7)	9 (31.0)	15 (51.7)
Long bone fragments	–	–	1 (50.0)	1 (50.0)
Total (% of black-tailed jackrabbit assemblage)	23 (3.1)	129 (17.6)	162 (22.1)	314 (42.8)

Note: A charred/calcined tarsal and a light brown/calcined ulna also were recovered.

[a] Percent of element type.

Ethnographic data from the Southwest indicate this difference in habitat had consequences for the tactics utilized to hunt these animals. Specifically, jackrabbits tended to be hunted by communal drives (Spier 1933; Underhill 1946; Whitman 1940). These drives usually involved groups of men and boys flushing the rabbits out of the brush and into nets or enclosed areas where the rabbits were then clubbed or shot by bow and arrow. Conversely, cottontails were more commonly hunted by individuals or in small groups and either skewered in their burrows (Cushing 1920; Parsons 1929; Spier 1928, 1933), trapped (Pennington 1963; Spier 1933), or flushed out by setting the bush near their burrow on fire (Pennington 1963).

Consequently, larger, more intensively occupied sites tend to yield more jackrabbit remains, as these groups have modified their environment to a greater extent, creating the more open living spaces preferred by jackrabbits (Szuter 1991). These sites can also provide more hunters for communal jackrabbit drives. In Early Agricultural Cienega phase contexts at the Clearwater site, a higher lagomorph ratio is expected, as compared with the ratios at later, larger, agricultural villages. However, the lagomorph ratio is 0.14—a ratio much lower than expected, and, in fact,

Table 13.7. Burned cottontail elements recovered from Cienega phase contexts at the Clearwater site, AZ BB:13:6 (ASM).

Element	Calcined [*n* (%)[a]]	Charred [*n* (%)[a]]	Partially Charred [*n* (%)[a]]	Total
Premaxillae	–	–	–	0 (0.0)
Maxillae	–	1 (25.0)	–	1 (25.0)
Premaxillae/Maxillae	–	–	–	0 (0.0)
Mandibles	1 (12.5)	1 (12.5)	–	2 (25.0)
Lumbar vertebrae	–	1 (25.0)	–	1 (25.0)
Ribs	–	1 (100.0)	–	1 (100.0)
Sternebrae	–	–	–	0 (0.0)
Scapulae	2 (20.0)	–	1 (10.0)	3 (30.0)
Humeri	–	3 (27.3)	4 (36.4)	7 (63.7)
Radii	1 (12.5)	–	–	1 (12.5)
Ulnae	2 (33.3)	1 (16.7)	2 (33.3)	5 (83.3)
Innominates	1 (4.5)	1 (4.5)	8 (36.4)	10 (45.5)
Femora	–	1 (7.1)	2 (14.3)	3 (21.4)
Tibiae	2 (9.1)	4 (18.2)	5 (22.7)	11 (50.0)
Astragali	–	–	–	0 (0.0)
Calcanea	1 (7.7)	2 (15.4)	4 (30.8)	7 (53.8)
Metatarsals	–	–	–	0 (0.0)
Phalanges	–	1 (50.0)	–	1 (50.0)
Metapodials, indeterminate	–	–	–	0 (0.0)
Total (% of cottontail assemblage)	10 (7.5)	17 (12.7)	26 (19.4)	53 (39.6)

[a] Percent of element type.

a ratio comparable with many later Hohokam agricultural villages (see Szuter 1991). This ratio could indicate the environment was relatively open during this earlier time period.

It is also possible that the Cienega phase contexts yielded a relatively high ratio of jackrabbits due to communal activities. Jackrabbits were occasionally used in community feasts by ethnographic populations (Beaglehole 1936; Parsons 1918), and the presence of a probable communal structure, Feature 9357, indicates communal activities occurred at the site during this time period. No direct evidence of jackrabbit use during communal activities is present in this particular structure, however, as most of the jackrabbit remains from this feature were derived from postabandonment fill. Jackrabbit elements were not recovered from the floor of the feature. It should also be noted that the ratio was influenced by recovery procedures, with cottontail remains underrepresented to an unknown degree due to use of ¼-inch mesh.

Rodents constituted less than 1 percent of the Cienega phase assemblage (*n* = 24, 0.6 percent). Approximately half of the rodent remains were identifiable below order. The most common identifiable rodent was pocket gopher (*Thomomys* sp.). Pocket gopher remains included a cranial fragment, a premaxilla, two mandibles, two humeri, and an innominate fragment recovered from pithouse Features 57 and 9357 and intramural pit Feature 3270.02. None of the pocket gopher remains were burned, and more than 50 percent were greater than three-quarters complete. All but two of the pocket gopher elements were covered with a hard sedimentary substance; one was root-etched and one was not environmentally modified.

Additional identifiable rodent remains included an unburned woodrat (*Neotoma* sp.) mandible, humerus, and tibia found in pithouse Features 57 and 218, and a partially charred muskrat (*Ondatra zibethicus*) caudal vertebra recovered from Feature 9357. All of the woodrat and muskrat bones were greater than three-quarters complete. Two of the woodrat bones were environmentally modified—one was partially covered with a hard sedimentary substance, and the other was root-etched. The muskrat vertebra was also partially covered with a hard sedimentary substance. Pocket gopher and woodrat remains have been commonly found at sites in the region (Szuter 1991). Muskrat remains are rare, although they have been noted at some later Tucson Basin sites, including San Xavier Bridge, AZ BB:13:14 (ASM) (Gillespie 1987), and Dakota Wash, AZ AA:16:49 (ASM) (Johnson 1989).

Unidentifiable rodent remains include: a humerus and two tibiae recovered from Features 57 and 3270.02 that were classified as small rodent (mouse-sized); and 2 incisors, a mandible, a scapula, 2 innominates, 2 femora, and 2 tibiae collected from pithouse Features 7, 57, 151, 3294, and 9168, identified as medium rodent (woodrat-sized). Two of the small rodent remains are greater than three-quarters complete, and all three were partially covered with a hard sedimentary substance. The medium rodent bones were more fragmented than the small rodent bones, with only 20 percent of the remains greater than three-quarters complete. However, the majority (80 percent) were greater than half complete. All but one of the medium rodent remains were partially covered with a hard sedimentary substance. The remaining bone was not environmentally modified. A few of the unidentifiable rodent bones were burned, including a small rodent humerus that was light brown in color, as well as a light brown, medium rodent femur; a partially charred innominate; and a calcined innominate. These bones were recovered from Features 7, 151, and 3270.02.

Ethnographic and archaeological evidence (see Cameron 1998; Sobolik 1993; Szuter 1991) indicate rodents were consumed prehistorically by numerous populations; therefore, the burned rodent remains may represent food residue. The possibility that the bones were burned when a pest was disposed of in a fire must also be considered. The light brown, small rodent element was also collected from an intramural feature (Feature 3270.02) that was burned before abandonment and as such, may represent a bone that burned when the feature burned. The relative completeness of the unburned rodent elements suggests many of these remains probably represent more recent, intrusive deposits.

Carnivore remains constituted approximately 1 percent of the assemblage (see Table 13.3). Identifiable carnivore remains were primarily fragments of dog/coyote (*Canis* sp.) elements, including: 5 maxillae, a mandible, 5 teeth, an atlas, 2 thoracic vertebrae, 3 caudal vertebrae, 3 humeri, a tibia, and 5 phalanges. All but four of the remains were recovered from Feature 9357, with two bones each collected from Features 112 and 3312. Slightly more than half of the dog/coyote remains were less than one-quarter complete, with most having some recent breakage. More than 80 percent of the remains were environmentally modified; most were covered with a hard sedimentary substance (n = 17). Two bones were root-etched, and three bones were eroded. A few of the bones were burned, including: a partially charred mandible and tibia; a charred atlas, two caudal vertebrae, and a humerus; and a calcined humerus. All of the burned bones were recovered from Feature 9357. The condition of the bones precluded identifying the remains below genus, although they likely represent domestic dog.

Additional identifiable carnivore remains included a number of fox (*Vulpes/Urocyon*) elements: 2 atlases, a scapula, a radius, a metacarpal, an innominate fragment, a femur, 2 calcanea, and a metatarsal. All but one of the elements were collected from Feature 9357; the other element was recovered from Feature 112. The majority of the elements (n = 8) were less than half complete, most with recent breakage, and all but one of the bones was covered with a hard sedimentary substance. The other bone was not modified. Four of the fox bones were burned, including: a partially charred femur and calcaneus, as well as a charred scapula and metacarpal. These remains were recovered from both of the features that yielded fox bones. Fox elements were not identified more specifically due to a lack of comparative material for all of the fox taxa available in the area. Fox remains are not commonly recovered from faunal assemblages in the region, but have been noted in small numbers at earlier and later sites (Cameron 2003a, 2003c; Szuter and Brown 1986).

A few elements were identified as Canidae (dog/coyote/fox), including a calcined ulna and two unburned innominate fragments collected from Feature 9357. All of the Canidae remains fell in size between the coyote and the fox remains in the comparative collection and could represent immature dog. These remains were all environmentally modified. Unidentifiable carnivore remains included two unburned mandible fragments identified as small carnivore, as well as two charred caudal vertebrae, a charred metacarpal, and an unburned phalange classified as medium carnivore. These remains were recovered from Feature 9357. All but one of the medium carnivore elements were environmentally modified.

Ethnographically, carnivores (dogs) were kept as pets, or their furs and pelts were used to manufacture ceremonial items and costumes (e.g., Henderson and Harrington 1914; Lange 1959). As noted above, most of the Cienega phase carnivore bones were recovered from Feature 9357, a possible communal structure. However, most of these remains were found in postabandonment trash fill, and thus, are unrelated to the original use of that particular feature. It is unclear why several of the carnivore bones were burned, although they could represent refuse disposal practices. They also could represent cooking practices, although, ethnographically, carnivores were not generally noted as food sources.

Artiodactyl remains constituted 3 percent of the Cienega phase assemblage (see Table 13.3). Prehistorically, several artiodactyl genera may have inhabited the site area, including mule deer (*Odocoileus hemionus*), white-tailed deer (*O. virginianus*), antelope (*Antilocapra americana*), and bighorn sheep (*Ovis canadensis*) (Hoffmeister 1986). A lack of comparative material for bighorn sheep, as well as the fragmentary nature of the elements (more than 70 percent were less than one-quarter complete), precluded the identification of most of the artiodactyl remains below order.

The majority of the identifiable artiodactyl remains were deer (*Odocoileus* sp.); deer element types are listed in Table 13.8. Most of the deer bones were environmentally modified, primarily covered with a hard sedimentary substance (*n* = 17, 45 percent). Several bones were eroded, indicating they had been exposed to surface conditions (*n* = 9, 24 percent). A few bones were root-etched (*n* = 3, 8 percent), or exhibited multiple modifications (*n* = 6, 16 percent). Burned deer bones included: 2 partially charred humeri, a carpal, an innominate fragment, 2 femora, a patella, a tibia, and an astragalus; and a charred antler fragment and humerus. Most of the burned bones were recovered from Feature 9357. Additional identifiable artiodactyl remains included three unburned cheek tooth fragments recovered from pithouse Feature 57 and intramural Feature 3327.02; these were classified as Cervidae. All three of these elements were covered, to varying degrees, by a hard sedimentary substance. These elements were larger than the deer in the comparative collection and may represent elk.

Unidentifiable medium artiodactyl elements are listed in Table 13.8. The majority of the medium artiodactyl remains were environmentally modified, with approximately equal numbers of eroded (*n* = 28, 39 percent) elements and bones that were covered to varying degrees by a hard sedimentary substance (*n* = 30, 42 percent). A few bones were root-etched (*n* = 3, 4 percent) or had multiple modifications (*n* = 7, 10 percent). Burned medium artiodactyl remains included: a partially charred tooth, 4 ribs, a scapula, a humerus, 4 innominate fragments, 5 femora, 2 tibiae, and a phalange; and a charred radius, ulna, carpal, 2 femora, and 3 phalanges. Most of the burned medium artiodactyl bones were found in Feature 9357.

A few elements—including two thoracic vertebrae fragments, an unidentifiable vertebra fragment, and an indeterminate carpal—were classified as indeterminate artiodactyl. These remains were recovered from the fill of pithouse Features 57 and 218. None of these remains were burned, but three were eroded, indicating they were exposed to surface conditions. The fourth was not environmentally modified. All of these remains were larger than the deer in the comparative collection.

A number of elements (see Table 13.8) were identified as large mammal and probably represent artiodactyl remains too fragmented to identify. All but one of the large mammal remains were less than one-quarter complete, and more than 90 percent were environmentally modified, most covered with a hard sedimentary substance (*n* = 222, 78 percent). Several others were eroded (*n* = 39, 14 percent), and a few were root-etched (*n* = 3, 1 percent) or had evidence of multiple modifications (*n* = 8, 3 percent). Approximately 50 percent of the remains were burned, including: two partially charred ribs, a scapula, shaft fragments (*n* = 16, 6 percent), and indeterminate elements (*n* = 48, 17 percent); charred shaft fragments (*n* = 22, 8 percent) and indeterminate elements (*n* = 42, 15 percent); a charred/calcined indeterminate element; a calcined rib and indeterminate elements (*n* = 8, 3 percent); and a blue/gray rib and indeterminate elements (*n* = 4, 1 percent).

Ethnographically, artiodactyl resources were used across the Southwest for a variety of purposes including for food, clothing, tools, and raw material for ritual paraphernalia. Artiodactyl meat was consumed in both domestic and ceremonial contexts (Lange 1959; Parsons 1925, 1936; Stevenson 1904). In domestic situations, artiodactyl meat was often shared among families and other members of a village (Parsons 1929; Spier 1928; Underhill 1939). There is little ethnographic mention of large-scale use of artiodactyls for ceremonies, although some researchers have suggested such behavior occurred prehistorically (Akins 1985). Small-scale ceremonial use of deer has been noted, and on occasion—such as the Tohono O'odham annual cleansing ceremony (Underhill 1946)—a single deer played a central role in the ceremony.

After processing, some ethnographic groups disposed of artiodactyl bones in special areas, occasionally away from sites (Underhill 1946; Whitman 1940). Other deer bones were used to make awls, rattles, and musical instruments (Lange 1959; Parsons 1925, 1936), and artiodactyl skulls were often worn as headdresses during hunts (Spier 1928). Deer hunting was generally not a casual occurrence, and many rituals were often associated with deer hunts, including purification rites, dances, and the use of charms (Spier 1928, 1933; Stevenson 1904; Whitman 1940).

Interpreting the role of artiodactyl resources in an archaeological assemblage is complicated due to variables such as the location of the natural habitat of the animals, with relation to the location of the site, transportation issues, butchering practices, bone disposal practices, as well as the influence of other

Table 13.8. Artiodactyl and large mammal elements recovered from Cienega phase contexts at the Clearwater site, AZ BB:13:6 (ASM).

Element	*Odocoileus* sp. [*n* (%)]	Medium Artiodactyl [*n* (%)]	Large Mammal [*n* (%)]
Crania	–	1 (1.4)	–
Maxillae	1 (2.6)	–	–
Mandibles	–	3 (4.2)	–
Teeth	7 (18.4)	4 (5.6)	–
Antlers	3 (7.9)	–	–
Lumbar vertebrae	–	2 (2.8)	–
Unidentifiable vertebrae	–	–	2 (0.7)
Ribs	–	4 (5.6)	9 (3.2)
Costal cartilage	–	–	1 (0.4)
Scapulae	–	4 (5.6)	1 (0.4)
Humeri	3 (7.9)	2 (2.8)	–
Radii	–	2 (2.8)	–
Ulnae	1 (2.6)	1 (1.4)	–
Carpals	2 (5.3)	1 (1.4)	–
Innominates	5 (13.2)	8 (11.3)	–
Femora	4 (10.5)	24 (33.8)	–
Patellas	1 (2.6)	–	–
Tibiae	1 (2.6)	2 (2.8)	–
Astragali	2 (5.3)	–	–
Calcanea	2 (5.3)	–	–
Tarsals	2 (5.3)	–	–
Metatarsals III-IV	1 (2.6)	2 (2.8)	–
Sesamoids	–	–	–
Phalanges	–	–	–
Metapodials III-IV	–	–	–
Carpals/Tarsals	–	–	–
Shaft fragments	–	–	–
Indeterminate elements	–	–	–
Total	38	71	285

Note: Two thoracic vertebrae fragments, an unidentifiable vertebra fragment, and an intermediate carpal were identified as unsized artiodactyl, and three cheek tooth fragments were identified as Cervidae.

cultural behaviors. Additionally, the number of artiodactyl remains recovered is often small, making it difficult to assess some of these variables. However, some general assumptions about artiodactyl use during the Cienega phase can still be made. Femora and innominate fragments—elements that are often considered higher in utility and more likely to be transported longer distances—are the most common element type, suggesting long-distance hunting and differential transport of element types may have occurred. This pattern has been documented in other areas of south-central Arizona (Cameron 1998). The presence of small numbers of elements from other portions of the carcass, however, also indicate that, at least on occasion, some animals were butchered at the site. It is not clear if these animals were transported whole from a long-distance kill site, or if they were killed nearby.

The general distribution of the artiodactyl and large mammal bones in the Cienega phase contexts suggests this resource was not used for large-scale feasting. More than 25 features and intramural features yielded small numbers (generally less than five bones) of artiodactyl and large mammal remains. Feature 9357, the possible ceremonial structure, did yield a large number of these remains, but the proportion of these taxa in that feature is comparable with that noted in other features. Therefore, it is likely that the large number of artiodactyl and large mammal bones recovered from this feature is simply due to excavation volume. Further, none of the artiodactyl and large mammal remains could be directly associated with the original function of the feature because most were recovered from postabandonment fill and none were recovered from floor contexts. Both loci also yielded comparable proportions of these taxa (see Table 13.3). Although the artiodactyl and large mammal remains cannot be directly associated with the ceremonial structure, the possibility that some of the artiodactyl remains were consumed in other, small-scale communal activities, in addition to domestic use, cannot be ruled out.

Fifteen bone artifacts were recovered from a variety of Cienega phase features (see Table 13.2). Most of the bone artifacts were small awl or awl shaft fragments. The possibility that some of these artifacts may have been used as hairpins cannot be ruled out, although because none of the artifacts had any decoration, design, or other morphological features that clearly indicated a function as a hairpin, they are considered awls for this report. Most of the awls were manufactured from large mammal bones—probably artiodactyl elements that had been modified to such an extent they are no longer identifiable. All but one of the worked bones were recovered from the fill of the features. The artiodactyl metapodial recovered from Feature 15 was found on the floor. Environmental modification, primarily a coating of a hard sedimentary substance, on many of the awl fragments made observations of striations and polish difficult. Some light-to-moderate polish was observed on a few awls in unmodified areas. Awls are common bone artifacts recovered at many archaeological sites in southeastern Arizona.

A few elements of indeterminate function were also noted, including a large mammal shaft fragment with a beveled edge (Bag #6279). This specimen may represent a bead fragment. Two other fragments had shaped or flattened edges. It is not clear if these are small fragments of awls, fragments of pendants or gaming pieces, or if they had some other function.

Early Ceramic Period (A.D. 50-500)

More than 30 faunal remains recovered from contexts dating to the Early Ceramic period were analyzed, including 32 unworked bones (Table 13.9) and one worked bone (see also Table 13.2). These remains were collected from two pithouse features, Features 3014 and 3038, and an intramural pit feature, Feature 3038.02, located in the Mission Gardens locus. Similar to the pattern noted for the earlier time periods, the bones in the assemblage were highly fragmented, with the majority of the unworked remains less than one-quarter complete (n = 30, 93.8 percent). Half of the unworked bones exhibited a combination of past and recent breakage (n = 16, 50 percent), indicating recovery procedures and more recent bone handling had some impact on bone fragmentation in the assemblage. The remaining bones exhibited evidence of only past breakage.

Table 13.9. Unworked taxa recovered from Early Ceramic period contexts at the Clearwater site, AZ BB:13:6 (ASM).

Taxa	*n* (%)
Identifiable mammal (Mammalia)	
Rabbit or hare (Leporidae)	1 (3.1)
Cottontail (*Sylvilagus* sp.)	1 (3.1)
Medium artiodactyl (deer-sized)	3 (9.4)
Unidentifiable mammal	
Unsized mammal	9 (28.1)
Small mammal	5 (15.6)
Medium mammal	1 (3.1)
Large-medium mammal	3 (9.4)
Large mammal	9 (28.1)
Total	32 (100.0)

Environmental modification was noted on slightly more than one-quarter of the bones (n = 9, 28.1 percent). Most of the environmentally modified bones were covered, to varying degrees, by a hard unidentifiable sedimentary substance (n = 6, 66.7 percent). Two bones were root-etched, and one bone was eroded. Overall, the proportion of environmentally modified bones in this assemblage is much lower than the proportions noted for the earlier assemblages. While varying (and for three assemblages, small) sample sizes make it difficult to interpret the meaning of this difference, some of the difference may be related to the fact that the Early Ceramic assemblage was recovered from the Mission Gardens locus, while the assemblages from the other time periods were recovered from the San Agustín Mission, Brickyard, and Congress Street loci. This pattern suggests taphonomic conditions varied in this locus, compared with the other loci, impacting bone preservation in uncertain ways.

More than two-thirds of the bones were burned (n = 23, 71.9 percent), with equal numbers of partially charred (n = 11, 48 percent) and calcined (n = 11, 48 percent) bones. One bone was charred. The overall proportion of burned remains and the relatively high proportion of calcined bones in this assemblage differ markedly from the patterns observed in the earlier assemblages. Unfortunately, due to the small sample size of this and many of the earlier assemblages, it is not clear if these differences are due to behavioral differences, contextual differences, sample size, or a combination of these and other factors. Most of the burned remains were unidentifiable mammal (*n* = 8, 35 percent), small mammal (*n* = 4, 17 percent), and large-medium mammal (*n* = 3, 13 percent). Burned bones were recovered from all three Early Ceramic features, with most recovered from Feature 3014 (*n* = 15, 65 percent) and Feature 3038 (*n* = 7, 30 percent).

All of the remains analyzed from Early Ceramic period contexts were identified as mammals. Slightly more than 10 percent of these remains were identifiable below class, including a calcined indeterminate rabbit femur and an unburned cottontail femur recovered from Feature 3014. Both of these elements were less than half complete, and the cottontail femur was environmentally modified (root-etched). Due to the small number of rabbit bones, an assessment of rabbit use during this time period cannot be made.

Additional identifiable remains included a medium artiodactyl charred radius and a partially charred ulna recovered from Feature 3038; and an unburned medium artiodactyl radius found in Feature 3014. All of these elements were less than one-quarter complete, and the two elements from Feature 3038 were partially covered with a hard unidentifiable sedimentary substance. The radius from Feature 3014 was eroded, suggesting it had lain on the surface prior to burial.

Nine large mammal elements, which may represent artiodactyl remains too fragmented to identify, were also recovered from Features 3014 and 3038. These elements included an indeterminate vertebra fragment, two shaft fragments, and six indeterminate elements. All of these elements were less than one-quarter complete, and three of the elements were environmentally modified—two were partially covered with a hard sedimentary substance and another was root-etched. Some of the large mammal remains were partially charred, including the vertebra fragment, the two shaft fragments, and two of the indeterminate elements.

Overall, the proportion of artiodactyl and large mammal remains in this assemblage is much greater than that noted for the earlier assemblages. This pattern may reflect a difference in an emphasis on artiodactyl resources; however, given the small sample size of this and some of the other assemblages, any interpretation of behavioral differences is problematic.

One small worked bone (see Table 13.2) was recovered from Feature 3014. This is a possible awl fragment manufactured from a large-medium sized mammal element. Moderate polish was noted in a few areas along the edge of the artifact. The small size of the element precluded a more definitive identification of the tool type and any specific functions.

Hohokam Sequence (A.D. 750-1450)

Thirteen faunal remains recovered from contexts dating to Hohokam periods were analyzed, including 11 unworked elements (Table 13.10) and two worked bones (see also Table 13.2). These remains were collected from three pithouse or possible pithouse features in two areas: Feature 2 in RNA 2 and Features 3293 and 9376 in RNA 8. Similar to the pattern noted for the prior two time periods, the unworked bones in the Hohokam assemblage were highly fragmented, with most being less than one-quarter complete (*n* = 10, 90.9 percent). Slightly less than three-quarters of the unworked bones exhibited a combination of past and recent breakage (*n* = 8, 72.7 percent), which suggests recovery procedures and more recent bone handling had some impact on the degree of bone fragmentation in the assemblage. The remaining bones exhibited evidence of only past breakage (*n* = 3, 27.3 percent).

Table 13.10. Unworked taxa recovered from Hohokam period contexts at the Clearwater site, AZ BB:13:6 (ASM).

Taxa	*n* (%)
Identifiable mammal (Mammalia)	
Rabbit or hare (Leporidae)	1 (9.1)
Black-tailed jackrabbit (*Lepus californicus*)	3 (27.3)
Unidentifiable mammal	
Unsized mammal	5 (45.5)
Small mammal	1 (9.1)
Large mammal	1 (9.1)
Total	11 (100.0)

More than 80 percent of the unworked bones were environmentally modified (*n* = 9, 81.8 percent)—all covered to varying degrees by a hard unidentifiable sedimentary substance. The proportion of environmentally modified bones, as well the type of modification, are comparable to the patterns noted in the earlier assemblages. Similar to the strata 503/504 assemblage, no gnawed bones were noted, which suggests carnivores had relatively little impact on this assemblage.

Slightly less than half the unworked bones were burned (*n* = 5, 45.5 percent), with roughly equal numbers of partially charred (*n* = 3, 60 percent) and calcined (*n* = 2, 40 percent) bones. No charred bones were noted. The proportion of burned bones in this assemblage is comparable with the proportions of burned bones noted for the two earlier assemblages. Burned bones were recovered from all three Hohokam features. The absence of charred bones is probably related to the small size of the Hohokam assemblage.

All of the remains analyzed from Hohokam period contexts were identified as mammals. Slightly more than one-third of the unworked remains were identifiable below class, and all of these were rabbit (see Table 13.9). Rabbit elements included fragments of an unburned black-tailed jackrabbit scapula, a partially charred ulna, and a partially charred metatarsal collected from Features 3293 and 9376, as well as an indeterminate rabbit unburned tibia found in Feature 3293. All but one of the rabbit bones, a jackrabbit element, were less than half complete, with some of the breakage occurring recently. All of the black-tailed jackrabbit bones were also environmentally modified. The indeterminate rabbit remain was not modified. Overall, the proportion of rabbit remains in the Hohokam assemblage is slightly greater than the proportions noted for the two earlier assemblages (approximately 25 percent). However, due to varying and often small sample sizes, more detailed comparisons and observations about rabbit use cannot be made.

A partially charred large mammal indeterminate element, which may represent an artiodactyl remain too fragmented to identify, was recovered from Feature 2. This element was less than one-quarter complete and partially covered with a hard sedimentary substance. The recovery of only a single unworked large mammal element precludes any observations about artiodactyl or large mammal use.

Two worked bones—which may represent a single awl based on similar morphological and taphonomic features—were also analyzed (see Table 13.2). These artifacts were recovered from Feature 3293, but could not be refit. More specific functions of the worked bones could not be determined due to their small size and poor condition. Much of the surface area of the bones was covered with a hard sedimentary substance. Moderate polish was observed in some areas without environmental modification.

Tucson Presidio, AZ BB:13:13 (ASM)

A total of 69 faunal remains recovered from the Tucson Presidio site were analyzed (Table 13.11). All of these remains were recovered from four Hohokam features located in area RNA 12. These features included two pithouses (Features 406 and 417), a possible pithouse (Feature 380), and a small pit (Feature 350.02). The site is located in downtown Tucson, a few hundred meters east of the Santa Cruz River. A large historic-era component, including a Spanish period presidio, is present at the site and overlies the prehistoric contexts.

Similar to the assemblages at the Clearwater site, most of the bones in this assemblage were less than one-quarter complete (*n* = 63, 91.3 percent) and slightly more than half of the bones exhibited a combination of past and recent breakage (*n* = 37, 53.6 percent). Unlike the other assemblages, however, about one-quarter of the bones in this assemblage had only recent breakage (*n* = 16, 23.2 percent). This relatively high proportion suggests recovery procedures and more recent bone handling had greater impact on the degree of bone fragmentation in this assemblage. About one-fifth of the bones exhibited evidence of only past breakage (*n* = 14, 20.3 percent). Only two bones were unbroken.

Slightly more than one-third of the remains were environmentally modified (*n* = 24, 34.8 percent). The majority of the environmentally modified bones were eroded (*n* = 18, 75.0 percent) or root-etched (*n* = 4, 16.7 percent). One bone was sun bleached, and another exhibited a combination of environmental modifications. The relatively high percentage of eroded bones in this assemblage suggests the faunal remains may not have been buried as quickly at this site, or the contexts were disturbed, exposing previously buried bones to surface conditions. Either scenario would result in poorer preservation. This

Table 13.11. Unworked taxa recovered from Hohokam period contexts at the Tucson Presidio, AZ BB:13:13 (ASM).

Taxa	*n* (%)
Bird (Aves)	
Surface-feeding ducks (Anatinae)	1 (1.4)
Medium-small bird	1 (1.4)
Identifiable mammal (Mammalia)	
Small rodent	1 (1.4)
Medium artiodactyl (deer-sized)	2 (2.9)
Domestic cow (*Bos taurus*)[a]	4 (5.8)
Unidentifiable mammal	
Unsized mammal	29 (42.0)
Small mammal	1 (1.4)
Large-medium mammal	16 (23.2)
Large mammal	13 (18.8)
Indeterminate vertebrate	1 (1.4)
Total	69 (100.0)

[a] Site has a large historic-era component, and these elements undoubtedly originated from that occupation.

pattern could also account, at least in part, for the higher proportion of bones with only fresh breaks in the assemblage. Eroded bones are often more fragile, and therefore, more likely to break during excavation, or even in the specimen bags, than bones that have not been exposed to weathering processes. No gnawed bones were noted.

Less than one-fifth of the remains were burned (*n* = 10, 14.5 percent), with the majority of the burned remains being calcined (*n* = 8, 80 percent of the burned material). Only one charred and one partially charred bone were identified. The proportion of burned bones in this assemblage is much lower than that noted for the other assemblages. Unfortunately, it is unclear if these differences are related to behavioral differences, differences in the types of contexts from which the burned remains were recovered, taphonomic differences, sample size differences, or a combination of these and other factors. Most of the burned remains were unidentifiable mammal (*n* = 8, 80 percent) bones. Burned bones were recovered from three of the four features—most from Feature 406 (*n* = 6, 60 percent). Feature 380, which had a sample size of one, did not yield any burned bones.

All but two of the remains in the assemblage were identified as mammals (see Table 13.11). Non-mammalian remains included an unburned surface feeding duck (Anatinae) radius and an unburned medium-small bird vertebra collected from Feature 406. Both of these elements were complete, and the vertebra was not environmentally modified; the duck radius was sun bleached. The bones were generally in good condition, and they may represent more recent deposits. The recovery of historic cow bones in Feature 406 (see below) indicates this feature had been disturbed or contaminated with more recent deposits.

Identifiable mammal remains constituted approximately 10 percent of the assemblage. These remains included an unburned small rodent innominate recovered from Feature 380. Based on bone condition and color, this element is thought to represent a more recent, intrusive deposit. Additional identifiable mammal remains included two medium artiodactyl vertebrae fragments, one charred, recovered from Feature 406. Both of these elements were less than one-quarter complete, but only one exhibited evidence of recent breakage. Neither of the bones were environmentally modified.

Several large mammal indeterminate elements, as well as an atlas fragment, were recovered from Features 350.02, 406, and 417. All of the large mammal elements, which may represent artiodactyl remains too fragmented to identify, were less than one-quarter complete—many with a combination of past and recent damage. More than half of these elements were environmentally modified, primarily eroded (*n* = 6, 46.2 percent). Two bones were root-etched. A large mammal indeterminate element was calcined. Overall, the proportion of artiodactyl and large mammal remains in this assemblage is much greater than the proportions noted for the Hohokam and earlier assemblages at Clearwater. This pattern may reflect a difference in emphasis on artiodactyl resources; however, given the small sample size of many of the assemblages, as well as the possibility of disturbed contexts and poorer preservation at the Tucson Presidio, any interpretation of behavioral differences is problematic.

Four cow (*Bos taurus*) phalange fragments were also recovered from Feature 406, including the remains of two first phalanges and two third phalange fragments that may represent a single element. None of the cow bones were burned, and all but one have an eroded surface area. Three of the elements were less than half complete, and all had only fresh breaks. Given the nature of the contexts from which these bones were recovered, it is not clear if they represent an earlier or later Historic era use of the area.

Summary and Conclusions

The faunal assemblages from both sites were dominated by mammal remains. Except the Early Ceramic period contexts at Clearwater and the disturbed Hohokam contexts at the Tucson Presidio, the most common identifiable mammal was rabbits, particularly jackrabbits. This is typical for the assemblages of many prehistoric southeastern Arizona sites (Cameron 1998; Szuter 1991), although the Cienega phase contexts at Clearwater had a higher proportion of jackrabbits than expected, compared with later, larger Hohokam agricultural villages. Worked or unworked artiodactyl and large mammal bones were recovered for all temporal contexts.

Small sample sizes precluded interpretations about artiodactyl exploitation for many of the temporal phases. For the Cienega phase, the data suggested long-distance hunting and differential transport of elements may have occurred, although whole carcasses appear to have been butchered at the site on occasion. Although a possible communal structure dating to this phase was excavated, no evidence for utilizing artiodactyl resources in large-scale feasting activities was noted; nor could any of these remains be directly associated with any activities conducted in the structure. Artiodactyls may have been used for other communal activities and smaller-scale feasts, however. Communal activities may also account, in part, for the relatively high proportion of jackrabbits in this phase.

Burned rodent elements recovered from Cienega phase contexts provided some evidence that rodents may have been consumed occasionally, although many of the rodent remains appear to represent intrusive deposits. Many of the non-mammalian remains also appear to represent a combination of intrusive and cultural deposits, with the most likely cultural deposits being the turtle remains. Only one of the bird remains, a possible crow wing phalanx from the Cienega phase at Clearwater, appears to represent a cultural deposit. The paucity of bird remains in the assemblages is unusual. Ethnographic and archaeological evidence have indicated that ground-dwelling birds, such as quail, were used as meat resources (Cameron 1998; Henderson and Harrington 1914; Lange 1959). Raptors and several types of small birds were used to provide feathers for dance costumes and other ritual items (Henderson and Harrington 1914; Lange 1959; Underhill 1946). It is not clear why birds were not recovered in greater quantities, particularly for the Cienega phase contexts, which had a large sample size. No fish remains were noted, even though the sites are located relatively close to the Santa Cruz River. The absence of fish is not entirely surprising, however, as fish are not commonly recovered in archaeological sites in the region. Possible explanations for the absence of fish remains have included poorer preservation of fish bones, recovery procedures, and prehistoric dietary preferences.

VERTEBRATE FAUNAL REMAINS FROM THE SPANISH AND MEXICAN PERIOD FEATURES AT THE TUCSON PRESIDIO, AZ BB:13:13 (ASM)

Meat was an important part of the diet for the Spanish and Mexicans living in the Tucson Presidio. During the 2003 excavations at the site, 3,789 animal bone fragments were collected from six features dated primarily to the Spanish and Mexican periods (1694 to 1856). Two analyses of much smaller faunal assemblages from the Tucson Presidio that dated to the same periods were previously conducted (Diehl and Waters 2004; Thiel and Faught 1995). Based on the animal bones recovered, domestic taxa provided most of the meat consumed by presidio residents. Chickens, pigs, sheep or goats, and cattle were butchered inside the presidio walls, although beef comprised the largest portion of the meat diet. Traditional butchering methods using axes, cleavers, and knives were utilized to dismember carcasses and to divide body parts into edible portions. Comparisons with other Spanish and Mexican period faunal assemblages from the Tucson area show similarities in the types and proportions of animals used. Traditional butchering techniques gave way to the methods of the modern meat-packing industry by the turn of the nineteenth century.

Methods

All faunal material recovered from ¼-inch dry screening was analyzed to some degree. The NISP was tabulated for all identifiable taxa; identifiable includes all specimens identified at or below the order level. The identification of faunal specimens was assisted by the Western Archeological and Conservation Center (WACC) and Stanley J. Olsen comparative collections at the Arizona State Museum (ASM), as well as several references (Gilbert 1990; Gilbert et al. 1981; Hoffmeister 1986; Olsen 1964, 1968, 1979; Peterson 1990; Sisson 1953; Stebbins 1985). Fragments from recently broken identifiable specimens were refitted when possible and counted as one. Bone surface modifications resulting from both cultural and natural agents were recorded. The minimum number of individuals (MNI) was calculated for each discrete taxon based on the site total. Recorded variables for identifiable bone included provenience, taxon, element, element part and side, degree of fusion, amount present, degree of burning, and other surface modifications, including butchering marks.

Unidentifiable bone comprised 79 percent of the bone fragments. Unidentifiable large mammal (pig-/sheep-/cattle-sized) and very large mammal (horse-/cattle-sized) bone scrap was counted and weighed, but not otherwise analyzed unless it was identifiable to element, had butchering marks, or exhibited burning. These data were recorded for use in the butchering and body part representation tabulations. Other specimens were recorded by class and size; for example, medium bird (chicken-sized), small mammal (rabbit-/rodent-sized), and medium mammal (dog-/coyote-sized). Due to the small size of most bone fragments, refitting was not attempted for the unidentifiable bone; consequently, each fragment was counted as one.

The large proportion of unidentifiable bone is primarily the result of a combination of preservation problems and excavation techniques. Much of the bone exhibited traces of gypsum (calcium sulfate) crystals. This substance weakens the structure of the bone so that a single blow with a shovel reduces even complete elements into fragments. Most of the unidentifiable specimens are very large mammal long bone shaft pieces. Based on the distribution of taxa in the identifiable assemblage, these are probably cattle bone.

Identified Taxa

The majority (63 percent) of identifiable bone was from cattle (*Bos taurus*) (Table 13.12). Other domestic taxa comprised 19 percent of the identifiable assemblage, including chicken (*Gallus gallus*), possible chicken (cf. *Gallus gallus*), horse/mule/donkey (*Equus* sp.), pig (*Sus scrofa*), and sheep/goat (*Ovis aries/Capra hircus*). Wild taxa made up 12 percent of the assemblage, including one fish, an unspecified sucker (Catostomidae); two birds, dove (*Zenaida* sp.) and raven (*Corvus corax*); and four mammals, including jackrabbit (*Lepus* sp.), pocket gopher (*Thomomys* sp.), pocket mouse (*Perognathus* sp.), and deer (*Odocoileus* sp.). The remaining 6 percent are from either domestic or wild taxa. Dog/coyote/wolf (*Canis* sp.) may represent domestic dog (*Canis familiaris*), coyote (*Canis latrans*), or wolf (*Canis lupus*). Unidentified artiodactyl and medium artiodactyl (Artiodactyla) contain identifiable elements from artiodactyls of unknown size and pig/sheep/deer size, respectively.

The meat diet of the presidio residents was comprised almost entirely of domestic animals, with cattle being consumed most often. Very few wild food taxa are present in the assemblage. The sucker, dove, jackrabbit, and deer specimens are presumedly food remains. The remaining wild taxa, including pocket gopher and pocket mouse, probably represent recent, intrusive specimens, based on their unweathered bone surfaces. One unusual occurrence in the wild taxa is the raven from Features 420 and 423; the 34 total specimens belong to the same individual. All parts of the skeleton are represented, indicating the bird was relatively complete when buried. It may have been captured and treated as a pet. If the canid specimens belong to domestic dog, they were likely pets as well.

The MNIs for each discrete taxon are shown in the last column in Table 13.12. Most discrete taxa in the Tucson Presidio assemblage have a MNI of one. Exceptions include chicken, dog/coyote/wolf, pig, sheep/goat, and cattle. Multiple individuals were identified by differences in size, repetitions in element representation, and variations in bone development or estimated age. The ageing of domestic animals within animal husbandry has a long history. For example, the eruption of teeth occurs at regular intervals in pig, sheep, and cattle and provides a guide to the ages of the individuals represented (e.g., Silver 1970; Sisson 1953). Epiphyseal fusion rates for postcranial elements are also established and provide age range estimates for domestic taxa (e.g., Silver 1970).

Table 13.12. Taxa represented among identifiable bone (number of identified specimens) in features from the Tucson Presidio, AZ BB:13:13 (ASM).

	Features						
Taxon	373	409	420[a]	422	423[a]	441	Taxon Total[b]
Unspecified sucker (Catostomidae)	–	1	–	–	–	–	1/1 (<1)
Chicken (*Gallus gallus*/cf. *Gallus gallus*)	8	22	–	–	–	2	32/4 (8)
Dove (*Zenaida* sp.)	1	–	–	–	–	–	1/1 (<1)
Raven (*Corvus corax*)	–	–	31	–	3	–	34/1 (9)
Jackrabbit (*Lepus* sp.)	–	–	–	1	–	–	1/1 (<1)
Pocket gopher (*Thomomys* sp.)	2	–	4	–	–	–	6/1 (2)
Pocket mouse (*Perognathus* sp.)	–	–	–	–	1	–	1/1 (<1)
Dog/Coyote/Wolf (*Canis* sp.)	2	5	–	–	–	–	7/2 (2)
Horse/Mule/Donkey (*Equus* sp.)	–	10	–	–	–	2	16/1 (4)
Unidentified artiodactyl (Artiodactyla)	–	1	–	–	–	3	4 (1)
Medium artiodactyl (pig-/sheep-/deer-sized)	6	4	–	–	–	2	12 (3)
Pig (*Sus scrofa*)	–	9	–	–	–	1	10/2 (3)
Deer (*Odocoileus* sp.)	–	2	–	–	–	–	2/1 (1)
Sheep/Goat (*Ovis aries/Capra hircus*)	5	11	1	–	–	3	20/2 (5)
Cattle (*Bos taurus*)	36	152	26	10	1	22	247/5 (63)
Feature total	60	217	64	11	5	35	394/23 (101)

[a] Feature 420 cuts into Feature 423; looks as if there is some mixing of deposits and most of Feature 423 belongs with Feature 420?

[b] NISP/MNI; percentage of identifiable assemblage in parentheses.

Minimally, four chickens are present in the presidio assemblage, predicated on age and element representation. Based on modern comparative material, there is at least one individual aged 2-3 months at death and one individual aged approximately 6 months at death. At least two adults are present in the assemblage based on two left proximal radii.

The two dog/coyote/wolf individuals are differentiated by size. One specimen from Feature 409 is much larger than the others and is in the size range of a large dog or wolf, rather than a medium-large dog or coyote.

At least two pigs are represented in the assemblage and are differentiated by age. Two pig mandibles were recovered from Feature 409. One is an adult older than 20 months with all teeth erupted. The other is a juvenile aged between 4-12 months at death, based on the presence of a deciduous fourth premolar and permanent first molar (Silver 1970; Sisson 1953). One unfused long bone, a distal radius (which fuses at 3.5 years), was also identified. None of the other pig specimens could be aged.

At least two sheep/goat individuals are present in the Tucson Presidio assemblage, based on epiphyseal fusion rates (Table 13.13). One individual was less than 1.5-2 years of age at death, based on two unfused distal tibiae—one from each side of the body. The other individual was older than 3 years at death, based on one fused distal radius.

The standard MNI calculation for the cattle specimens in the presidio assemblage yields a minimum of five individuals. At least four adult or subadult individuals are represented by four right and four left proximal metacarpals and four right calcanei.

Table 13.13. Epiphyseal fusion rates for sheep/goat and cattle specimens from the Tucson Presidio, AZ BB:13:13 (ASM).

Element	Fused	Unfused	Age at Fusion[a]
Sheep/Goat			
Distal first phalanx	3	–	Before birth
Distal humerus	1	–	10 months
Proximal first phalanx	2	–	13-16 months
Distal tibia	–	2 (1 fusing)	1.5-2 years
Distal radius	1	–	3 years
Proximal humerus	–	1	3-3.5 years
Cattle			
Proximal metacarpal	8	–	Before birth
Proximal metatarsal	6	–	Before birth
Distal first or second phalanx	48	–	Before birth
Distal humerus	1	–	12-18 months
Proximal radius	2	–	12-18 months
Proximal first or second phalanx	43	2	1.5 years
Distal metacarpal	2	–	2-2.5 years
Distal tibia	2	1	2-2.5 years
Distal metapodial[b]	1	6	2-3 years
Distal metatarsal	3	–	2.5-3 years
Calcaneus	1	–	3-3.5 years
Proximal femur	–	3	3.5 years
Proximal humerus	–	1	3.5-4 years
Distal radius	1	3	3.5-4 years
Distal ulna	–	4	3.5-4 years
Distal femur	1	–	3.5-4 years
Proximal tibia	1	1	3.5-4 years
Innominate	3	–	4.5 years
Vertebral body	1	5	5 years

[a] Silver 1970.

[b] Combination of metacarpal and metatarsal fusion rates.

Based on comparison with modern skeletal material, one calf (less than 6 months old) is represented by a metatarsal shaft from Feature 420. The ages of the adult individuals range from less than 1.5 years to more than 5 years old (see Table 13.13). Additionally, two adult (older than 2-2.5 years) mandibles with all teeth erupted represent two of the individuals. This age profile, with individuals aged from less than 6 months to over 5 years, shows that animals of all ages except the very old were killed and that some of the cattle were used for purposes other than food. Most animals raised primarily for food are slaughtered before they are fully grown, although a small number are kept alive for breeding. The use of cattle for draft or dairying would result in more animals living to an older age (Landon 1996:96).

The following analyses include an additional 484 unidentifiable specimens, bringing the total to 876 analyzed specimens. These additional specimens were recorded in the database because they exhibit butchering marks or evidence of burning.

Bone Surface Modifications

Bone surface modifications resulting from both cultural and environmental processes were present on much of the faunal material from the Tucson Presidio. Cultural processes, such as burning and butchering, are biostrationomic, occurring before burial (Lyman 1994b:402). Modifications by environmental processes tend to occur after burial.

Environmental Modifications

The assemblage from the Tucson Presidio was in fair to poor condition. A total of 386 (44 percent) analyzed specimens exhibit postdepositional bone surface modifications from environmental factors. Erosion affected the largest number of modified specimens ($n = 175$). Erosion is most commonly associated with exposure to sunlight, moisture, and temperature fluctuations before bone is buried (Behrensmeyer 1978). Traces of gypsum were noted on 75 specimens. Gypsum forms in soil under different circumstances; for example, when, under the proper conditions, autotrophic sulfur bacteria produce sulfuric acid in the presence of calcium carbonate (caliche) or calcium phosphate (hydroxyapatite), the latter of which is the inorganic component comprising 70 percent of bone (Lyman 1994b:72; Waksman 1952:67). Further, substances such as gypsum may be formed from solutes carried through the soil by water. Gypsum crystals often co-occur with surface erosion on bones in the Tucson Presidio assemblage. This combination of environmental weathering led to the destruction of many bone surfaces and was responsible for much of the breakage leading to the large proportion of unidentifiable bone.

Sixty specimens exhibited root-etching. Root-etching is thought to result from the acidic secretions of plant roots, although whether the acid is secreted by the roots themselves or by the fungi associated with decomposing roots is unknown (Grayson 1988:30; Lyman 1994b:375). Root-etching may have occurred either before or after burial. Caliche-coating, covering less than 50 percent of bone surfaces, was present on 52 specimens. Caliche-coating on bone results from the precipitation of calcium carbonate. In an arid environment with high rates of evapotranspiration, calcium carbonate is distributed throughout the soil horizon. The depth of dense accumulations of caliche depends on soil moisture and texture (McFadden and Tinsley 1985:30-32).

Twenty-one specimens were stained. Dark-colored staining on bone from the Tucson Presidio was likely caused by manganese oxide in the soil matrix (Brain and Sillen 1988:464, cited in Lyman 1994b:421). Only three specimens were abraded; abrasion is usually the result of "the tumbling of bones in a liquid that contains sediment" (Lyman 1994b:185). However, several processes other than fluvial transport can abrade bone, such as trampling and eolian activity (Lyman and references cited 1994b:187).

Evidence of animal damage was present on only 34 specimens. Carnivore gnawing was observed on 18 analyzed specimens; five occurrences were indeterminate gnawing. Two specimens show signs of carnivore digestion. Nine specimens from Feature 420 exhibited "bore holes," possibly from insects (cf. Lyman and references cited 1994b:393-394).

Bone Tools

Three very large (horse-/cattle-sized) mammal specimens were modified by Tucson Presidio residents into bone tools (Figure 13.1). One long bone

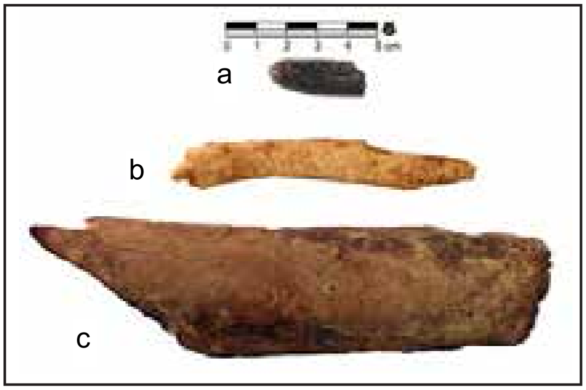

Figure 13.1. Bone tools from the Tucson Presidio, AZ BB:13:13 (ASM).

shaft from Feature 423 (FN 4217) exhibits scrapes where it was formed into a blunt point for an unknown use (see Figure 13.1a). This specimen is completely charred. One awl-like implement from Feature 441 (FN 4274) was fashioned out of a rib shaft (see Figure 13.1b). One distal rib from Feature 409 (FN 4240) was chopped diagonally through the shaft, ground to a point, and the point fire-hardened for use as an awl-like implement (see Figure 13.1c). One large mammal (pig-/sheep-/cattle-sized) mandible fragment was also ground down on one edge for an unknown use.

Prior to the 1850s, imported goods in Tucson were in short supply and those that were available were very expensive (Faught et al. 1995:42). People had to make do with what they brought with them and with what they could make on site. There were no shops selling manufactured goods until later in the Mexican period. Many residents reworked and reused their metal implements for as long as possible. The bone tools in the presidio assemblage are very crudely made and may represent quick substitutes for metal tools.

Burning

Twelve percent (*n* = 109) of the assemblage exhibits evidence of burning. The burned bone was grouped into four categories: partially charred, charred (black), charred/calcined, and calcined (blue/gray or white). Burning colors generally indicate the length of exposure to heat and/or the temperature of the fire. Higher temperatures and longer burning periods produce bone colors from brown to black to gray to white (Gilchrist and Mytum 1986:31). Most bones recovered from archaeological sites were probably not burned during cooking (Lyman 1994b:384). More often, bone was burned after being tossed into the cooking fire after consumption of the meat, through trash burning, as fuel for fires, or through the intentional burning of structures after abandonment (Haury 1976:115; Lyman 1994b:388).

Charred (*n* = 32), charred/calcined (*n* = 19), and calcined (*n* = 4) bone comprises 51 percent of the burned bone from the Tucson Presidio. Partially charred specimens (*n* = 54) comprised the remainder (49 percent) of the burned assemblage and may represent bone from meat that was roasted. However, the charred and calcined specimens were probably the result of incineration rather than food preparation, based on the intensity of burning (cf. Gilchrist and Mytum 1986:36). Individual pit features produced both burned and unburned specimens, indicating much of the bone was burned prior to its final deposition (cf. Stahl and Zeidler 1990, cited in Lyman 1994b:392).

Butchering Marks

Butchering marks were observed on 407 specimens, or 47 percent of the analyzed assemblage. Nearly all (*n* = 373, 92 percent) of the specimens with butchering marks exhibited chopmarks made by axes or cleavers. These marks indicate dismemberment and division of the carcass into edible portions. The large number (*n* = 226) of long bone shaft fragments with chopmarks may indicate breakage for marrow as well. Far fewer specimens exhibited cutmarks (*n* = 16, 4 percent) made by a thin blade, probably the result of skinning and defleshing. Seventeen specimens (4 percent) display both chopmarks and cutmarks. One specimen from Feature 441, a cattle lumbar vertebra, exhibits parallel sawmarks. Because it is the only recorded specimen with sawmarks, it may be an intrusion from later contexts at the site.

Element Representation and Butchering Practices

The element representation and incidence of butchering marks on pig, sheep/goat, and other identifiable artiodactyl specimens from the Tucson Presidio are shown in Table 13.14. Only 10 specimens were positively identified as pig; half are skull parts, including 1 squamous temporal, 2 mandibles, and 2 isolated teeth. Postcranial pig elements consist of 1 rib, 1 radius, and 3 fibulae. The sheep/goat skeleton was better represented, with 20 specimens. Identified elements include: 1 maxillary molar, 1 thoracic vertebra, 1 sacrum, 3 humeri, 1 radius, 1 ilium, 2 femora, 2 tibiae, 3 tarsals, 1 metapodial, and 4 phalanges. The six medium artiodactyl specimens identifiable to element are mostly axial elements, including 2 vertebrae, 2 ribs, and 1 innominate, and are probably either pig or sheep. One medium artiodactyl first phalanx from Feature 373 is either sheep or deer.

Butchering marks on pig specimens occur on postcranial elements only, and all of these butchering marks are chopmarks (*n* = 5). Sheep/goat specimens with butchering marks (*n* = 7) are mostly limb bones except one ilium; all are chopped. One medium artiodactyl rib has a cutmark, and one vertebra and one innominate display chopmarks. Due to the small sample sizes, it is not possible to interpret the sheep/goat and pig element representation and estimate the carcass apportionment for each taxon. However, because skull and foot elements are present and the butchering marks are almost exclusively chopmarks, complete animals appear to have been butchered within the presidio walls using traditional methods.

Table 13.14. Pig, sheep/goat, and identifiable artiodactyl elements from the Tucson Presidio, AZ BB:13:13 (ASM).

Taxon	Element	Butchering Marks	Number of Identifiable Specimens
Feature 373			
Medium artiodactyl	Thoracic vertebra	Chopmarks	1
	Rib	None	1
	Phalanx	None	1
Sheep/Goat	Sacrum	None	1
	Humerus	Chopmarks	1
	Ilium	Chopmarks	1
	Naviculo-cuboid	None	1
	Phalanx	None	1
Feature 409			
Pig	Mandible	None	2
	Rib	Chopmarks	1
	Radius	Chopmarks	1
	Fibula	Chopmarks	3
Sheep/Goat	Maxillary molar	None	1
	Thoracic vertebra	None	1
	Humerus	Chopmarks (1)	2
	Radius	Chopmarks	1
	Femur	None	1
	Tibia	Chopmarks	1
	Astragalus	None	1
	Metapodial	None	1
	Phalanx	None	2
Feature 441			
Medium artiodactyl	Unidentified vertebra	None	1
	Ischium/Acetabulum	Chopmarks	1
Pig	Squamous, temporal	None	1
Sheep/Goat	Femur	Chopmarks	1
	Tibia	Chopmarks	1
	Astragalus	None	1

Note: Feature 420 contained one sheep/goat first phalanx without butchering marks; Feature 423 had one medium artiodactyl rib with cutmarks.

To offset some of the effects of fragmentation on the NISP (Grayson 1984), the minimum number of elements (MNE) was calculated and then standardized for cattle anatomical portions after Stiner (1994:240). The MNE for selected portions of the cattle skeleton are shown in Table 13.15. Large mammal specimens identifiable to element are also included in Table 13.15 on the assumption that most are from cattle. The standardized MNEs are composed of the raw MNE counts collapsed into seven anatomical regions. The MNE for each region was calculated using the most common portion of each unpaired element and the sum of the rights and lefts of the most common portion, usually an articular end, of each type of paired element.

The seven regions include: the head (maxillae and mandibles), axial column (ribs, vertebrae, and innominates), upper front limbs (scapulae and humeri), lower front limbs (radii, ulnae, and metacarpals), upper hind limbs (femora), lower hind limbs (tibiae and metatarsals), and the feet (phalanges). The MNEs are summed for each anatomical region and then divided by the expected number of MNEs per anatomical region to obtain the standardized MNE. Each

Table 13.15. Body part representation (minimum number of elements, or MNE) of cattle and large mammal specimens identifiable to element from the Tucson Presidio, AZ BB:13:13 (ASM).

Body Part	Feature 373	Feature 409	Feature 420	Feature 422	Feature 441	rMNE[a]	sMNE[b]	sMNE/MNI[c]
Skull	2	4	1	0	7	14	3.50	1.00
Axial	11	33	6	4	5	59	1.20	0.34
Upper front	2	4	0	2	0	8	2.00	0.57
Lower front	3	12	2	2	1	20	3.33	0.95
Upper hind	2	3	1	0	1	7	3.50	1.00
Lower hind	2	12	4	0	2	21[d]	2.63	0.71
Feet	1	36	2	2	1	52	2.25	0.64

[a] Total raw MNE.
[b] Total standardized MNE.
[c] Anatomical completeness index.
[d] Includes one metatarsal from Feature 423.

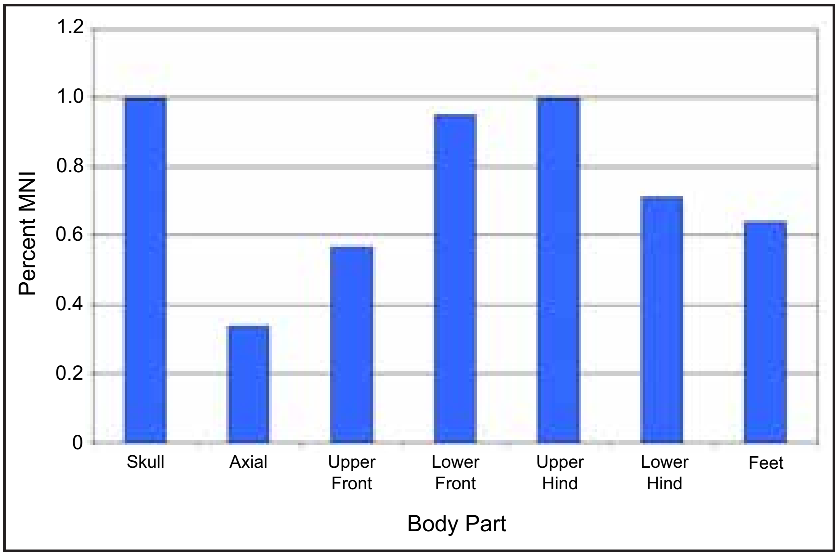

Figure 13.2. Tucson Presidio, AZ BB:13:13 (ASM), cattle body part representation.

standardized MNE represents a bone-based MNI estimate for each of the seven regions (Stiner 1994:241). The highest standardized MNE serves as the estimated number of carcasses represented. Figure 13.2 illustrates the MNI percentages based on the standardized MNEs from Table 13.15, using the standardized MNEs for the skull and upper hind regions (3.50) as 100 percent.

As shown in Figure 13.2, the skull, lower front, and upper hind were the best-represented portions of the cattle carcass. The upper front, lower hind, and feet were less well represented. However, only the axial skeleton is seriously underrepresented. The meatier and higher-quality portions are the axial, upper front, and upper hind. The lower front, lower hind, and particularly the skull and feet, contain less and lower-quality meat. The relatively good representation of all portions indicates the Tucson Presidio pit assemblages contain evidence for initial butchering, including the removal of the head and feet, as well as secondary butchering, or the subsequent partitioning of the carcass into edible portions. The low proportion of axial specimens may indicate these elements represent the most common end product of tertiary butchering for consumption and were disposed of elsewhere.

The cattle and large mammal elements with butchering marks are listed in Table 13.16. Elements from the meatier portions of the cattle carcass are assumed to have had more butchering marks than elements from less meaty portions. With only a few exceptions, all portions confirm this assumption. The upper front and the upper hind portions have 67 percent and 65 percent, respectively, of the specimens displaying butchering marks. The axial portion is lower, with 54 percent showing butchering marks. Interestingly, thoracic vertebrae, ribs, and innominates all display butchering marks in higher proportions than the axial average. Most parts with little meat show few butchering marks. Skull parts have a

Table 13.16. Cattle and very large mammal elements with butchering marks from the Tucson Presidio, AZ BB:13:13 (ASM).

Element	Feature 373	Feature 409	Feature 420	Feature 422	Feature 423	Feature 441	Total[a]
Skull	1	2	–	–	–	–	3 (30)
Hyoid	–	1	–	–	–	–	1 (100)
Cervical vertebra	–	2	–	–	–	1	3 (33)
Thoracic vertebra	–	8	1	–	–	–	9 (64)
Lumbar vertebra	1	2	3	–	–	1	7 (44)
Rib	11	33	3	1	–	4	52 (60)
Scapula	1	3	–	–	–	–	4 (67)
Humerus	1	4	–	1	–	–	6 (67)
Radius	2	4	1	2	–	–	9 (89)
Ulna	1	5	1	–	–	–	7 (88)
Carpal (scaphoid)	–	1	–	–	–	–	1 (7)
Metacarpal	–	6	–	–	–	1	7 (54)
Innominate	2	2	–	–	–	–	4 (67)
Femur	2	2	5	–	–	2	11 (65)
Patella	–	–	–	–	–	1	1 (100)
Tibia	3	4	3	–	–	–	10 (77)
Astragalus	–	3	–	–	–	–	3 (75)
Calcaneus	–	5	–	–	–	–	5 (100)
Metatarsal	–	7	–	–	1	–	8 (80)
Metapodial	–	2	–	–	–	1	3 (23)
Long bone	29	116	46	–	5	23	219[b]
Unidentifiable element	1	4	1	–	1	–	7[b]
Total[a]	55 (49)	216 (56)	64 (76)	4 (33)	7 (47)	34 (60)	380 (58)

[a] Numbers in parentheses are percentage of the element total.

[b] Only fragments with butchering marks or burning were recorded.

low proportion (11 percent) of butchering marks, and foot elements show no butchering marks at all. However, the lower front and the lower hind portions have the highest proportions of butchering marks—73 percent and 81 percent, respectively. The elements in these portions are not surrounded by much meat, and the large proportions with butchering marks may reflect the use of these parts for the traditional Mexican dish of menudo (cf. Diehl et al. 2005:192).

Almost 90 percent of the cattle specimens with butchering marks exhibit only chopmarks. Chopmarks are primarily involved in initial butchering and secondary apportionment. Thirty-seven specimens display cutmarks, either alone or in combination with chopmarks, including one maxillary premolar with cutmarks along the gum line, eight ribs with cutmarks only, five ribs with chopmarks and cutmarks, and one proximal metatarsal with chopmarks and cutmarks. Twenty-two long bone shafts exhibit chopmarks and cutmarks. Cutmarks may be an indicator of skinning, a step of initial butchering, or of tertiary butchering, particularly deboning and meat removal for consumption.

Due to the heavy fragmentation of the assemblage, estimates of cattle carcass apportionment patterns were not attempted. However, some descriptive statements about initial and secondary butchering practices may be made. Chopmarks on the proximal and distal radius and ulna suggest separation from the humerus and carpus, although there are also lateral shaft chopmarks, possibly to apportion the radius into segments. Roughly parallel chopmarks through the acetabulum appear to be for apportioning the innominate into segments rather than disarticulating the femur. However, that disarticulation is indicated in a large percentage of proximal femur specimens where the femur head was chopped through. Horizontal chopmarks through the distal femur epiphyses likely indicate separation from the tibia. There are only two examples of intact femur shafts with chopmarks; one example is illustrated in Figure 13.3. This specimen represents the division of the element into portions. The distal tibia does not appear to be involved in the disarticulation of the lower hind leg. Instead, chopmarks through the calcaneus and astragalus indicate the removal of the lower hind leg.

Metacarpals and metatarsals were chopped through the shaft, possibly to remove the feet (Figures 13.4-13.5). However, it is more expedient to separate the feet from the metapodials by chopping into the joint between the distal metapodial and the first phalanges rather than chopping through the shaft of the metapodial (Landon 1996:91). Only two distal metapodial specimens exhibited chopmarks. This suggests the metapodials were fractured for marrow. Only one proximal metatarsal (see Figure 13.5) exhibits the transverse cutmarks encircling the shaft that indicate skinning (Landon 1996:90).

Figure 13.3. Cattle femur from the Tucson Presidio, AZ BB:13:13 (ASM), showing chopmarks (top) and impact scar (bottom).

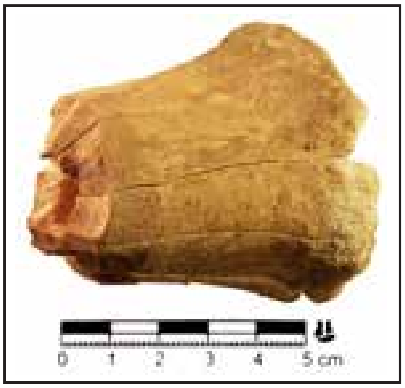

Figure 13.4. Cattle metacarpal from the Tucson Presidio, AZ BB:13:13 (ASM), with chopmarks.

There is little evidence for marrow processing in the presidio assemblage. Fourteen bone "flakes" and corresponding impact scars on large mammal long bone shafts show fracturing for possible marrow removal (see Figure 13.3). The use of bone marrow was probably more frequent than these examples suggest, however. Many of the limb bones were systematically partitioned through some portion of the shaft, ostensibly to divide the carcass into edible portions of meat. However, the partitioning of various long bones may have also been intended to retrieve bone marrow. This duality makes it difficult to determine the degree to which bone marrow was habitually used (cf. Landon 1996:78, 93).

As noted above, there is not much evidence for tertiary butchering in the Tucson Presidio assemblage. There are relatively few of the shallow cutmarks involved in deboning and meat removal. This suggests final butchering for consumption may have occurred elsewhere, although the pervasive erosion of bone surfaces in the assemblage could have obscured many of the shallower cuts.

Comparisons with Other Hispanic Assemblages in the Tucson Area

The Tucson Presidio faunal assemblage is compared with seven other faunal assemblages recovered from Hispanic features in the Tucson area dating to the Spanish, Mexican, and American Territorial periods (Table 13.17). The earliest assemblage in the comparison came from the Mission San Miguel de

Figure 13.5. Cattle metatarsal from the Tucson Presidio, AZ BB:13:13 (ASM), showing cutmarks (top) and chopmarks (bottom).

Table 13.17. Percentages of major domestic animal bone and butchering marks in Hispanic faunal assemblages from the Spanish, Mexican, and American Territorial periods.

Site	Cattle	Sheep	Pig	Chopmarks	Cutmarks	Sawmarks	Chopmarks and Sawmarks	Chopmarks and Cutmarks
Mission San Miguel de Guevavi[a] (1701-1773)	15	69	15	83	17	–	–	–
Mission San Agustín de Tucson[b] (1795-1820)	94	6	–	17	84	2	–	–
Tubac Presidio[c] (1775-1854)	35	64	1	Noted	Noted	Noted, rare	–	–
Tubac Presidio (1854-?)	40	59	1	Noted	Noted	Noted, rare	–	–
Tucson Presidio (1775-1854)	89	7	4	92	4	<1	–	4
Block 192[d] (circa 1780-1850)	77	19	3	62	12	17	–	10
León household[e] (1840s-1880s)	93	5	1	96	1	3	–	–
León household[e] (1880s-1890s)	87	11	1	74	1	23	2	–
León household[e] (1890s-1910s)	90	9	1	59	1	36	2	2
Mexican features at AZ BB:13:6 (ASM)[f] (1870-1890)	81	5	14	27	8	57	–	8
Block 180, Feature 26[g] (1870-1905)	78	18	4	34	2	63	–	–

[a] Gillespie 1992.

[b] This report.

[c] Hewitt 1975.

[d] Thiel and Faught 1995.

[e] Diehl et al. 2005.

[f] Diehl et al. 1997.

[g] Jones 1997.

Guevavi, AZ EE:9:1 (ASM), and dates from 1701-1773 (Gillespie 1992). Roughly contemporaneous to the Tucson Presidio assemblage are the assemblages from Mission San Agustín de Tucson (this volume), the Tubac Presidio (Hewitt 1975), and the Tucson Presidio occupation on Block 192 (Thiel and Faught 1995). The León household, AZ BB:13:505 (ASM), was occupied continuously from the 1840s through the 1910s (Diehl et al. 2005). The faunal assemblage from the Mexican features at the Clearwater site dates from 1870-1890 (Diehl et al. 1997). The final assemblage in the comparison, from Feature 26 in Block 180, dates from 1870-1905 (Jones 1997).

Beef was always the mainstay of the meat diet among Hispanic residents. Except the Mission San Miguel de Guevavi and the Tubac Presidio, cattle bone comprises from 78-94 percent of the bone from large domestic animals—including cattle, sheep, and pig—in the study group. Mutton and pork consumption was more variable, although pig specimens were generally recovered in lower quantities than sheep/goat specimens throughout the timespan.

Faunal assemblages dating to the Spanish and Mexican periods are dominated by chopped cattle bone. Hispanic butchers traditionally used cleavers, while handsaws were associated almost exclusively with Euro-American butchers of the American periods (Chapin-Pyritz and Mabry 1994:155). The early use of cleavers and axes to dismember and separate the carcass was very different from methods utilized later by the modern meat-packing industry. This trend is evident in the Hispanic faunal assemblages shown in Table 13.17. Through time, modern butchering methods were adopted by Hispanic butchers, and Hispanic shoppers patronized Euro-American butcher shops. This is seen in an increase in the proportion of sawn bone in Hispanic faunal assemblages from the Tucson area. Sawn bone ranges from 0-2 percent of the butchering marks in the Spanish period, while sawn bone comprises up to 63 percent of the butchered bone in the selected Hispanic assemblages by the turn of the nineteenth century. There is some variability in the proportions of sawn bone to chopped bone in the comparison. The León household assemblage still exhibits chopmarks on a majority of the identifiable assemblage into the 1910s. The León family owned several ranches outside of Tucson, and they likely butchered their own meat (Diehl et al. 2005:192).

Summary and Conclusions

The distribution of animal bone within the Tucson Presidio walls shows cattle as the primary source of meat, with chickens, sheep or goats, and pigs making smaller contributions. Wild mammals, birds, and fish were captured and eaten, but far less frequently. All domestic taxa were represented by both juveniles and adults. Chickens range in age from 2-3 months to adults. Pigs are represented by at least one juvenile and one adult older than 20 months. At least one subadult and one adult sheep or goats are present in the assemblage. The age profile for cattle specimens in the assemblage includes animals ranging in age from juveniles less than 1 year old to adults more than 5 years old. The range in ages at slaughter suggests not all animals were killed in their prime and that they were raised for more than meat.

Element representation among the domestic taxa indicates complete animals were butchered and processed by the Tucson Presidio residents. The relatively good representation of all portions of the cattle carcass suggests the Tucson Presidio pit assemblages are the result of initial and secondary butchering, including dismemberment and apportionment into segments. Nearly half of the assemblage exhibits butchering marks. Most are chopmarks made by an axe or a cleaver, further suggesting initial and secondary butchering. Little evidence for tertiary butchering, such as cutmarks from deboning and meat removal, is present. Cutmarks may also indicate skinning, part of the initial butchering process. However, except the cutmarks on the cattle maxillary premolar and proximal metatarsal from Feature 409, the position of the cutmarks and the elements they are on are not customary for skinning marks (Landon 1996).

Elements from the meatier portions of the cattle carcass display a higher proportion of butchering marks except the lower front and lower hind limb bones. These bones are consistently chopped through at various points on their shafts, indicating secondary apportionment, fracturing for marrow, or both. Because these bones have little and low-quality meat, marrow processing seems more likely. However, meat from the lower legs and feet were used in making menudo, a traditional Mexican dish. The chopmarks through shafts of the lower limb bones may be the result of marrow processing after the removal of the meat.

In the end,

> Butchery marks on bones reflect all stages of the butchery process, and it is not always possible to correlate specific marks, or even mark clusters, with a single step in the butchery process (Landon 1996:92).

However, based on element representation and butchering marks, complete animals were certainly being butchered within the presidio walls using traditional methods.

Comparisons with other Hispanic faunal assemblages through time show that domestic animals provided most of the meat for Hispanic residents of Tucson. Beef was by far the most popular, comprising the overwhelming majority of the meat consumed in the Spanish period and continuing through the early American Territorial period. Butchering was initially accomplished with axes and cleavers, and the finer work was done with knives. By the turn of the nineteenth century, sawmarks comprised the majority of butchering marks in most Hispanic faunal assemblages. This increase in sawmarks was probably the result of the gradual shift from a subsistence economy to a market economy where meat production is specialized and butchering methods are mechanized.

ZOOARCHAEOLOGY OF MISSION SAN AGUSTÍN DEL TUCSON, AZ BB:13:6 (ASM)

The adoption of animal husbandry as a subsistence strategy by southwestern Native American groups was an important goal of Spanish colonial missionaries. Documentary evidence suggests some Native Americans quickly adopted animal husbandry, but archaeological evidence indicates this strategy was not always successful in all regions. Current understanding of the responses of southwestern Native Americans to the introduction of domestic animals is hindered, however, by a dearth of evidence. Recent excavations at the site of the Franciscan mission of San Agustín in downtown Tucson, Arizona, provide an opportunity to examine Tohono O'odham subsistence practices at the turn of the nineteenth century. Analysis of faunal remains from the mission suggests missionary efforts to encourage Native Americans to adopt animal husbandry were, to some extent, successful. However, the hunting of wild resources continued to be an important part of missionized Tohono O'odham subsistence practices.

Introduction

The arrival of Europeans in North America beginning in the late fifteenth century A.D. had enormous implications for the lives of Native Americans. Some of the consequences of European contact and colonization were intentional and some were unintentional. Europeans introduced infectious diseases that devastated Native American populations and caused social and political upheaval. European trade goods such as cloth and metal knives were quickly incorporated into existing Native American trade networks, sometimes replacing, and sometimes adding to, traditional technologies. As part of a larger colonization strategy, Spanish missionaries were often the first Europeans to make contact with Native American groups. Missionization involved not only conversion to Catholicism but also the "civilizing" of the frontier in preparation for colonization by Spanish laypeople. Spanish missions were intended to become self-sustaining colonial enterprises that would support Spanish military efforts. Spanish military presidios (forts) were often placed near missions to take advantage of the latter's productivity, particularly during the initial days of military presence.

An important aspect of the Spanish missionization strategy was to introduce Eurasian crops and domestic animals and to convince Native American groups to adopt sedentary agriculture and animal husbandry. This strategy met with limited success at Spain's missions in what is now the southeastern United States (Reitz 1993). While Native American groups in Spain's eastern missions adopted some crops and domestic animals fairly early in the Historic era, the bulk of the Native American and Spanish diet was comprised of wild meats and indigenous domestic crops, such as maize and beans (Gremillion 1993; Reitz 1993).

Little is known about the introduction of domesticated animals in Spain's western missions. Ethnohistoric documents suggest southwestern Native Americans quickly adopted domestic animals such as cattle and sheep after their introduction by Father Eusebio Kino in the early eighteenth century (Sheridan 1988; Spicer 1962), but very little archaeological evidence exists to support or refute the written record. Only a handful of southwestern missions have been excavated. Faunal remains from the missions at Awatovi, San Marcos, and San Miguel de Guevavi suggest the introduction of domestic animals was more successful in the Southwest than it was in the Southeast (Chapin-Pyritz 2000; Gillespie 1992; Lucas et al. 2003; Olsen and Wheeler 1978).

Archaeological excavations at Mission San Agustín del Tucson provide a rare and important opportunity to examine the response of missionized Tohono O'odham to the introduction of Eurasian domestic animals.

Methods

Zooarchaeological remains from the San Agustín Mission were excavated from seven features dating between 1795 and 1820. Most of the materials from these features are thought to have been deposited as a result of subsistence activities by Tohono O'odham who resided at the mission. All zooarchaeological remains from San Agustín del Tucson were analyzed using standard zooarchaeological methods (Reitz and Wing 1999). Specimens were identified to the lowest taxonomic level possible using ASM's modern comparative skeletal collections on the campus of the University of Arizona, Tucson. The tables here use three common statistics in zooarchaeological analyses: (1) NISP; (2) MNI; and (3) biomass, an estimate of the amount of meat associated with a given weight of bone (Reitz et al. 1987). To depict overall subsistence strategies at the San Agustín Mission during the late eighteenth and early nineteenth centuries, all materials from the excavated seven features are combined here.

Results and Discussion

The San Agustín assemblage is relatively large, with over 9,000 specimens from an estimated MNI of 31 (Table 13.18). The assemblage includes a wide variety of wild and domestic animals, including reptiles and amphibians, birds, small mammals, and large wild and domestic mammals.

The San Agustín assemblage includes two unusual taxa: domestic cat (*Felis silvestris*) and collared peccary (*Tayassu tajacu)*, or javelina. Domestic cats, although introduced in the early Historic era by Europeans, are rare at isolated colonial sites. The cat specimens at San Agustín suggest the animal was intentionally brought to the area, perhaps by one of the friars, or soldiers at the nearby Spanish fort. The animal may have been brought as a pet, and/or to control pests. Javelina are indigenous to Central and South America and spread to present day northern Mexico and southern Arizona around the time of European colonization. The javelina specimen may be one of the earliest members of its kind in the region.

Domestic mammals, including cow and sheep or goat, predominate in the assemblage in terms of biomass (Table 13.19). However, wild mammals are more numerous in the assemblage than all domestic animals combined in terms of the estimated MNI.

Commensal taxa are animals found in close association with humans and their environment, and whose presence is not primarily attributable to their use as a food resource. In the San Agustín assemblage, the toad (cf. *Bufo alvarius*), the dog or coyote (*Canis* sp.), domestic cat, and horse or donkey (*Equus* spp.) are placed in the commensal category. The horse or donkey specimens are placed such to reflect their primary use as a pack animal and for transportation. However, the presence of cutmarks on one specimen suggests horse or donkey meat was at least occasionally consumed. No other commensal species identified in the assemblage exhibit modifications indicating they were used as a food resource.

The deer sample is small; however, the recovery of skeletal elements from across the skeleton suggests deer were acquired in relative close proximity to the mission (Table 13.20). The recovery of cattle and caprine (sheep or goat) remains from all parts of the carcass indicates these animals were slaughtered and butchered at the mission.

One mule deer (*Odocoileus hemionus*) was less than 29 months of age at death, as evidenced by an unfused calcaneus (Table 13.21). A fused proximal femur indicates a probable white-tailed deer (*Odocoileus* cf. *virginianus*) died at less than 32 months old. A cow (*Bos taurus*) individual was less than 10 months old at death, as evidenced by an unfused scapula (Table 13.22). Several unfused proximal tibia fragments indicate at least two cow individuals were over the age of 42 months at death. Two caprine (Caprinae) individuals were at least 3 months old at death (Table 13.23). The unfused distal metapodial fragment suggests at least one individual was less than 36 months at death, and the fused metapodial suggests an age of over 18 months.

Modification by heat, including burning and calcination, are the most common modification observed in the assemblage (Table 13.24). Gnawing by animals such as rodents and carnivores was also noted in the assemblage, suggesting scavenging and pest animals in the mission may have destroyed at least some osteological remains. The presence of only one sawn specimen and the preponderance of cutmarks and hackmarks are typical of carcass processing prior to the use of mechanical saws.

Conclusions

The San Agustín Mission provides an important opportunity to examine the role that animal husbandry played in the subsistence strategy of missionized Tohono O’odham. The overall pattern of subsistence here indicates a primary reliance on domestic animals for the meat-based portion of the diet. The Tohono O’odham who lived at the mission appear to have raised and butchered chickens, cattle, sheep or goat, and occasionally, horse or donkey, for meat, and likely for other animal products such as hide. The presence of large numbers of wild animals indicates domestic animals did not entirely replace traditional resources. The hunting of deer, rabbits, hares, and other small wild animals continued to be an important contributor to Native American diet even after the incorporation of animal husbandry.

The San Agustín assemblage is very different from mission assemblages from southeastern North America, although it is similar to assemblages from the few southwestern mission assemblages studied to date. These regional differences are likely attributable to a number of factors, including environmental differences, and, in the Southwest, previous experience with husbandry of the domestic turkey (Pavao-Zuckerman and Reitz 2004).

Table 13.18. Faunal species list from the San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

		Minimum Number of Individuals			Biomass	
Taxa	Number of Identifiable Species	No.	%	Weight (gm)	kg	%
cf. *Bufo alvarius* (probable Colorado River toad)	10	2	6.5	2.27	N/A	N/A
cf. *Gopherus agassizii* (probable desert tortoise)	3	–	–	4.68	0.089	0.0
Gopherus agassizii (desert tortoise)	1	1	3.2	2.06	0.051	0.0
Serpentes (indeterminate snake)	1	–	–	0.11	0.001	0.0
cf. Colubridae (probable nonpoisonous snake)	2	1	3.2	0.24	0.003	0.0
Aves (indeterminate bird)	4	–	–	0.68	0.014	0.0
cf. *Branta canadensis* (probable Canada geese)	1	1	3.2	0.62	0.013	0.0
cf. *Gallus gallus* (probable chicken)	3	–	–	2.73	0.051	0.0
Gallus gallus (chicken)	4	1	3.2	2.99	0.055	0.0
Mammalia (indeterminate mammal)	7,385	–	–	10,769.40	111.940	58.7
Leporidae (rabbit/hare family)	3	–	–	0.51	0.014	0.0
Lepus sp. (hare)	66	5	16.1	36.57	0.671	0.4
Lepus cf. *alleni* (probable antelope jackrabbit)	16	–	–	16.98	0.336	0.2
Lepus californicus (black-tailed jackrabbit)	5	–	–	4.87	0.109	0.1
Sylvilagus sp. (rabbit)	7	2	6.5	1.71	0.043	0.0
Rodentia (indeterminate rodent)	5	–	–	1.21	0.031	0.0
cf. *Spermophilus variegatus* (probable rock squirrel)	1	1	3.2	0.47	0.013	0.0
cf. *Thomomys* sp. (probable pocket gopher)	2	–	–	0.44	0.013	0.0
Thomomys sp. (pocket gopher)	5	2	6.5	1.05	0.027	0.0
Carnivora (indeterminate carnivore)	1	–	–	0.17	0.005	0.0
Canis sp. (dog or coyote)	4	1	3.2	12.54	0.256	0.1
Vulpes macrotis (kit fox)	1	1	3.2	0.34	0.010	0.0
Felis silvestris (domestic cat)	9	1	3.2	6.83	0.148	0.1
Equus sp. (horse or donkey)	1	–	–	6.48	0.141	0.1
Equus cf. *caballus* (probable horse)	2	–	–	23.20	0.446	0.2
Equus caballus (horse)	2	1	3.2	36.79	0.675	0.4
Artiodactyla (even-toed ungulate)	6	–	–	16.25	0.323	0.2
Tayassu tajacu (collared peccary)	1	1	3.2	2.26	0.055	0.0
Cervidae (deer family)	2	–	–	8.04	0.172	0.1
cf. *Odocoileus* sp. (probable deer)	1	–	–	1.35	0.034	0.0
Odocoileus sp. (deer)	6	–	–	33.81	0.625	0.3
Odocoileus cf. *hemionus* (probable mule deer)	2	–	–	11.20	0.231	0.1
Odocoileus hemionus (mule deer)	2	1	3.2	27.57	0.520	0.3
Odocoileus cf. *virginianus* (probable white-tailed deer)	2	1	3.2	5.76	0.127	0.1
cf. *Bos taurus* (probable cow)	39	–	–	378.17	5.495	2.9
Bos taurus (cow)	305	6	19.4	5,866.37	64.796	34.0
Caprinae (domestic sheep or goat)	23	2	6.5	196.52	3.048	1.6
Vertebrata (indeterminate vertebrate)	1,091	–	–	237.94	–	–
Total	9,024	31	100.0	17,721.18	190.587	100.0

Table 13.19. Faunal remains from the San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM), summary table.

	Minimum Number of Individuals		Biomass	
	No.	%	kg	%
Domestic mammals	8	25.8	73.339	91.1
Domestic birds	1	3.2	0.055	0.1
Wild mammals	14	45.2	3.000	3.7
Wild birds	1	3.2	0.013	0.0
Snakes/Turtles	2	6.5	0.144	0.2
Commensals	5	16.1	3.936	4.9
Total	31	100.0	80.487	100.0

Note: Includes all taxa identified beyond the taxonomic level of order. Anurans are included in the MNI calculation, but are not included in the biomass calculation because allometric values are not currently available for the Anurans.

Analysis of the San Agustín zooarchaeological assemblage provides a clearer picture of missionized Native American subsistence than possible using only historical documents. The data support ethnohistoric reports of the early adoption of animal husbandry by southwestern Native Americans. However, the data also indicate traditional hunting continued to be practiced at the missions—an aspect of Native American life that is not often recorded in colonial documents.

Table 13.20. San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM), faunal body part distribution.

	Deer	Cow	Sheep/Goat
Head	2	68	5
Vertebra/Rib	1	66	2
Forequarter	0	28	6
Hindquarter	3	47	4
Forefoot	3	40	1
Hindfoot	2	36	2
Foot	2	59	3
Total	13	344	23

Note: Includes all specimens with cf. and sp. identifications.

Table 13.21. Epiphyseal fusion for all deer *(Odocoileus* sp.) at the San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

	Unfused	Fused	Total
Early fusing			
Metapodials, proximal	–	1	1
1st/2nd phalanx, proximal	–	1	1
Middle fusing			
Calcaneus, proximal	1	–	1
Late fusing			
Femur, proximal	–	1	1
Total	1	3	4

Note: Includes all specimens with cf. or sp. identifications.

FAUNAL BONE FROM THE CHINESE WELL, SAN AGUSTÍN MISSION LOCUS, THE CLEARWATER SITE, AZ BB:13:6 (ASM)

The Chinese residents at the former site of the Mission de San Agustín are represented by artifacts recovered from a trash-filled well, Feature 4. The fill from this feature was deposited between 1893 and 1900. The men were gardeners by trade, but evidently also raised livestock and fruits and vegetables. Their meat diet was comprised primarily of, but not limited to, pork. Other domestic animals—including cattle, turkey, chicken, sheep or goat, dog, and cat—were also included in their meals. They ate a wide variety of wild animals as well, including fish, turtle, birds, leporids, and rodents. Many fish taxa were identified and are described in a separate section of this chapter.

Methods

An abbreviated analysis of the total assemblage was completed; the analyzed assemblage is comprised of 9,215 fragments of non-fish bone. All specimens assigned to the order level or below were considered identifiable and were quantified using NISP. Only specimens from the large domestic taxa, including horse/mule/donkey (*Equus* sp.), medium artiodactyl (pig-/sheep-/goat-sized), pig (*Sus scrofa*), sheep/goat (*Ovis aries*/*Capra hircus*), and cattle (*Bos*

Table 13.22. Epiphyseal fusion for cow (cf. *Bos taurus* and *Bos taurus*) at the San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

	Unfused	Fused	Total
Early fusing			
Humerus, distal	–	4	4
Scapula, distal	1	5	6
Radius, proximal	–	1	1
Metapodials, proximal	–	7	7
1st/2nd phalanx, proximal	1	23	24
Middle fusing			
Tibia, distal	2	–	2
Calcaneus, proximal	2	2	4
Metapodials, distal	4	7	11
Late fusing			
Humerus, proximal	1	–	1
Ulna, proximal	1	1	2
Femur, proximal	5	–	5
Femur, distal	2	–	2
Tibia, proximal	3	4	7
Total	22	54	76

Table 13.23. Epiphyseal fusion for sheep/goat (Caprinae) at the San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

	Unfused	Fused	Total
Early fusing			
Radius, proximal	–	2	2
Metapodials, proximal	–	1	1
1st/2nd phalanx, proximal	–	2	2
Middle fusing			
Tibia, distal	–	1	1
Calcaneus, proximal	–	1	1
Metapodials, distal	1	1	2
Total	1	8	9

taurus) were entered into the computer database. Recorded variables for these specimens included provenience, taxon, element, element part, fusion, and butchering marks. All specimens—including 139 fragments of unidentified bird bone, 4,643 fragments of unidentified mammal bone, and 240 fragments of cuttlefish (*Sepia* sp.)—were counted and weighed. The cuttlefish is a member of the invertebrate Class Cephalopoda (nautiluses, squids, cuttlefishes, and octopods) (Dorit et al. 1991:682). These animals also are found in other faunal assemblages deposited by Chinese immigrants in the western United States (e.g., Gust 1993; Waters 2005).

Assemblage Description

Domestic taxa comprised 72 percent of the identifiable assemblage, with the largest proportion (40 percent) from pigs (*Sus scrofa*) (Table 13.25). Other domestic animals include chicken (*Gallus gallus*) and possible chicken (cf. *Gallus gallus*), with 13 percent; cattle (*Bos taurus*), with 12 percent; domestic cat (*Felis silvestris*), with 5 percent; dog (*Canis familiaris*) and sheep/goat (*Ovis aries/Capra hircus*), with 1 percent each; and horse/mule/donkey (*Equus* sp.), with less than 1 percent. Wild taxa made up 13 percent of the assemblage, including bony fishes (Osteichthyes), frog/toad (Anura), turtle/tortoise (Testudines), two birds, woodpecker (Picidae), and small passerine (Passeriformes), as well as five mammals including cottontail (*Sylvilagus* sp.), jackrabbit (*Lepus* sp.), pocket gopher (*Thomomys* sp.), cotton rat (*Sigmodon* sp.), and deer (*Odocoileus* sp.). Two percent are from either domestic or wild taxa, including duck (Anatidae), turkey (*Meleagris gallopavo*), and pigeon (cf. *Columba livia*). Unidentified artiodactyl and medium artiodactyl (Artiodactyla) contain identifiable elements from artiodactyls of unknown size and pig-/sheep-/deer-sized. A sizable portion (13 percent) of the identifiable assemblage is comprised of medium artiodactyls. Based on the distribution of taxa, most of these are likely pig, although they cannot be positively identified as such.

The element representation of the large ungulates—including cattle, pig, and sheep/goat—was examined to determine if animals were butchered on the premises. Similarly, the slaughtering ages were estimated for each taxon to look for indications of animal husbandry. Finally, butchering marks were examined per level for evidence of changes in butchering practices through time and the use of purchased meat.

Element Representation of Large Domestic Ungulates

The ungulate carcass may be divided into seven regions, including the head (maxillae and mandibles), axial column (ribs, vertebrae, and innominates), the upper front limbs (scapulae and humeri), lower front limbs (radii, ulnae, and metacarpals), upper hind limbs (femora), lower hind limbs (tibiae and metatarsals), and feet (phalanges). The axial, upper front, and upper hind portions are the best-

Table 13.24. Bone modifications, the San Agustín Mission locus, the Clearwater site, AZ BB:13:6 (ASM).

Taxon	Rodent Gnawed	Carnivore Gnawed	Burned	Calcined	Cut	Hacked	Clean Cut	Sawed	Weathered
Probable Colorado River toad	–	1	–	–	–	–	–	–	–
Indeterminate mammal	3	13	498	167	72	8	–	–	6
Jackrabbit	3	2	9	1	–	–	–	–	–
Probable antelope jackrabbit	1	–	–	–	1	–	–	–	–
Black-tailed jackrabbit	1	–	–	–	–	–	–	–	–
Rabbit	–	–	1	–	–	–	–	–	–
Dog or coyote	1	–	–	–	–	–	–	–	–
Kit fox	1	–	–	–	–	–	–	–	–
Probable horse	–	–	–	–	1	–	–	–	–
Even-toed ungulate	–	–	1	–	4	–	–	–	–
Collared peccary	–	–	–	1	–	–	–	–	–
Deer	–	1	3	–	4	1	–	–	1
Mule deer	–	1	1	–	1	1	–	–	–
Probable white-tailed deer	–	–	–	–	1	–	–	–	
Probable cow	–	–	2	1	2	–	–	–	2
Cow	1	6	19	1	24	9	2	1	14
Caprinae	–	1	–	–	2	–	–	–	1
Indeterminate vertebrate	–	–	76	45	–	–	–	–	–
Total	11	25	610	216	112	19	2	1	24

represented sections of the carcasses of all three taxa (Table 13.26). Not surprisingly, these are the parts with the most and best-quality meat. However, because the axial skeleton contains the largest number of elements, the element distribution may be biased toward those elements.

The skull, lower front, lower hind, and feet were less well-represented. The lower front, lower hind, and, particularly, the skull and feet contain less and lower-quality meat. However, the presence of head and foot bones at archaeological sites is cited as evidence for animal husbandry or on-site butchering, because the "cranial and foot bones of cows and sheep are commonly discarded in the butchering process due to low food value" (Lyman 1977:69). Cattle skull and foot bones comprise only 1 percent each of the total cattle specimens. In contrast, the pig subassemblage contains 6 percent skull parts and 9 percent foot bones. Likewise, 13 percent of the sheep/goat subassemblage are cranial parts and 6 percent are foot bones. This suggests beef was purchased rather than raised and butchered on-site, while the opposite appears true for sheep/goat and pig. The slaughtering ages of the respective ungulate taxa also imply this.

Slaughtering Ages of Large Domestic Ungulates

The aging of domestic animals within animal husbandry has a long history. For example, the eruption of teeth occurs at regular intervals in pig, sheep, and cattle, and provides a guide to the ages of the individuals represented (e.g., Silver 1970; Sisson 1953). Epiphyseal fusion rates for postcranial elements are also established and provide age range estimates for domestic taxa (e.g., Silver 1970).

The tooth eruption sequence for domestic ungulates begins with deciduous incisors and premolars at, or within weeks after birth. Deciduous molars are absent. The permanent premolars and the molars erupt in a regular sequence, allowing rough age estimates for maxillae and mandibles. Eruption dates also depend on management and nutrition. "The better the housing and feeding and the more highly bred, the earlier the eruption of teeth" (Silver 1970:295). However, domestic ungulates consist of many breeds whose rates of maturation vary considerably. The dates used in the current study are nineteenth century figures for cattle, median dates between modern figures and 1790 figures from semi-wild, hill sheep for sheep/goats, and the median

Table 13.25. Faunal taxa represented in Feature 4 at the Clearwater site, AZ BB:13:6 (ASM).

Taxon	Quantity[a]
Cuttlefish (*Sepia* sp.)	240
Bony fish (Osteichthyes)	518[b]
Unidentified frog/toad (Anura)	1
Unidentified turtle/tortoise (Testudines)	1
Unidentified duck (Anatidae)	46
Chicken (*Gallus gallus*)	546
Turkey (*Meleagris gallopavo*)	5
Pigeon (cf. *Columba livia*)	21
Woodpecker (Picidae)	2
Small passerine (Passeriformes)	10
Cottontail (*Sylvilagus* sp.)	10
Jackrabbit (*Lepus* sp.)	8
Medium rodent (Rodentia)	3
Pocket gopher (*Thomomys* sp.)	4
Cotton rat (*Sigmodon* sp.)	1
Dog (*Canis* sp.)	28
Domestic cat (*Felis silvestris*)	215
Horse/Mule/Donkey (*Equus* sp.)	1
Pig (*Sus scrofa*)	1,723
Pig/Sheep/Goat (*Sus/Ovis/Capra*)	566
Sheep/Goat (*Ovis aries/Capra hircus*)	52
Deer (*Odocoileus* sp.)	1[c]
Cattle (*Bos taurus*)	534
Identifiable total	4,536

[a] Number of identified specimens, except cuttlefish, which is number of fragments.
[b] Fish taxa are described in Table 13.34.
[c] Antler tool handle.

Table 13.26. Cattle, pig, and sheep/goat elements (number of identified specimens) from Feature 4 at the Clearwater site, AZ BB:13:6 (ASM).

Element	Cattle	Pig	Sheep/Goat
Skull	4	102[a]	8
Cervical vertebra	32	103	1
Thoracic vertebra	14	114	4
Lumbar vertebra	21	114	3
Sacrum	9	9	–
Caudal vertebra	24	24	–
Unspecified vertebra	26	137	–
Rib	85	328	9
Innominate	58	38	2
Scapula	36	95	3
Humerus	19	68	3
Radius	8	40	2
Ulna	6	46	5
Femur	139	74	3
Patella	–	3	–
Tibia	5	31	3
Fibula	–	16	–
Astragalus	1	7	–
Calcaneus	2	17	5
Carpal/Tarsal	5	30	1
Metapodial	–	149	–
Sesamoid	1	–	–
Phalanx	2	159	3
Long bone	33	1	–
Unidentifiable element	2	–	–
Total	532	1,705	55

[a] Does not include isolated teeth.

between late eighteenth century figures and modern figures for pigs (Silver 1970:296-299). In all cases, eruption dates can only be used as a rough estimate for the indication of age.

Only four skull parts from cattle were identified in the assemblage from Feature 4; three of those are isolated teeth. One adult mandible with the first through the third molars (FN 5295) was recovered. The third molar was erupted but unworn, indicating an age of approximately 48 months. Seven sheep/goat skull parts were recovered, including one frontal and one indeterminate skull fragment, two maxillae with teeth, and three mandibles with teeth. At least three different-aged and different-sized individuals are represented (Table 13.27). The left and right maxillae (FN 5129) each contain a newly erupted third molar and are aged at approximately 30 months (Silver 1970:297); they are probably from the same individual. One left mandible (FN 5129) contains a deciduous fourth premolar with the second molar erupting, indicating an age of 6-14 months. One right mandible (FN 5158) contains all teeth except the unerupted third molar; all premolars are deciduous. This mandible was from an individual aged between 14 months and 26 months at death. The unsided mandible (FN 5114) contains only a deciduous fourth premolar and permanent first molar. This mandible belonged to an individual between 6 months and 26 months at death.

Not surprisingly, there were many more skull parts from pigs than from sheep/goats or cattle. The specimens were also more complete than the cattle and sheep/goat cranial parts. At least 114 pig skull parts were recorded in the assemblage from Feature 4. However, two-thirds (67 percent) are not ageable, including 12 isolated teeth, 48 indeterminate cranial fragments, and 16 fragments without teeth.

Of the remainder, 35 specimens, representing at least 12 individuals, are ageable (Table 13.28). One individual, represented by a right maxilla (FN 6423), was aged to approximately 12 months. At least three individuals, represented by three left mandibles (FN 5114, 5445, 6423), were aged to approximately 16 months. Three right maxillae (FN 6423, 6350) represent at least three individuals and were aged to

Table 13.27. Age ranges for sheep/goat cranial material with teeth from Feature 4 at the Clearwater site, AZ BB:13:6 (ASM).

Field Number	Element	Teeth	Age	Age Criteria
5129	Left mandible with teeth	Fourth premolar through second molar	6-14 months	Deciduous premolar, second molar erupting
5114	Mandible with teeth	Fourth premolar, first molar	6-26 months	Deciduous premolar, permanent molar
5158	Right mandible with teeth	All teeth except third molar (missing)	14-26 months	Deciduous premolars, permanent second molar
5129	Left maxilla with teeth	Second premolar to third molar	circa 30 months	Permanent premolars, third molar newly erupted
5129	Right maxilla with teeth	Second and third molars	circa 30 months	Third molar newly erupted

Table 13.28. Ages of pig cranial material with teeth from Feature 4 at the Clearwater site, AZ BB:13:6 (ASM).

Field Number	Element	Age (months)	Age Criteria
6423	Right maxilla	circa 12	Canine erupting, permanent first molar (M1)
6423	Right mandible	Less than 16	Deciduous premolars, permanent M1, second molar (M2) unerupted
5092	Left mandible	Less than 18	Deciduous premolars
5114	Right mandible, left maxilla	Less than 18	Deciduous premolars
5114, 5445	Left mandible (*n* = 2)	circa 16	Deciduous premolars, M2 erupting
6391, 6423	Right maxilla, left partial skull	circa 16	M2 newly erupted, third molar (M3) unerupted
6423	Left and right mandibles	circa 16	Permanent M1, M2 (unworn), M3 unerupted
5173	Right maxilla	16-18	Newly erupted P3, deciduous P4, unworn M2
5326	Right and left mandibles	16 -18	Deciduous premolars, M3 unerupted
6423	Left maxilla, right maxilla (*n* = 2)	circa 18	Premolars erupting, M3 unerupted
6350, 6391	Right maxilla, right mandible	circa 18	Premolars erupting, M3 unerupted
6391	Right mandible	18-26	Permanent M2, M3 unerupted
6391, 6419	Left partial skull, left mandible	18-26	Permanent premolars, M3 unerupted
6350, 6423	Right maxilla, left maxilla	18-26	Permanent premolars, M3 unerupted
5092	Right maxilla	circa 26	Permanent M2, M3 erupting
6391	Left maxilla, left and right mandibles	circa 26	Permanent premolars, M3 erupting
6494	Left and right mandibles	circa 26	Permanent premolars, M3 erupting
6499	Unsided mandible	circa 26	M3 newly erupted
5404, 6391	Unsided mandible, right mandibles (*n* = 2)	More than 18	Permanent premolars
6423	Left maxilla	More than 18	Permanent premolars

around 18 months. At least two individuals, represented by two left maxillae (FN 6391, 6423), were aged to between 18 months and 26 months, and at least three individuals, represented by three left or right mandibles (FN 6391, 6494, 6499), were aged to approximately 26 months at death. Four specimens could only be aged as less than 16-18 months. Three specimens were aged to more than 18 months. Due to missing teeth, these specimens cannot be placed in a bracketed age category.

Epiphyseal fusion of specimens further established an age range for the three main domestic taxa. Very few of the cattle postcranial specimens are unfused (Table 13.29). Only six of 142 specimens with epiphyses were from immature individuals, and all were from relatively late-fusing elements. One proximal ulna and one distal ulna were unfused. These epiphyses do not fuse in cattle until 3.5-4 years of age. The other four unfused specimens are vertebral pads that do not fuse until 5 years of age. The age at fusion distribution of sheep/goat postcranial specimens is more dispersed than for cattle (see Table 13.29). Specimens with unfused epiphyses range in age at fusion from 3-6 months to 3.5 years. The proportion of unfused to fused specimens is much more even than among the cattle specimens.

Nearly half (48 percent, *n* = 15) the sheep/goat specimens with epiphyses are unfused or fusing. An examination of pig epiphyseal fusion rates shows that many young specimens were present in the assemblage (Table 13.30). Nearly one-third (32 percent, *n* = 242) of pig specimens with epiphyses were unfused or fusing. The youngest specimens are not shown in Table 13.30. One nearly complete humerus and three phalanges are from at least one fetal/neonate individual. More mature animals range in age from less than 3-6 months to more than 3.5 years at death. Most of the unfused specimens are from elements that fuse at less than 3.5 years old. Only 14 (2 percent) of the 733 specimens with fused epiphyses are from elements that fuse at more than 3.5 years.

The postcranial material from the three main domestic taxa fits fairly well with the cranial material in terms of relative age. Cattle postcranial specimens

Table 13.29. Epiphyseal fusion rates for sheep/goat and cattle specimens from Feature 4 at the Clearwater site, AZ BB:13:6 (ASM).

Element	Fused	Unfused	Fusing	Age at Fusion[a]
Sheep				
Distal first or second phalanx	1	–	–	Before birth
Vertebral body with arch	8	2	–	3-6 months
Scapula	3	1	–	6-8 months
Proximal radius	1	1	–	10 months
Proximal first phalanx	–	1	–	13-16 months
Proximal ulna	1	2	–	2.5 years
Calcaneus	2	3	–	2.5-3 years
Proximal femur	–	–	1	2.5-3 years
Proximal humerus	–	1	–	3-3.5 years
Distal femur	–	1	–	3-3.5 years
Proximal tibia	–	2	–	3.5 years
Innominate	1	1	–	3.5 years
Cattle				
Proximal radius	3	–	–	12-18 months
Distal tibia	2	–	–	2-2.5 years
Proximal humerus	2	–	–	3.5-4 years
Proximal ulna	1	1	–	3.5-4 years
Distal ulna	1	1	–	3.5-4 years
Distal femur	1	–	–	3.5-4 years
Innominate	51	–	–	4.5 years
Vertebral body with pad	82	4	–	5 years

[a] Silver 1970.

range from at least 1 year to more than 5 years at death. The mandible with teeth was aged to 4 years. The sheep/goat postcranial elements appear to be slightly younger than the cranial elements; the youngest specimen was less than 3-6 months at death, compared with 6-14 months at death. However, the oldest specimens, two calcanei, are more than 2.5 years old, which compares favorably with the oldest cranial part aged to 30 months at death. The tooth eruption data for pigs fit fairly well with the postcranial fusion rates, except they do not include the youngest or the oldest individuals.

This age profile shows that mostly older cattle were present in the assemblage. Most animals raised primarily for food are slaughtered before they are fully grown, although a small number are kept alive for breeding. The use of cattle for draft or dairying would result in more animals living to an older age (Landon 1996:96). In contrast, sheep appear to have a more normal slaughtering distribution, with mostly young animals; none of the specimens were older than 3.5 years at death. The pig age profile, with individuals aged from fetal/neonate to more than 3.5 years, shows that animals of all ages were killed. The presence of older pigs may by an indication the Chinese gardeners kept some in reserve for breeding purposes.

Butchering Marks

Seventy-one percent (*n* = 2,068) of the large domestic ungulates exhibit butchering marks. This total includes 1,206 pig specimens, 437 cattle specimens, 396 medium artiodactyl (pig-/sheep-/goat-sized) specimens, and 29 sheep/goat specimens. Butchered specimens comprise 70 percent of the pig bone, 82 percent of cattle bone, 70 percent of medium artiodactyl bone, and 56 percent of sheep/goat bone. In addition to the large ungulates, bones from ducks, chickens, turkeys, dogs, and domestic cats also displayed butchering marks. Although the smaller mammals, such as rabbits and rodents, did not exhibit butchering marks, they may also have been used for food.

Butchering marks include chopmarks, sawmarks, cutmarks, and various combinations of the three. Chopmarks made with an axe or a cleaver are primarily involved in initial butchering and secondary apportionment, and indicate butchering as traditionally practiced by the Chinese (Gust 1982:109). Sawmarks are reflective of the Euro-American style of butchering, in which the carcass is apportioned into specific cuts. Far fewer specimens exhibit cutmarks made by a thin blade, probably the result of skinning and defleshing.

Table 13.30. Epiphyseal fusion rates for pig specimens from Feature 4 at the Clearwater site, AZ BB:13:6 (ASM).

Element	Fused	Unfused	Fusing	Age at Fusion[a]
Proximal metapodial	41	–	–	Before birth
Distal first or second phalanx	8	–	–	Before birth
Vertebral body with arch	410	88	–	3-6 months
Scapula	87	2	–	1 year
Distal humerus	12	14	2	1 year
Proximal radius	14	5	–	1 year
Proximal second phalanx	–	6	1	1 year
Distal tibia	7	6	–	2 years
Proximal first phalanx	3	13	–	2 years
Distal metapodial[b]	4	90	1	2-2.25 years
Calcaneus	9	5	–	2-2.5 years
Proximal ulna	3	6	–	3-3.5 years
Distal ulna	2	3	–	3-3.5 years
Proximal humerus	6	24	2	3.5 years
Distal radius	–	9	–	3.5 years
Proximal femur	1	27	–	3.5 years
Distal femur	2	28	1	3.5 years
Proximal tibia	–	12	1	3.5 years

[a] Silver 1970.
[b] Combination of metacarpal and metatarsal fusion rates.

Pig specimens with butchering marks exhibit chopmarks more frequently than sawmarks, by an almost 10-to-1 margin, or 1,045 with chopmarks and 111 with sawcuts. Conversely, cattle specimens with butchering marks exhibit over twice as many sawmarks (*n* = 296), as opposed to chopmarks (*n* = 129). The overwhelming majority (*n* = 25) of butchered sheep/goat specimens contain chopmarks. Medium artiodactyls, presumably comprised of mostly pig specimens, with butchering marks contain 382 specimens with chopmarks, as opposed to only 14 with sawcuts. All the smaller animals with butchering marks exhibit only chopmarks, including a domesticated cat (Figure 13.6). Only small, nondomesticated animals appear to have been captured for food. The lone deer bone identified in the assemblage is an antler tine tool handle, probably purchased or traded for rather than hunted. Several deer specimens were recovered from previous excavations (Diehl et al. 1997).

Diachronic Trends in Feature 4

The frequencies of butchering marks by excavation level are shown in Table 13.31. The proportion of chopmarks decreases from a clear majority in the lower, or earlier, levels to about half of the butchering marks at the top, or later, levels. The feature can be divided into roughly three groups based on the proportion of chopmarks. The first group includes Level 11 through Level 15, where chopmarks make up between 80 percent and 93 percent of the butchering marks. Levels 5-10 contain between 62-83 percent of butchered specimens with chopmarks. The third group, representing the later part of the deposition, consists of Level 1 through Level 4, with 40 percent to 55 percent chopped specimens.

The NISP of cattle versus pig by excavation level is provided in Table 13.32. An index was derived from the ratio of the pig NISP divided by the sum of the cattle NISP and pig NISP. The index decreases through time, indicating a reduction in the proportion of pig specimens relative to cattle specimens. Again, the levels can be divided into three groups based on the index value. Levels 10-15 comprise the earliest group, with index values between 0.90 and 0.93; the middle group values range from 0.82-0.83 in Levels 6-9. The latest levels, Levels 1-5, have index values between 0.28 and 0.58. Pig specimens barely outnumber cattle specimens in these later levels, even falling below cattle specimens in Levels 3 and 4. These groups follow the butchering groups fairly closely, although the index values are more consistent within each group than the butchering mark percentages.

Both the proportion of chopmarks and pig specimens relative to cattle specimens decrease through time, indicating an increase in sawcuts and cattle specimens relative to pig specimens. These trends indicate a change in diet and animal husbandry practices. If pigs were no longer raised by the Chinese gardeners, purchased meat, particularly beef, may have replaced the pork from their own animals. They would not butcher their own animals and

Figure 13.6. Chopmarks on domestic cat (*Felis silvestris*) bones from Feature 4 at the Clearwater site, AZ BB:13:6 (ASM).

would purchase standard retail meat cuts from butcher shops.

Previous excavations of features associated with Chinese gardeners at the Clearwater site revealed a meat diet high in beef, with little pork or mutton evident (Diehl et al. 1997, 1998; Thiel 1997). The assemblage was dated from 1892 to 1905, extending five years later than the assemblage from Feature 4. It is hard to imagine that their diet could change so radically within five years. However, that trend

Table 13.31. Butchering marks on identifiable bone from Feature 4 at the Clearwater site, AZ BB:13:6 (ASM), by level. (Quantities are number of identified specimens [NISP] with butchering marks.)

Level	Chopmarks	Sawmarks	Other Marks	Feature Total
1	40	36	1	77
2	29	36	0	65
3	50	72	2	124
4	84	62	6	152
5	89	29	1	119
6	220	35	4	259
7	59	29	3	91
8	58	14	2	74
9	53	20	6	79
10	54	22	11	87
11	488	22	15	525
12	195	19	3	217
13	100	15	4	119
14/15	62	14	2	78
Feature total	1,581	425	60	2,066 (71)

Table 13.32. The number of identified specimens (NISP) of cattle versus pig in Feature 4 at the Clearwater site, AZ BB:13:6 (ASM), by level.

Level	Total NISP	Cattle NISP	Pig NISP	Index Value[a]
1	102	47	48	0.51
2	124	50	69	0.58
3	169	83	80	0.49
4	219	96	35	0.28
5	194	68	78	0.53
6	353	54	268	0.83
7	169	27	119	0.82
8	108	16	80	0.83
9	122	10	49	0.83
10	107	10	92	0.90
11	658	26	326	0.93
12	280	25	248	0.91
13	194	13	138	0.91
14/15[b]	108	6	80	0.93

[a] Pig NISP/Cattle + Pig NISP.

[b] Level 15 contained fewer than 20 cattle and pig specimens.

was already obvious in the level data from Feature 4, with fewer pigs relative to cows (see Table 13.32). The butchering data in the assemblage recovered from previous excavations showed more sawcuts (86 percent) than chopmarks (9 percent) (Diehl et al. 1997). This is in contrast to the assemblage from Feature 4, where chopmarks outnumbered sawcuts. Nonetheless, as noted above, the trend toward sawcuts outnumbering chopmarks was starting in the upper levels of Feature 4.

It is uncertain if the difference between the two samples is due to sampling error, or if it reflects a change in behavior. Based on the age profiles of the assemblage from Feature 4, the Chinese gardeners at Clearwater appear to have been raising pigs for food, and possibly for sale to other Tucson residents. The proportion of pig specimens in the assemblage could have been drastically reduced if they had quit raising pigs by 1900. One explanation is that they no longer raised pigs and that they turned to beef to fulfill most of their protein needs. This may signal a change in economic status as well. On the other hand, the features are far enough apart spatially that they may represent two different households of Chinese gardeners.

Comparisons with Contemporaneous Assemblages

How does the Chinese gardeners' meat diet compare with that of their contemporaries in Tucson? The assemblage from Feature 4 was compared with two Chinese faunal assemblages, as well as several Mexican and Euro-American assemblages (Table 13.33). Most of the assemblages date to between 1880 and 1910, although the starting date of the earliest Mexican assemblage is circa 1840, while the latest ending date is 1929. The time depth in the Mexican assemblages allows for the charting of some change through time. The Tucson Chinatown was excavated as part of the Tucson Urban Renewal project (Lister and Lister 1989a). Feature 21 in Block 136 was a borrow pit filled with refuse from the local Chinese grocer in the Barrio Libre (Thiel 2002). Feature 26 in Block 180 was a small borrow pit and trash deposit filled with trash from a Mexican household (Ciolek-Torrello and Swanson 1997). Bone refuse from the other features in Block 180 were deposited by Anglo families on the block (Ciolek-Torrello and Swanson 1997). The León household assemblage came from a farmstead occupied by a Mexican-American family

Table 13.33. Comparisons among the faunal assemblage from Feature 4, the Clearwater site, AZ BB:13:6 (ASM), and contemporaneous assemblages in Tucson.

Site	Dates	Sample Size	Cattle NISP	Pig NISP	Chopmarks	Sawmarks	Ethnicity
Tucson Chinatown	1880-1910	2,090	1,179	573	NA[a]	NA[a]	Chinese
Block 136, Feature 21	1890-1910	1,965	572	49	NA[b]	NA[b]	Chinese
AZ BB:13:6 (ASM), Feature 4	1893-1900	4,296	534	1,723	1,581	425	Chinese
Block 180, Feature 26	1870-1905	1,084	565	28	149	275	Mexican
León Household	1840-1860	1,169	233	4	107	1	Mexican
León Household	1870-1880	221	44	0	22	3	Mexican
León Household	1880-1890	2,540	474	7	175	54	Mexican
León Household	1890-1910	3,783	520	7	119	121	Mexican
Block 139, Features 1, 19	1891-1900	1,250	373	4	31[c]	360[c]	Mexican
Block 139, Feature 6	1905-1929	1,018	488	23	51[c]	225[c]	Mexican
Block 180 (all except Feature 26)	1880-1920	1,522	456	228	196	1,395	Euro-American
Block 83, Feature 14 (Levels 5-6)	1886-1893	951	360	0	0	63	Euro-American
Block 83, Feature 18 (Levels 9-12)	1893-1902	347	246	0	0	54	Euro-American

Note: NISP = Number of identifiable specimens.

[a] Gust (1993:193) notes that there were mostly handsaw marks.

[b] Not recorded.

[c] Butchering marks on cattle and very large mammal bone only.

from the mid-to-late 1800s (Thiel 2005). The assemblage was separated into four intervals based on associated artifacts (Diehl et al. 2005). The features in Block 139 contained trash from three different Mexican-American families in the Barrio Libre (Diehl and Thiel 2003). Feature 14 (Levels 5-6) and Feature 18 (Levels 9-12) in Block 83 consisted of trash deposited by Euro-American families on the block (Mabry et al. 1994).

Ethnic affiliation appears to play a role in meat selection. Pork was the preferred meat in China, and the eating of pork has a long tradition among the Chinese (Gust 1993:185). Pig bones found in archaeological sites in China date to perhaps as early as 9300-7000 B.C. (Simoons 1991:295). Cattle bones were recovered from later (5000-1700 B.C.) sites, but the consumption of beef in China declined by the T'ang Dynasty (618-907 A.D.) under the influence of Buddhism (Chang 1977:29). The taboo against beef consumption continued into the nineteenth century, when laws prohibited the slaughter of cattle and water buffalo for food (Simoons 1991:303). Consequently, beef consumption was not common among Chinese at that time, including those immigrating to the United States. The Chinese are also known for the diversity of their diet. They traditionally used a wider range of animals for food. There are several species found in the Chinese features that are not usually found in urban Mexican or Euro-American features, including fish, duck, dog, cat, and deer. The inclusion of these more unusual meats in their meals suggests the Chinese immigrants were trying to recreate the diet of their homeland.

Excavations in urban Chinatowns outside Arizona show that pork was the main meat consumed in Sacramento, Woodland, and Ventura, California, and in Lovelock, Nevada (Gust 1993). However, as shown in Table 13.33, the assemblage from the Tucson Chinatown had cattle specimens comprising 56 percent of the assemblage, compared with 27 percent for pig specimens (Gust 1993). Cattle specimens from the borrow pit filled by the Chinese grocer in Block 136 comprise 29 percent of the assemblage, compared with only 3 percent for pig specimens (Diehl et al. 2002). The Mexican assemblages contain even lower proportions of pig specimens, ranging from 0-3 percent of the assemblage (Cameron 2003b; Diehl et al. 2005; Jones 1997). The Euro-American assemblages range from 0 percent in the assemblages from Block 83, to 15 percent in the assemblages from Block 180 (Jones 1997; Mabry et al. 1994).

Butchering techniques are also related to ethnicity. The presence of chopmarks in greater numbers than sawmarks in historic faunal assemblages from Tucson can be a good indicator of ethnicity (Thiel and Faught 1995:209). Greater proportions of chopmarks versus sawmarks are associated with early Chinese and Mexican assemblages. Traditionally, Mexican butchers used axes and cleavers to divide the carcass into portions (Diehl et al. 2005:192); traditional Chinese butchering used cleavers as well (Gust 1982:109). Handsaws were associated almost exclusively with Euro-American butchers (Chapin-Pyritz and Mabry 1994:155).

Comparisons of chopmarks to sawmarks among the assemblages in Table 13.33 show some interesting patterns. Only Feature 4 from the Clearwater site and the León household contained more specimens that exhibited chopmarks than sawmarks. Unfortunately, the butchering marks for the two other Chinese assemblages were not published, although Gust (1993:193) notes that most of the marks were made by handsaws, which is very different than the assemblage from Feature 4. There were some differences in degree among the assemblages with more sawmarks than chopmarks. Two of the three Euro-American assemblages did not have any butchered specimens with chopmarks. The Mexican assemblages from Block 139 contained relatively fewer specimens with chopmarks than the Mexican assemblage from Block 180. Tenants in Block 139 may have patronized Euro-American butchers, while the family on Block 180 either butchered their own meat, or patronized a Mexican butcher.

Discussion

The arrival of the railroad to Tucson in 1880 "opened the floodgates of Anglo-American settlement" (Thiel 2002:6), which created a market for individual meat cuts. This was "in contrast with the slaughter and consumption of the entire animal in one location" (Clonts 1983:351) and ushered in the systematic techniques used by the modern meat-packing industry. Rather than being chopped into pieces with cleavers and hatchets, carcasses were divided into specific wholesale and retail cuts using handsaws and, after the advent of electricity, band saws.

As shown in Table 13.33, the archaeological evidence from many urban Tucson residences at the turn of the nineteenth century reflects meat purchases in a market economy rather than home butchering. After the introduction of American butchering methods, Mexicans living in Tucson appear to have either adopted the same butchering methods as, or patronized, Euro-American butchers. This is evident in the León household assemblage, where chopmarks outnumbered sawmarks until around 1890, when the frequency of both marks was nearly equal. Likewise, Gust (1993:193) notes that cleaver marks declined and sawmarks increased through time on faunal bone from selected Chinese sites in the western United States. This was evident in Feature 4 where chopmarks became less prevalent through time (see Table 13.31). Therefore, Chinese and Mexican assemblages dating to 1880 and later are difficult to distinguish from Euro-American assemblages based on butchering marks alone.

Summary and Conclusions

A large and diverse faunal assemblage was recovered at the Clearwater site from Feature 4, a trash-filled well associated with Chinese gardeners, dating to the turn of the nineteenth century. Domestic animals include duck, turkey, chicken, pigeon, horse/mule/donkey, pig, cattle, sheep/goat, dog, and cat. Wild animals include fish—both freshwater and marine—frog/toad, turtle/tortoise, woodpecker, small passerine, cottontail, jackrabbit, pocket gopher, cotton rat, and deer. All the domestic taxa, except horse/mule/donkey, probably represent food items, as they contain at least one specimen with butchering marks. However, the wild small animal specimens, such as rodents and wild birds, did not exhibit butchering marks and may or may not represent food items. Pork was the preferred meat, with pig specimens comprising at least 40 percent of the identifiable assemblage.

The presence of head and foot bones at archaeological sites is cited as evidence for animal husbandry and on-site butchering. These bones were usually discarded during the butchering process due to low food value (Lyman 1977:69). This does not necessarily apply to pigs' feet, which were, and still are today, sold in butcher shops. The small proportion (2 percent) of cattle cranial and foot bones suggests a low occurrence of primary home butchering. This contrasts with the pig and sheep/goat element representation, where skull and foot specimens comprise 15 percent and 20 percent, respectively, of the element representation.

Slaughtering ages of the large domestic taxa also indicate animal husbandry, or the lack of it, in the Chinese gardeners' assemblage. Cattle fusion rates show the age at fusion range from less than 3.5 years to over 5 years. None of the sheep specimens were older than 3.5 years at death. Similarly, the pig specimens consist of mostly young individuals, ranging in age from fetal/neonate to more than 3.5 years at death. Because most animals raised primarily for food are slaughtered before they are fully grown, this age profile suggests the older cattle in the assemblage were used for draft or dairying, or they represent purchased beef. In contrast, sheep and pigs appear to have a more normal slaughtering distribution, with primarily young animals. Additionally, the full range of elements, in conjunction with the age spread, suggests on-site butchering, and therefore, animal husbandry, in the sheep/goat and, particularly, the pig subassemblages.

Butchering marks imply that some meat cuts were purchased, while others represent home butchering. Sixty-eight percent of cattle butchering marks were sawcuts. Most of the specimens were standard retail cuts, indicating most beef was purchased from outside sources. For example, a quarter of the cattle specimens represent round steaks; that is, femur shafts exhibiting parallel sawcuts. In contrast, 88 percent of pig specimens with butchering marks were chopped into varying cuts that did not necessarily correspond with standard retail cuts. All the sheep specimens that exhibited butchering marks were chopped. In comparison, the Tucson Chinatown assemblage exhibited mostly handsaw cuts, and cleaver marks account for roughly 20-40 percent of the butchering marks on pig and sheep bones, compared with only 10 percent on cattle bone (Gust 1993:193). The trend in butchering marks exhibited by specimens from Feature 4 tends to be one in which sawcuts increase in relation to chopmarks in the upper levels. The few sources documenting late nineteenth century butchering by Chinese in the United States indicate they eventually adopted American methods and tools (Gust 1993:207). Likewise, the traditional butchering strategies used by the Chinese gardeners at Clearwater gradually gave way to the techniques of the modern meat-packing industry.

Although beef rivaled pork as the main meat consumed at the end of the sequence in Feature 4 at the Clearwater site, this trend was already apparent in the other Chinese assemblages from Tucson during the late 1800s, including those recovered from the Tucson Chinatown, the Chinese-associated borrow pit from Block 136, and previous excavations into the Chinese gardeners' features at Clearwater (Diehl et al. 1997; Diehl et al. 2002; Gust 1993). All these assemblages showed a definite preference for beef over pork.

Comparisons with other late nineteenth century assemblages from Tucson suggest the determination of ethnicity using only faunal remains is not advisable. Nonetheless, several characteristics emerge that are useful in identifying Chinese faunal assemblages in Tucson. The best indicators include a diversity of animals used for food and a large proportion of chopmarks, particularly on smaller animals such as chicken, rabbits, cat, and dog. Chopmarks on the larger domestic ungulate bone alone may be difficult to distinguish from early Mexican assemblages. The proportion of cattle to pig specimens is still unreliable, because it seems to depend on whether animal husbandry was practiced and also if the assemblage predates the introduction of the railroad.

LATE NINETEENTH CENTURY FISH REMAINS FROM A *HUÁQIÁO* SITE NEAR TUCSON, ARIZONA

In the last half of the nineteenth century, overseas Chinese (*Huáqiáo*) immigrants played a crucial role in the settlement and industrialization of the far west, providing both the abundant cheap labor source demanded by capitalists and also—in spite of legal and extralegal impediments—a large number of innovative entrepreneurs. While the role of these immigrants in urban centers and various major industries is well known, their activities in the Southwest has not been extensively studied (Fong 1980; Lister and Lister 1989a, 1989b).

A previous archaeological study of Chinese gardeners in Tucson has provided information regarding the dietary adaptations of these immigrants. Popular images of the southwestern frontier picture it as an area of isolation, remote from urban sources of supply—a region where settlers lived off the land and produced their own food. In fact, the gardeners arrived after the railroad reached Tucson in 1880, and the real mediating factor in dietary decisions—as in many other aspects of the local economy—was probably the high transportation cost of imported goods:

> Evidence recovered from the Chinese gardeners' household in Tucson suggests that these individuals maintained a traditional diet by using missing items with innovative ingredients and analogues. Despite the apparent low economic status of the gardeners, they mitigated the constraints imposed by the local dominance of nontraditional foods by preparing and serving these foods in a traditional manner. Moreover, the maintenance of a diverse diet was promoted through the use of locally-available wild and animal foods (Diehl et al. 1998:30).

Recent excavation of a second assemblage from contemporary local gardeners provides an opportunity to expand those studies and to assess the relevance of fish remains to the perspective provided by the earlier study.

Provenience, Materials, and Methods

Archaeological investigations at San Agustín Mission, conducted by Desert Archaeology in 2001, involved excavation of a well that was backfilled between 1893 and 1900. During that time, the property was leased to a group of unidentified Chinese gardeners. The well was almost 3 m deep and was filled rapidly, based upon ceramic crossmends that span several feet of fill.

The fish remains were examined under light magnification and identified to the most specific taxonomic level that could be confidently assigned. Identification of native Pacific Coast species was relatively routine, with comparative material being available at the California State Archeological Laboratory, the California Academy of Sciences and the Museum of Anthropology, University of California, Davis. Additional comparative material was made available by the Natural History Museum of Los Angeles County, the University of Michigan Zoology Museum, and by Kenneth Gobalet, Steve James, and Mark Roeder. Identification of Chinese species relied on comparative material collected by the author—salt fish specimens obtained during two trips to Hong Kong, Guangzhou, and Macao, as well as salt, frozen, and fresh specimens collected over several years in Asian markets in California. The availability of this material allowed secure identification of the majority of the submitted elements. Fuller diagnostic notes on the Chinese specimens have been provided in a report on a California site in that included the species found here (Schulz 2002). Most of the material that remains unidentified is too fragmentary for definitive identification. The collection does, however, contain several distinctive elements that remain unidentified for lack of appropriate comparative material.

Wet weight estimations for salmon are derived either from bone-dimension or live-weight regressions provided by Casteel (1972). Similar estimations for pikeminnows, chubs, and suckers are derived from the same source, using, in each case, regressions for California species of the same genus. Regressions for cod are from Kenchington and Kenchington (1993) and sources therein. Wet weight of other species is extrapolated from known-weight museum specimens.

Salt-dried weights of imported species were based on the foregoing figures, using weight loss percentages from the literature. A salt-dried weight of 20.5 percent of round weight used by Kenchington and Kenchington (1993) for cod is in rough accord with figures in earlier sources and indicates that the dried product fish had been gutted, headed, and trimmed before salt processing. Absent independent figures for salt salmon, the same figure was used, because these large fish were treated in a somewhat similar manner. The other, smaller species were sometimes gutted and sometimes split, but generally retained the heads and most of the skeleton—as amply demonstrated by the present collection. For these fishes, various ratios were used, following Tanikawa (1971) and Yean et al. (1998). Sciaenid (croaker and corvina) weights were estimated at 50 percent of round weight, shad at 34 percent (using ratios from other clupeids), and other fishes at 50 percent. White herring were estimated directly from known-weight salt-dried specimens.

Results

The 517 specimens in the present collection include 60 scales. These derive from teleost fishes, although no attempt was made at identification. Of the remaining 457 bones and fragments, 292 were identified at least to family. These materials represent at least 18 species. The collection can be grouped into three associations: fishes caught locally, those imported from the Pacific Coast, and those imported from China (Table 13.34).

Arizona Species

Colorado Pikeminnow. The Colorado pikeminnow (*Ptychocheilus lucius*), the largest freshwater fish in the Colorado River drainage, is identified from 25 specimens representing at least three individuals. An inhabitant of larger flowing streams throughout the Colorado Basin, this species probably approached a length of 2 m and a weight of 45 kg, although most individuals were much smaller. Known vernacularly as "salmon" or "white salmon," these fish were quite abundant in some localities and were common enough in the Salt River to support a commercial fishery in the very early twentieth century. Populations declined during the last century, however, and the species was extirpated in the Gila Basin by the late 1950s (Minckley 1973:120-121).

Live weight of these fish was from vertebral diameters, using calculations provided by Casteel (1972) for *Ptychocheilus grandis*, a related California species. Caution is merited here, however, because the calculated size of these specimens exceeds the modern comparative sample range available for computation of Casteel's formulae.

Chub. Six specimens from the collection clearly represent chubs (*Gila* sp.). The Gila chub (*G. intermedia*) is the only species of this genus reported from the Santa Cruz River (Minckley and DeMarais 2000), and no comparative specimens were available for this study. The presumption that they represent this species is strengthened by the fact that the remains do not compare favorably with osteological specimens of bonytail chub (*G. elegans*) or roundtail chub (*G. robusta*)—large chubs that were common in other parts of Arizona.

Table 13.34. Chinese fish remains (San Agustín Mission species) from other *Huáqiáo* sites.

Species	Common Name	IJ56 Block, Sacramento, CA, 1850s[a]	HI56 Block, Sacramento, CA, 1850s[b]	IJFront2 Block, Sacramento, CA, 1880s[c]	Second Street Laundry, Woodland, CA, 1880s[d]	Yema-Po Construction Camp, Alameda County, CA, 1874-1875[e]	Point San Pedro Fishing Camp, Marin County, CA, 1870-1910[f]	Woolen Mills Chinatown, San Jose, CA, 1887-1902[g]	Los Angeles Chinatown, 1880-1930?[h]	Wong Ho Leun, Riverside, CA[i]	Tucson, AZ, Chinatown, 1880-1900?[j]
Ilisha elongata	White herring	–	P	–	–	–	–	P	–	–	–
Nemipterus spp.	Threadfin breams	–	P	–	–	–	–	P	–	–	–
Larimichthys crocea	Yellow croaker	P	–	–	–	–	–	P	P	P	–
Tetraodontidae	Puffers	–	–	P	P	P	P	P	P	P	P

[a] Schulz 1982.
[b] Schulz 1997.
[c] Personal observation.
[d] Schulz 1984.
[e] Gill 1985.
[f] Personal observation.
[g] Schulz 2002.
[h] Roeder 1996.
[i] Collins 1987.
[j] Gust 1993.

F. M. Chamberlain, who conducted a fish survey of Arizona waters in 1904, reported that Gila chubs then being taken on hook and line in the San Pedro Basin and were "more or less esteemed for food" (Minckley 1999:201). The chub was popularly known as *lisa*, accurately enough reported by Chamberlain as "meaning smooth." While this may have been a local folk etymology, the term is actually the most frequent Spanish word for mullet, and is commonly used for those marine fish (*Mugil* spp.) from the Gulf of California. The general similarity of western chubs to mullets in shape, size, and coloration undoubtedly facilitated the transfer of coastal nomenclature to the unrelated inland fish.

Live weight of the minnows represented here is estimated from a large series of known-weight material of *Gila bicolor,* a related species from the Great Basin.

Suckers. Four species of suckers occurred in southeastern Arizona prior to the environmental disruptions of the last century: *Xyrauchen texanus*, *Catostomus latipinnis*, *C. insignis,* and *C. (Pantosteus) clarki*. The present specimens clearly represent one or more species of the genus *Catostomus.* However, it was not possible to assign the material definitively to any of the three species.

Carp. The common carp (*Cyprinus carpio*) accounted for 19 bones from at least five fish. This fish was introduced to Arizona in the early 1880s (and much of the rest of the country) from the national piscicultural ponds in Washington, D.C. By 1885, at least 65 Arizona applicants had been supplied with fish (Anonymous 1886; Smiley 1886); one of these carp ponds, Warner Lake, was located 0.25 miles southwest of the present site. In 1889, it was leased by Chan Tin Wo, a Chinese immigrant, who intended "to furnish Tucson with fresh carp at all times" (*Arizona Daily Star* 1889).

Pacific Coast Species

American Shad. American shad (*Alosa sapidissima*) is represented in the present collection by 14 elements—representing two fish.

This species is a common food fish on the Atlantic coast. In the nineteenth century, it provided an abundant, inexpensive, and highly valued contribution to the diet of America's eastern cities. A favored species of early fish culturists, it became the first exotic fish species formally introduced into California when, in 1871, 10,000 young shad from the Hudson River were deposited in the Sacramento River. Taking of the species was prohibited prior to December 1877, by which time it seems to have become fairly well established (Dill and Cordone 1997:15, 31-33). Lockington (1879a:58) reports it as scarce but repeatedly present in the San Francisco market, and it appears intermittently in the retail market listings from 1880 onward.

Although the hopes of its advocates were fulfilled in that the species became well established, gastronomic enthusiasm among potential consumers seems to have waned over the years. By the second and third decades of the new century, shad had come to be viewed—in spite of promotion from the fish commission and anglers' journals—as a "common" fish, and one difficult to prepare for the table. It eventually became one of the cheapest and least-desired fish in the market (California Fish and Game 1922; California Fish and Game Commission 1916; Hedderly 1912; Nidever 1916).

A specialized and well-known fishery for salt shad existed in the Sacramento-San Joaquin Delta for a few years following 1912:

> From the time shad became abundant in our waters up to 1912 they were utilized almost entirely by fresh markets. But in the spring of 1912 several salting stations for shad were established on the San Joaquin River by Chinese companies… These continued for only two seasons, for they did not seem to pay. Later a salt shad market was established for China and practically all the California fish were shipped there. Several local salmon packers have now taken up the dry-salting of shad and have packed many tons during the last two or three years, which they have sold through Chinese brokers in San Francisco (Nidever 1916:62).

Although this report emphasizes the fresh market for shad prior to 1912, it can be assumed that the fish were at least occasionally salted for market. Documentation is scarce, but at least one report survives:

> During the past two weeks shad have been coming up the American river in great numbers, but there is a useless destruction of them by Chinese and Portuguese miners by placing nets across the entire river and catching the fish in great quantities. At the mouth of Alder creek and Mississippi bar nets have been stretched across the river for a week or more, and fish are being caught and salted down by the barrel (*San Francisco Post* 1890:4).

Short-term, localized operations such as this undoubtedly account for the present specimens.

Cod. Cod (*Gadus* sp.) are represented by only a single bone. Recent taxonomic summaries generally classify the world's cod populations into three species, at least two of which were available as salt fish on western markets during the last century. Atlantic cod (*G. morhua*) have been commercially important in Europe and North America for hundreds of years, while the large populations of Pacific cod (*G. macrocephalus*) began to be exploited by the San Francisco fishing fleet in the 1860s. Species of the present specimen cannot be determined.

Certainly the paucity of cod remains here is a contrast from Euro-American assemblages, where such bones are generally among the most common of fish remains. Such remains are almost ubiquitous in late nineteenth century California assemblages, reflecting the status of salt cod as the most important fish on the North American market. It seldom appears in Pacific Coast fish market retail price lists, but only because it stocked the shelves of almost every grocer in the west and was available in confusing variety. A sense of the ubiquity of salt cod in western settlements can be gained from a sardonic commentary from a Wyoming newspaper, reprinted in a San Francisco contemporary:

> The Wyoming codfish is generally dead. Death in most cases is the result of exposure and loss of appetite. No one can look at the codfish of commerce and not shed a tear. Far from home with his system filled with salt, while his internal economy is gone, there is an air of sadness and homesickness and briny hopelessness about him that no one can see unmoved.
>
> It is in our home life, however, that the codfish makes himself felt and remembered. When he enters our household, we feel his all prevading [sic] presence, like the perfume of wooden violets, or the seductive odor of a dead mouse in the piano.
>
> Friends may visit and go away to be forgotten with the advent of a new face, but the cold, calm, silent corpse of the codfish cannot be forgotten. Its chastened influence permeates the entire ranch. It steals into the parlor like an unbidden guest and flavors the costly curtains and high-priced lambiquins. It enters the dark closet and dallies lovingly with our swallow-tailed coat. It goes into your sleeping apartment and makes its home in your glove box and handkerchief case.
>
> That is why we say it is a solemn thing to take the life of a codfish. We would not do it. We would pass him by a thousand times, no matter how ferocious he might be, rather than take his life, and have our happy home haunted by his unholy presence (*San Francisco Journal of Commerce* 1882:1).

Chinook Salmon. This species (*Oncorhynchus tshawytscha*) was the most important food fish of the Pacific Coast in the latter half of the nineteenth century, although it is represented here by only three bone—a caudal vertebra and two hypurals (tail bones).

Salt salmon was always a significant by-product of the fishery, because it allowed fishermen (most of whom processed their own fish) to preserve part of their catch for later sale if the market was oversupplied with fresh product. This practice also provided an outlet for salmon taken illegally during the closed season (Jordan 1887:614, 618; Jordan and Gilbert 1887:732-735). The process, in anatomical terms, is worth noting:

> In dressing salmon for pickling on the Pacific coast, the heads are removed and the fish split along the belly, the cut ending with a downward curve on the tail. The viscera and two-thirds of the backbone are removed, and the blood, gurry, and black stomach membrane scraped away (Stevenson 1899:455-456).

Staghorn Sculpin. Only one specimen of the staghorn sculpin (*Leptocottus armatus*) was recovered. This fish is a common in-shore species throughout much of the Pacific Coast and is readily taken in line and net fisheries. The bones are extremely common among the fish remains recovered from a late nineteenth century Chinese fishing camp on San Francisco Bay (personal observation). One scientific observer in the 1880s referred to them as "catfish" and likewise noted them as an abundant component of the by-catch of the San Francisco Bay shrimp fishery:

> These fishes are not taken to market, but are soaked in brine and spread on mats to dry in the sun. When dried they sell at less than 2 cents per pound, the *Leptocottus* being nearly all head. The catch on hand during my visit must have contained fully half a ton of these small fish (Jordan 1887:612-613).

Rockfish. Numerous bones represent rockfish (*Sebastes* spp.). More than 50 species of this genus occur along the Pacific Coast. Specific identification from isolated bones is usually difficult. Because comparative specimens were available for only about 30 species, no attempt at specific identification is offered here. It is suspected that the remains derive from one or more species not represented in the comparative collections utilized.

Fishes of this genus—vernacularly known as rock cod—are quite common along the Pacific Coast, where they have contributed significantly to commercial landings since the early 1850s. Dried rockfish were a common product of fisheries operated by Chinese immigrants (Collins 1892:60; Lockington 1881:37) and probably account for most of the "cod" noted in the San Francisco custom house records as a common export to China.

California Corbina. The California corbina (*Menticirrhus undulatus*) was recognized from only a few bones. This croaker reaches a length of at least 71 cm and a weight of at least 3 kg. The species—known in the late nineteenth century as bagre, sucker bass, or sucker—was reported as abundant along the

California coast from Santa Barbara southward. It was reported as a food fish of fair quality, taken in seines and gill nets (Jordan 1884:379; Lockington 1881:45). No reports of salt-drying have been found, although given that the other species of this family were the subject of focused salt-drying industries, it is not surprising. The corbina is a common constituent of southern California middens and has been previously recovered from Chinatown deposits in San Diego and San Jose (Schulz 2002).

Surfperch. The collection yielded two bones identifiable as surfperch (Family Embiotocidae). Nineteen species of this family occur along the coast of California—most of them common food fishes. They were salted in quantity by Chinese fishermen in Monterey and on San Francisco Bay (Collins 1892:60; Jordan 1887:612-613), and undoubtedly in other localities as well.

Ocean Whitefish. The ocean whitefish (*Caulolatilus princeps*) is identified from four specimens. This was a common commercial fish of the southern California coast. They were commonly salted, by both Chinese and American fishermen, and were among the best salt fish on the market (Jordan and Gilbert 1882:46, 53).

Sheephead. The second-most abundantly represented fish in the sample is identified from 45 specimens from at least four individual fish. Formally ascribable only to the wrass family (Labridae), these bones are almost certainly those of California sheephead (*Semicossyphus pulcher*). Some caution in making this ascription is warranted given the numerous species of this family found in the Gulf of California and along the southern Chinese coast, where, it must be noted, at least some species are salted for market. However, the present remains all appear to be from a single relatively large species. All the specimens are osteologically compatible with *S. pulcher* and differ from the limited number of Chinese and Mexican comparative specimens available.

California sheephead—then vernacularly known as blackfish or redfish—were once abundant along the coast south of Point Conception. They were taken in immense numbers by Chinese fishermen and were salted and dried. The flesh was reputed by Euro-American observers as "rather coarse, but the fat forehead is esteemed for chowder" (Lockington 1881:42). Drying method was evidently specific to this fish:

> The redfish (Trochopus pulcher) are dressed by opening the abdomen and removing the viscera, and Chinamen exhibit much ingenuity in giving a picturesque appearance to the head and teeth of this species. According to Dr. D. S. Jordan: "A 'junk' with the deck covered with drying redfish seems at a little distance to be full of frogs about to leap" (Stevenson 1899:417).

Flatfishes. Although the excavation yielded 15 bones of flatfishes (Pleuronectiformes), only two could be identified to species. The latter bones are from the starry flounder (*Platichthys stellatus*), one of the most common flatfishes of the central California coast. Lockington (1879b:93) reported it as "the most abundant of all the flat-fishes brought to our markets," noting that it "is sold under the name of 'Flounder,' which here [San Francisco] appears limited strictly to this species." The terminology is confirmed by Jordan (1884), who reported that the name "Flounder" was rarely used in a generic sense in San Francisco.

Chinese Species

The excavations yielded remains of at least four species imported from China—all of them as salt fish.

White Herring. The white herring (*Ilisha elongata*) is identified from several specimens, representing at least two individuals. It may be noted that comparative specimens were available for only one species of the genus, *I. elongata*. Although two additional species occur along the coast of Guangdong, neither attains sufficient size to be responsible for the archaeological specimens.

Superficially, the species resembles a large herring—hence the English name—but it is generally classified in a separate family. Maximum standard length is 40.5 cm. This species is reported by Anderson (1972:110) as "a mainstay of the [Hong Kong] salt fish industry, and … the most highly valued salt fish." Yang and Chen (1971:8) note that it is caught only in small quantities in Taiwan, but that it is "highly esteemed when salted Cantonese style." Salt specimens were readily obtainable in Hong Kong and Macao markets in 1986 and 1989. In spite of this popularity in southeastern China, the species is not at all common on the overseas salt-fish market in California and has never been observed here by the author.

Threadfin Breams. The threadfin breams (*Nimipterus* spp.) are schooling perciform fishes, easily recognized by their reddish bodies with multiple luminous yellow pin-striping. They are among the most common fishes in the South China Sea and a traditional mainstay of Guangdong marine fisheries (Anderson 1972; Hong Kong Agricultural and Fisheries Department 1972). They are marketed mainly fresh, but were also widely dried and are readily available frozen in overseas markets today. Although at least five individuals were represented in the present collection, only one could be identified to species.

The identified species was the golden threadfin (*N. virgatus*), a benthic species that reaches a maximum size of 35 cm. This fish is widely known in Cantonese as *hung sam* ("red jacket") (Anderson 1972:125), although it is marketed in English most commonly as "golden thread" or "golden threadfin." Probably the most common nemipterid in southern Chinese landings, it is certainly the most common found in Pacific Coast markets today.

Yellow Croaker. The yellow croaker (*Larimichthys crocea*) is represented by 17 bones from at least two individuals. One of the most popular food fishes of southern China, the yellow croaker (or yellow flower fish) is also probably the most frequently exported. Remains of this species, recovered from gold rush-era deposits in Sacramento, indicate it was being imported into California by the 1850s (see Table 13.34). It is still readily available in Asian markets here, although now frozen and canned as well as salted.

Puffer. The collection includes three puffer bones (Family Tetraodontidae). These are from a relatively large fish, but are insufficient for identification of species. Such remains are quite commonly found in deposits associated with overseas Chinese communities (see Table 13.34). In only one case have such bones been identified to species—the remains of kanafugu (*Lagocephalus inermis*) from the Woolen Mills Chinatown in San Jose, California (Schulz 2002). Many species of puffers are found in the South China Sea. Whether the nineteenth century fishery targeted kanafugu in particular, is unknown.

The evident popularity of these fish in the overseas communities calls for some explanation, given their well-justified reputation for being poisonous. Various species of puffers are certainly in great demand as sashimi among Japanese epicures, but this enthusiasm is generally thought to be lacking in China. Read (1939:80) notes that in traditional Chinese pharmaceutical practice, puffer flesh was considered "sweet, warming and poisonous" and was used as "a tonic for weak people, dehydrotic, good for the loins and feet, for piles, antihelmintic."

Salt processing is unreliable in completely removing the poison (tetraodotoxin) from puffer flesh. However, cooking the processed product is effective to this end (Deng-fu Hwang, personal communication 2005; Ozawa 1983; Tsubone et al. 1986), and salt-dried puffer are still sold in China and Taiwan. Therefore, although consumption in nineteenth century North America may have been influenced by traditional medicinal beliefs, the archaeological remains represent salt fish consumed primarily as food.

Discussion

This study demonstrates that salt fish from China contributed to the diet of *Huáqiáo* residents of Tucson by the 1880s. The species identified were common market items recovered from many nineteenth century urban Chinatowns on the Pacific Coast (see Table 13.34). It is clear, however, that local fresh fish were more important in the diet, and that imported salt fish from the Pacific Coast vastly more so.

It is noteworthy that even the non-Chinese fishes represented in this assemblage reflect a dietary adaptation found among Chinese immigrants on the Pacific Coast, and one that differed substantially from Euro-American residents. Archaeological remains from the latter group often include bones of local freshwater or marine fishes, but salt fish is usually restricted to the traditional products of the North Atlantic and North Pacific: salt cod, and sometimes herrings or mackerels. Salt cod is—perhaps with the exception of salmon in areas where it could be obtained fresh or smoked—the most common food fish by far.

Chinese assemblages show a different pattern. Salt cod, although it occasionally (as in this case) is present, is uncommon. The same is true of salmon, even in areas where it was readily available. Instead, the diet was dominated by local marine and freshwater species, the products of primarily Chinese fisheries.

In the case of the present gardeners' assemblage, the carp consumed were the same species found in their homeland, and the other freshwater fishes were similar to species readily obtained there. Except cod and salmon, all the imported fishes were at least potentially products of *Landsmann* enterprises, processed in traditional ways. Because many of the Pacific Coast species (sheephead, whitefish, corbina, flatfish) were closely related to fishes common in Chinese markets, the gardeners who consumed them may have been unaware of their origin. The fish remains from the present assemblage thus seem to argue strongly for the maintenance of dietary traditions, even though those traditions drew upon new geographical sources of supply.

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CHAPTER 14

PLANT REMAINS FROM THE CLEARWATER SITE, AZ BB:13:6 (ASM), AND THE TUCSON PRESIDIO, AZ BB:13:13 (ASM)

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The archaeological effort associated with the Rio Nuevo Archaeology project resulted in the recovery and analysis of plant remains from 274 flotation samples. The data collected from this project provided an opportunity to test previous studies that document a series of trends in plant use spanning an interval of approximately 3,200 years. The plant assemblage discussed in this report substantiates earlier findings that Early Agricultural period (2100 B.C.-A.D. 50) subsistence efforts incorporated a wide range of wild plant taxa in an effort to minimize risks associated with floodplain farming. During the first millennium A.D., crops quickly displaced wild foods as subsistence efforts became highly focused on floodplain farming, reducing or eliminating the use of previously important wild plants. Upon the arrival of colonizing Spaniards and, later, emigrating Euro-Americans and Chinese, a host of new crops, ornamental trees, and weeds were brought in. These newly introduced Old World taxa greatly expanded the range of resources available to people living in the Tucson Basin.

QUANTIFICATION AND METHODS

The analyses in the current study compare the established 3,700-year trend in plant use known from prior studies with the new information from the Rio Nuevo project. Changes in the dietary importance of different plant taxa and different groups of plants are examined by considering two characteristics of the plant assemblage—ubiquity and diet breadth—discussed below.

Within the Rio Nuevo assemblage, the ubiquities and diet breadths of the assemblages are based on features from the same temporal component within one site. For example, ubiquity is calculated separately for the Cienega phase (800 B.C.-A.D. 50) assemblage from the Clearwater site, AZ BB:13:6 (ASM), and the Spanish period (A.D. 1694-1821) assemblage from the Mission Gardens locus. The Mission Gardens are, in turn, treated as a distinct entity from the Spanish period assemblage from the Tucson Presidio, AZ BB:13:13 (ASM).

Together, the ubiquities of taxa and the diet breadths of assemblages provide a way to track changes through time in the kinds of plants preferred by the prehistoric- and historic-era occupants of the Tucson area. To infer that the assemblage reflects preferences in food use, the ubiquity must be assumed to be indicative of the frequency with which a plant was used. Further, changes in diet breadth must be assumed to be driven by concerns about the relative merits of different kinds of resources compared with each other. Each of these assumptions is based on a suite of core principles discussed below.

Ubiquity as an Indicator of Importance

Ubiquity is a commonly used measure of the pervasiveness of a plant in an assemblage (Minnis 1981; Popper 1988). The use of ubiquity as an index for the importance of a particular plant derives from a chain of logical inferences that lead to the following conclusion. All other things being equal, the ubiquity of a plant is directly related to the overall dietary importance of the plant. The ubiquity (U_{taxon}) of a taxon (or plant group) is the proportional frequency of features that contain at least one individual of the taxon, compared with the total number of features that contained any plant taxon (or group). For example, if 10 features contained plant remains and six contained maize, $U_{maize} = 0.6$.

On any given day, humans consume plants in almost every meal they eat. However, the plant tissues commonly found in archaeological samples, particularly in prehistoric samples, are not the remnants of consumed foods; rather, they are the inedible remnants of things that could not be eaten. Burned foods are inedible; they are also nearly indestructible. Carbon does not rot, nor is it easily dissolved. Carbonized plant remains are inedible, and charring must occur as a result of an accident in processing, storage, or cooking food, or in discarding food waste.

The burned plant remains in an assemblage are assumed to be a sample of the foods that were regularly eaten, randomly generated as a result of the combined effects of, for example, spillage and the effects of charring once spilled food falls in a fire. Preserved plant remains are a random selection of regularly eaten foods; therefore, the relative occurrence of different burned foods is proportional to the frequencies and amounts in which they were eaten. One complicating factor, however, prevents the direct comparison of the ubiquities of different taxa; that is, the seeds of some taxa are so fragile they may be underrepresented in an assemblage. For that and other reasons, certain categories of plants whose frequencies and ubiquities are comparable are recognized. These plant resource groups are discussed in a later section.

Diet Breadth and Optimization

The number of plant types used by a prehistoric group (i.e., diet breadth) is a useful indicator of the roles of different plants or plant groups. Interest in diet breadth derives from an area of inquiry in which the critical questions revolve around the costs and benefits associated with the use of different plants (Kelly 1995; Krebs and Davies 1991; Schiffer 1996). It is sufficient to note that, when people are presumed to maximize their energy intake from the environment, they tend to first use resources that provide the greatest number of Calories for the effort required to obtain them.

Changes in diet breadth through time occur due to changes in the relative merits of different plants or to changes in the perceived need to maximize energy production. When diet breadth is quite broad despite the availability of several overwhelmingly superior resources, two explanations are offered. First is the idea that people have stopped caring about the relative returns for unit of effort; food is so plentiful that people do not worry much about the merits of the marginally profitable resources. An alternative explanation is that the availability of the high-quality foods is, in some way, limited. When diet breadth narrows, it is because some resources have become so superior that using them (and ignoring greatly inferior ones) is the most practical choice.

PLANT RESOURCE GROUPS

Based on commonalities in location, seed size, and the requisite harvesting and processing tool suites, categories of food plants called resource groups are recognized. Justification for the creation and membership among the groups is provided in Diehl and Waters (2005) and Gregory and Diehl (2002). The categories of plant resources include crops, high-density weeds, low-density weeds, desert tree legumes, cacti, low-density wild grasses, local shrubs, and long-distance resources. Plants assigned to each group share common harvesting, preparation and processing behaviors, and tools. In short, the chain of events that lead to their charring and preservation are similar, and plants within each group are mutually comparable using the ubiquity measure. Plants within each category also offer comparable energy returns. This explains the distinction, for example, between the very low-quality low-density weeds and the higher-quality high-density weeds, despite the fact that the same tools and behaviors are associated with the acquisition of plants in both groups. When diet breadths change, it is useful to determine which plant resource groups are emphasized among the overall range of subsistence practices. The resource groups are described below.

Crops

Crops are deliberately planted cultigens that have been anthropogenically transformed to have large fruits or seeds and that are highly, if not exclusively, dependent on humans for their successful propagation. Maize is the only confirmed cultigen in macrobotanical specimens from pre-San Pedro phase and Early Cienega phase deposits at Clearwater. Samples from other Early Agricultural period sites—most notably from San Pedro phase features at Las Capas, AZ AA:12:111 (ASM), and Late Cienega phase features at Los Pozos, AZ AA:12:91 (ASM)—produced remains tentatively identified as bean cotyledon fragments (cf. *Phaseolus*) and cotton pollen. As Mabry (2005) noted, extant evidence (primarily from pollen samples) hints that maize, beans, squash, and cotton may have arrived as a single crop complex during, or prior to, the Early Cienega phase of the Early Agricultural period.

From A.D. 50 through A.D. 1000, the list of confirmed domesticates expanded to include new varieties of maize (*Zea mays*), several varieties of beans (*Phaseolus acutifolius*, *P. vulgaris,* and *P. lunatus*), at least two varieties of squash (*Cucurbita pepo* and *C. moschata*), and cotton (*Gossypium* sp.) (see Adams 1994; Ford 1981; Galinat 1988; Upham et al. 1987, 1988). Of these, only beans have been confirmed from the Rio Nuevo samples.

Colonizing Spaniards and later, Mexicans, western-migrating Americans, and emigrant Chinese also each introduced new crops. In the Rio Nuevo samples, historically introduced cultigens included apples (*Malus* sp.), black mustard (*Brassica nigra*), clover (*Trifolium* sp.; for animal fodder), oats (*Avena* *sativa*), grapes (*Vitis vinifera*), peaches (*Prunus persica)*, raspberries (*Rubus* sp.), watermelons (*Citrullus* sp.), wheat (*Triticum* sp.), and white mustard (*Sinapis alba*). In addition, peppers (*Capsicum* sp.), a native cultigen, were observed in Spanish period samples.

High-density Weeds

High-density weeds are wild, nondomesticated plants that thrive in fallow fields, on the margins of active agricultural fields, or in frequently disturbed floodplains. Their locations are predictable, although there is a small search cost associated with their use, and they provided much lower yields per hectare than domesticated plants. Harvesting costs for these plants were higher than for domesticated plants, including more activity to strip or beat seed heads into containers, possibly with attendant losses to scattering. Subsequent processing steps included parching to remove closely fitting glumes, bracts, and capsules, and, in some cases, shelling, prior to subsequent grinding or cooking.

Flotation samples from the Rio Nuevo project produced dropseed (*Sporobolus* sp.), goosefoot (*Chenopodium* sp.), pigweed (*Amaranthus* sp.), indeterminate goosefoot-pigweed (cheno-ams), and tansy mustard (*Descurainia* sp.). The associated tool technology included baskets for collection and storage, as well as parching or winnowing trays. Depending on the strategy, flaked stone tools may have been necessary in the collection process. Where grinding was desired, basin metates and small manos were also used.

Low-density Weeds

Low-density weeds are wild, nondomesticated plants that thrive in fallow fields, on the margins of active agricultural floodplains, in disturbed soils away from floodplains. However, they occur in less pure stands than high-density weeds. Low-density weeds include starchy seed types, such as clammyweed (*Polansia* sp.), dock (*Rumex* sp.), false purslane (*Trianthema* sp.), purslane (*Portulaca* sp.), ragweed (*Ambrosia* sp.; found only in a nineteenth century context in these samples), ringwing (*Cycloloma* sp.), a smartweed-type seed (*Polygonum* sp.), and nightshade-/chokecherry-type seeds (*Solanum/Physalis*).

Due to their more dispersed growth habits, low-density weed resources provided much lower yields per hectare than high-density weeds because they had higher search and harvesting costs, as well as higher transport costs. The associated suite of tools was the same as that used for the high-density weeds; therefore, the processing costs were likely similar between the two groups. The search and harvesting costs associated with the use of low-density weeds, however, were much greater than for high-density weeds.

Desert Tree Legumes

In the Rio Nuevo samples, this category is represented only by mesquite (*Prosopis velutina*) pods, although it could also theoretically include screwbeans (*Prosopis pubescens*), acacias (*Acacia* spp.), and paloverde (*Cercidium* spp.). The requisite technology included heavy stone pestles and mortars made from tree stumps or formed in bedrock outcrops. The processing effort was labor intensive and involved repeated episodes of pounding and winnowing in baskets. The desired product was a meal made from the sweet, starchy mesocarp (a layer of tissue enclosed by the pod that surrounds the hard seeds within the pods). It is generally assumed by Southwestern archaeologists that the seeds, which were protein rich but very hard, were discarded except under circumstances of extreme need. It was common practice among the Pima and Papago in southern Arizona to discard the seeds (Doelle 1976, 1978; Gasser 1982). As with the floodplain weeds, mesquite was locally available on floodplains, alluvial fans, and low terraces on the margins of floodplains.

Cacti

Cactus fruit taxa are common in prehistoric assemblages in southern Arizona, and their persistence from the oldest prehistoric sites to recent history gives evidence of the enduring appreciation for cacti as sources of food. In the Rio Nuevo samples, the taxa include cactus family seeds (Cactaceae), cereus genus seeds (*Cereus* sp.), hedgehog cacti (*Echinocereus* spp.), prickly pear (*Opuntia* spp., “platyopuntia” type), and saguaro (*Carnegiea gigantea*). Most of the cacti can be found concentrated on the rocky slopes of foothills surrounding river basins. During July and August, the energetic costs of unsuccessful long-distance hunting forays (if they were attempted) could have been partially offset by harvesting cactus fruit during the return trip.

Ethnographically documented uses of cacti, especially saguaro, include the harvesting of the fruit with poles, heat treating to singe off the glochids and spines, and subsequent processing in pots (ultimately fermented) or drying on screens (Crosswhite 1980). Saguaro seeds were often dried, parched, ground into a meal, and consumed with other food. The associated cactus fruit harvesting technology included baskets or vessels for gathering fruit; a fire or other heat source for singing spines; tongs; sticks, or poles for knocking down fruit; and on some occasions, knives for splitting the fruit prior to seed removal. When the goal of fruit harvesting was to produce a beverage, the fruits were added to water in a ceramic vessel and boiled down to a thick syrup (Crosswhite 1980). Otherwise, fruit could have been dried for storage and consumed later as either a stand-alone food or as an additive in some other preparation. The fruit harvesting technology included task-specific items such as tongs and poles, as well as general-purpose tools such as baskets, vessels, parching and winnowing trays, grinding stones, and stone knives.

Low-density Wild Grasses

Non-floodplain wild grasses are low-density grasses that do not require the more silt-laden and moisture-rich floodplains to thrive. Their definitive characteristic is that they do not occur in very dense or nearly homogeneous stands. Most are not confined to floodplains or their margins, but instead, are dispersed throughout the Tucson Basin and the surrounding foothills and montane regions. Harvesting costs for wild grasses are generally quite high, and they provide low overall energy return rates (Cane 1989; Simms 1987). They could have been obtained and processed using the same suite of tools applied to high- and low-density floodplain weeds. In the Rio Nuevo samples, this group includes indeterminate grasses (Gramineae), bentgrass/muhly (*Agrostis*/ *Muhlenbergia* spp.), little barley (*Hordeum* cf. *pusillum*), and panic grass (*Panicum* spp.).

Local Shrubs

This category includes locally available woody shrubs (excluding the tree legumes) that produce seeds with an ethnographically documented use as food. Mint family/chia-type seeds (Labiatae/*Salvia* sp.) and sumac (*Rhus* sp.) were the only taxa from this group in the Rio Nuevo macrobotanical assemblage. There is no obvious associated tool technology, although any use of the seeds would almost certainly have entailed parching, winnowing, and grinding. These taxa generally occur away from floodplains on river terraces and alluvial fans, where they often compete with mesquite. Local shrubs may have been gathered as a embedded task during the acquisition of other resources, perhaps only when higher priority resources could not be located.

Distant Resources

This category includes resources that were not generally available along the floodplains, alluvial fans, terraces, or foothills in the intermontane basins, including manzanita (*Arctostaphylos* sp.) and juniper (*Juniperus* spp.). *Juniperus* occurred in only one sample from the undated Feature 529 at Clearwater. Manzanita was observed in Spanish and American period features but not in prehistoric features.

SUBSISTENCE TRENDS IN ARIZONA

The Rio Nuevo project flotation samples enhance current knowledge about resource use in the Tucson Basin because the data add to a growing body of information that may be used to document trends in resource selection over a period of nearly 4,000 years—from the Early Agricultural period (2100 B.C.-A.D. 50) until the late nineteenth century A.D. The samples recovered from Clearwater, the Mission Gardens, the Tucson Presidio, and Block 181 affirm the trend overall and add much-needed information about certain key intervals, such as the Early Ceramic period (A.D. 50-500) from which more paleobotanical data are needed.

Prior Research

To facilitate the comparison of the Rio Nuevo project assemblages with Tucson baseline data, the information is presented in two parts. Table 14.1 and Table 14.2 describe the Tucson Basin baseline data (excluding new data presented here). A detailed discussion of all 60 taxa in the Tucson Basin macrobotanical database would be both cumbersome and unnecessary. Table 14.1 lists temporal variation in the ubiquities (based on features) of 36 of the 61 taxa in the Tucson Basin database. Unidentified seeds and 13 other taxa whose ubiquities never exceeded 0.02, or that were only used in one time period, were excluded from this table. Table 14.2 tracks temporal variation in the mean total diet breadth and mean within-group diet breadth for Tucson Basin sites at different times. In the discussions that follow, the information in these tables is compared with the data from the Rio Nuevo project assemblages.

The trends described in Tables 14.1 and 14.2 have been extensively discussed elsewhere (Diehl 1997b; Diehl and Waters 2005; Gregory and Diehl 2002) and are only briefly described here. These trends are best understood as a description of the evolving relationship of humans to their environment, driven by the

Table 14.1. Trends in the ubiquities of selected taxa from Tucson Basin sites.

	Early Agricultural Period				Hohokam Periods			
	2100 B.C.- 1200 B.C.	1200 B.C.- 800 B.C.	800 B.C.- A.D. 50	A.D. 50- A.D. 500	A.D. 500- A.D. 750	A.D. 750- A.D. 950	A.D. 950- A.D. 1150	A.D. 1150- A.D. 1450
Taxon	Pre-San Pedro	San Pedro	Cienega	Early Ceramic	Pioneer	Colonial	Sedentary	Classic
Number of features (*n* =)	31	500	304	77	12	16	106	12
Agave sp. spines, etc.	0.00	0.00	0.01	0.00	0.50	0.38	0.44	0.58
Amaranthus sp.	0.00	0.21	0.20	0.17	0.08	0.13	0.10	0.17
Boraginaceae	0.00	0.00	0.00	0.00	0.08	0.00	0.01	0.00
Cactaceae	0.03	0.01	0.04	0.03	0.00	0.00	0.00	0.00
Carnegiea gigantea	0.10	0.12	0.47	0.29	0.25	0.44	0.12	0.25
Echinocereus sp.	0.00	0.05	0.22	0.14	0.25	0.13	0.02	0.08
Opuntia sp.	0.10	0.05	0.08	0.06	0.00	0.00	0.08	0.25
Chenopodiaceae	0.00	0.02	0.12	0.10	0.17	0.19	0.08	0.00
Atriplex sp.	0.00	0.03	0.02	0.03	0.00	0.00	0.01	0.00
Chenopodium sp.	0.81	0.90	0.75	0.65	0.42	0.56	0.64	0.58
Polansia sp.	0.00	0.13	0.06	0.00	0.00	0.00	0.01	0.08
Compositae	0.03	0.03	0.08	0.03	0.17	0.06	0.01	0.17
Cruciferae	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00
Descurainia sp.	0.03	0.46	0.41	0.26	0.08	0.13	0.28	0.08
Cucurbita sp.	0.00	0.00	0.02	0.00	0.08	0.06	0.05	0.08
Juniperus sp.	0.00	0.01	0.01	0.03	0.00	0.00	0.03	0.00
Cyperaceae	0.00	0.03	0.08	0.03	0.00	0.00	0.00	0.00
Euphorbia sp.	0.00	0.00	0.01	0.04	0.08	0.00	0.00	0.00
Gramineae	0.00	0.08	0.30	0.30	0.58	0.44	0.61	0.83
Agrostis or *Muhlenbergia* sp.	0.00	0.04	0.12	0.04	0.08	0.25	0.14	0.25
Eragrostis sp.	0.00	0.09	0.04	0.08	0.00	0.00	0.01	0.00
Panicum sp.	0.00	0.02	0.03	0.00	0.00	0.00	0.02	0.00
Sporobolus sp.	0.03	0.13	0.17	0.06	0.08	0.00	0.19	0.17
Zea mays	0.19	0.85	0.83	0.52	0.42	0.50	0.62	0.83
Labiatae	0.00	0.13	0.13	0.01	0.33	0.06	0.09	0.08
Leguminosae	0.00	0.01	0.04	0.09	0.17	0.06	0.07	0.00
Phaseolus cf. *vulgaris*	0.00	0.00	0.01	0.01	0.00	0.00	0.12	0.00
P. acutifolius	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00
Prosopis cf. *juliflora*	0.03	0.28	0.41	0.23	0.67	0.38	0.18	0.50
Malvaceae	0.00	0.00	0.01	0.00	0.08	0.06	0.07	0.08
Gossypium sp.	0.00	0.00	0.00	0.00	0.00	0.06	0.05	0.50
Sphaeralcea sp.	0.00	0.01	0.01	0.01	0.17	0.44	0.22	0.33
Boerhaavia sp.	0.00	0.07	0.00	0.00	0.00	0.00	0.04	0.00
Rumex sp.	0.00	0.15	0.04	0.04	0.00	0.00	0.00	0.00
Portulaca sp.	0.06	0.16	0.07	0.01	0.00	0.06	0.01	0.00
Solanum or *Physalis* sp.	0.00	0.01	0.03	0.00	0.00	0.00	0.01	0.00

Table 14.2. Trends in the mean diet breadths of Tucson Basin sites.

		Diet Breadth (mean number of taxa)								
Phase/Period	*n*	All Taxa	Crops	Cacti	High-density Weeds	Low-density Weeds	Tree Legumes	Grasses	Local Shrubs	Distant Resources
Pre-San Pedro	1	12.0	1.0	3.0	3.0	3.0	1.0	1.0	0.0	0.0
Early San Pedro	2	21.0	1.0	2.5	5.0	7.0	1.0	5.0	1.0	0.5
Late San Pedro	4	20.5	1.3	3.0	2.8	6.0	0.8	2.0	1.3	1.3
Early Cienega	6	13.8	0.8	2.0	2.3	2.3	1.0	1.2	0.7	0.0
Late Cienega	5	20.6	1.0	2.4	2.6	3.8	1.4	2.2	1.6	0.8
Early Ceramic	4	12.3	1.3	2.3	2.5	3.5	1.3	1.3	0.5	0.3
Pioneer	2	15.0	1.0	3.0	1.5	4.0	1.5	2.5	1.0	0.0
Colonial	4	8.8	1.3	1.8	1.3	1.8	1.0	0.5	0.5	0.0
Sedentary	12	11.2	1.4	1.5	1.8	2.3	1.2	1.3	0.9	0.2
Classic	1	21.0	3.0	4.0	2.0	6.0	1.0	2.0	0.0	0.0

changing productivity (yield) of crops and improving subsistence technologies. Although crops, at least in the form of maize, first appeared in the second millennium B.C., diet breadth remained great despite the very high ubiquities of maize tissues in macrobotanical assemblages. An optimization model predicts that diet breadth should narrow when a very high-yield resource such as maize appears in a subsistence regime. Therefore, an explanation for the sustained, broad diet is desirable. Two explanations are currently favored.

One explanation considers the bottleneck that occurs when maize or any other grain is ground with stone tools. Many of the energetic improvements, in the search and processing costs, that were obtained by the planting of higher-yield crops were lost when maize was ground in the same fashion as small, starchy, wild seeds. The other consideration recognizes that maize farming was a high-risk activity, and wild foods were probably extensively harvested to augment maize in good years and as an insurance strategy for failures in the farming system in bad years. The risk endemic to maize agriculture stems from both unpredictable access to water (mitigated in part by the use of irrigation canals during and after the Early Agricultural period) and to losses incurred in storage. A total of 10-25 percent of the late twentieth century United States grain yield was lost in storage despite the use of very high-technology storage facilities (Bala 1997:1). Prehistoric in-storage loss rates were undoubtedly greater, particularly when the primary means of storage were baskets and underground pits. Dry-matter losses as low as 1 percent from molding will render stored grain inedible to humans due to mycotoxin contamination (Bala 1997; Nash 1985).

Many of these problems were subsequently partially mitigated in the first millennium A.D. The first obvious change was the introduction of high-quality ceramic containers during the Early Ceramic period. Large, well-fired pots were available, and these would have substantially reduced airflow around stored grains and would have enhanced protection from insects. Both qualities would have immediately reduced in-storage losses of grain as compared with underground storage pits. It is not surprising, therefore, that the frequency of large, underground pits declined substantially in the Early Ceramic period. Two other changes that occurred almost concurrently were the introduction of better metates that continued to improve as maize use intensified (Diehl 1996) and the development or introduction of improved varieties of maize. The “floury” varieties of maize were easier to grind due to the presence of a larger, starchier endosperm, and their intrinsic yields (amount of grain per unit of cultivated land) were much improved (Adams 1994; Upham et al. 1988).

Given this overview of previous studies of changes in prehistoric Tucson Basin subsistence, how does the new information gained from the Rio Nuevo project add detail? The Rio Nuevo data increase confidence in the above-described trend, and they enhance the pre-San Pedro phase and Early Ceramic period data. The ubiquities of the taxa observed at Clearwater, the Mission Gardens, Tucson Presidio, and Block 181 (Hohokam and American Territorial period occupations at the Tucson Presidio site) are provided in Table 14.3. The contents of each flotation sample from the project are listed in Appendix B.

Table 14.3. Ubiquities of identified food, fodder, and ornamental plant taxa in the Rio Nuevo project assemblages.

Taxon	Clearwater Site	Block 181	Mission	Tucson Presidio
Unnamed phase of the Early Agricultural period (2100-1200 B.C.)				
n =	11	0	0	0
Trianthema sp.	0.09	–	–	–
Echinocereus or *Mammillaria* sp.	0.09	–	–	–
Cheno-am	0.09	–	–	–
Chenopodium sp.	0.45	–	–	–
Gramineae	0.18	–	–	–
Zea mays	0.45	–	–	–
Prosopis cf. *juliflora*	0.09	–	–	–
Rumex sp.	0.09	–	–	–
Cienega phase (800 B.C.-A.D. 50), predominantly Early Cienega (800-400 B.C.)				
n =	41	0	0	0
Amaranthus sp.	0.15	–	–	–
Cactaceae	0.10	–	–	–
Carnegiea gigantea	0.24	–	–	–
Echinocereus or *Mammillaria* sp.	0.17	–	–	–
Opuntia sp.	0.02	–	–	–
Cheno-am	0.12	–	–	–
Chenopodium sp.	0.37	–	–	–
Compositae	0.02	–	–	–
Cruciferae	0.02	–	–	–
Descurainia sp.	0.07	–	–	–
Gramineae	0.12	–	–	–
Sporobolus sp.	0.10	–	–	–
Zea mays	0.73	–	–	–
Labiatae	0.02	–	–	–
Leguminosae	0.05	–	–	–
Prosopis cf. *juliflora*	0.12	–	–	–
Cyperus or *Scirpus* sp.	0.02	–	–	–
Portulaca sp.	0.02	–	–	–
Early Ceramic period (A.D. 50-500)				
n =	2	0	0	0
Carnegiea gigantea	0.50	–	–	–
Cheno-am	0.50	–	–	–
Chenopodium sp.	0.50	–	–	–
Zea mays	1.00	–	–	–
Prosopis sp.	0.50	–	–	–
Hohokam Pioneer period (A.D. 500-750)				
n =	0	1	0	0
Trianthema sp.	–	1.00	–	–
Amaranthus sp.	–	1.00	–	–
Carnegiea gigantea	–	1.00	–	–
Echinocereus or *Mammillaria* sp.	–	1.00	–	–
Opuntia sp.	–	1.00	–	–
Chenopodium sp.	–	1.00	–	–
Zea mays	–	1.00	–	–
Prosopis cf. *juliflora*	–	1.00	–	–

Table 14.3. Continued.

Taxon	Clearwater Site	Block 181	Mission	Tucson Presidio
Hohokam Colonial period (A.D. 750-950)				
n =	1	1.00	–	–
Trianthema sp.	0.00	1.00	–	–
Chenopodium sp.	0.00	1.00	–	–
Zea mays	1.00	1.00	–	–
Hohokam Classic period (A.D. 1150-1450)				
n =	2	0	0	0
Opuntia sp.	0.50	–	–	–
Gramineae	0.50	–	–	–
Spanish period (A.D. 1694-1821)				
n =	0	0	5	8
Trianthema sp.	–	–	0.40	0.38
Rhus sp.	–	–	0.20	0.00
Cactaceae	–	–	0.20	0.25
Carnegiea gigantea	–	–	0.20	0.63
Echinocereus or *Mammillaria* sp.	–	–	0.00	0.13
Opuntia sp.	–	–	0.20	0.13
Cheno-am	–	–	0.00	0.13
Chenopodium sp.	–	–	0.00	0.50
Cycloloma sp.	–	–	0.00	0.13
Polansia sp.	–	–	0.00	0.13
Cucurbita sp.	–	–	0.20	0.00
Cyperaceae	–	–	0.00	0.13
Gramineae	–	–	0.00	0.38
Panicum sp.	–	–	0.20	0.25
Triticum sp.	–	–	1.00	0.75
Zea mays	–	–	0.40	0.75
Prosopis sp.	–	–	0.40	0.38
Phaseolus cf. *vulgaris*	–	–	0.00	0.38
Prosopis cf. *juliflora*	–	–	0.00	0.25
Trifolium sp.	–	–	0.00	0.13
Portulaca sp.	–	–	0.00	0.13
Malus sp.	–	–	0.00	0.13
Capsicum sp.	–	–	0.00	0.50
Solanum or *Physalis* sp.	–	–	0.00	0.25
American Territorial period (A.D. 1856-1912; in this assemblage, effectively prior to 1900; includes Chinese)				
n =	10	20	0	0
Trianthema sp.	0.00	0.20	–	–
Amaranthus sp.	0.00	0.05	–	–
Cactaceae	0.10	0.05	–	–
Carnegiea gigantea	0.00	0.15	–	–
Cheno-am	0.00	0.05	–	–
Chenopodium sp.	0.10	0.60	–	–
Cycloloma sp.	0.00	0.05	–	–
Polansia sp.	0.00	0.10	–	–

Table 14.3. Continued.

Taxon	Clearwater Site	Block 181	Mission	Tucson Presidio
Compositae	0.00	0.05	–	–
Helianthus sp.	0.00	0.05	–	–
Descurainia sp.	0.00	0.05	–	–
Brassica cf. *nigra*	0.00	0.05	–	–
Sinapis alba	0.00	0.05	–	–
Cucurbita cf. *pepo*	0.10	0.05	–	–
Cyperaceae	0.00	0.05	–	–
Citrullus cf. *lanatus*	0.10	0.00	–	–
Gramineae	0.10	0.30	–	–
Agrostis or *Muhlenbergia* sp.	0.00	0.05	–	–
Hordeum cf. *pusillum*	0.00	0.10	–	–
Triticum sp.	0.30	0.35	–	–
Zea mays	0.50	0.30	–	–
cf. *Avena sativa*	0.10	0.00	–	–
Labiatae	0.00	0.25	–	–
Leguminosae	0.10	0.20	–	–
Phaseolus vulgaris	0.00	0.05	–	–
Prosopis cf. *juliflora*	0.20	0.25	–	–
Melia azederach	0.00	0.10	–	–
Polygonum sp.	0.00	0.05	–	–
Rumex sp.	0.00	0.05	–	–
Portulaca sp.	0.10	0.15	–	–
Rubus sp.	0.10	0.15	–	–
Capsicum sp.	0.00	0.15	–	–
Solanum or *Physalis* sp.	0.00	0.20	–	–
Vitis cf. *vinifera*	0.10	0.00	–	–

Unnamed Phase of the Early Agricultural Period

Eight taxa were observed in the strata 503/504 macrobotanical assemblage from Clearwater. The most important finding is the observation of maize (*Zea mays*) cupules in significant amounts. Radiocarbon dates from maize specimens in the strata 503/504 components indicate occupations near 2100 B.C. and 1500 B.C. The observation is not surprising, because maize was also observed in pre-San Pedro phase contexts in the Sweetwater locality at Los Pozos (Gregory 2001). As shown in Table 14.1, maize was not very ubiquitous at the Sweetwater locality; in contrast, ubiquity at Clearwater (U_{maize} = 0.45) is consistent with later prehistoric maize ubiquities and suggests maize was an important component of the subsistence base of Tucson Basin forager-farmers more than 4,000 years ago.

Differences between the Clearwater site and the Sweetwater locality goosefoot ubiquities are interesting in light of the maize findings. The Clearwater ubiquity ($U_{goosefoot}$ = 0.45) was substantially lower than the Sweetwater locality ubiquity indicated in Table 14.1—a reversal of the rank of the two sites with respect to maize. This information should be used with caution at this time because the number of sites and the number of features at each site are too small to permit statistical comparison with any confidence. However, the differences may indicate a high degree of experimental variation in the relative emphasis on maize or high-density (floodplain) weeds in nascent local farming strategies. The variation could also be a consequence of a strategy that relied on foods obtained from cleared plots that were alternately farmed for maize and left fallow.

Cienega Phase

New data recovered from Clearwater during the Rio Nuevo project indicated the presence of a suite of plants similar to the assemblages from other Cienega phase sites in the Tucson Basin. Maize ubiquity is relatively high at all Cienega phase sites

($U_{\text{maize-all}} = 0.83$, $U_{\text{maize-Clearwater}} = 0.73$). Cienega phase sites contain moderate-to-high ubiquities of goosefoot, amaranth, or cheno-ams and, to a varying extent, tansy mustard and dropseed. Mesquite and various cacti (principally saguaro) also remained important.

Wild plant taxa from Cienega phase sites include a wide range of species ranging from high-density weeds to long-distance resources. The extreme diet breadth of Cienega phase (as well as the preceding San Pedro phase)—as compared with Early Ceramic period and Hohokam sites—has been suggested to be a consequence of high risks accompanying the initial efforts at agriculture in the Southwest. Eighteen taxa (17 wild taxa plus maize, not including unidentified seeds) were observed in the Clearwater assemblage. This is comparable with the Late Cienega phase mean of 20.6 taxa for other sites and greater than the 13.8 taxa mean derived from Early Cienega phase sites (including the initial Clearwater site excavations reported in Diehl 1997a).

Early Ceramic Period

A very limited sample (two features) of Early Ceramic period data was obtained from the Clearwater site (see Table 14.3). Five taxa, including saguaro cactus, cheno-ams, goosefoot, maize, and mesquite were observed. With respect to ubiquities, maize scored very high ($U_{\text{maize}} = 1.00$), although given the limited sample size, the ubiquity scores do not warrant any test of significance. Early Ceramic period sites generally have fewer taxa (mean = 12.3 taxa) than Early Agricultural period sites (mean = 14-21 taxa), and in prior studies, the difference has been found to be statistically significant (Diehl 1997b; Diehl and Waters 2005; Gregory and Diehl 2002). The samples from Clearwater replicate the general pattern from the Tucson Basin regarding changes in diet breadth, as well as continued emphasis on maize, cactus fruit, high-density weeds, and mesquite pods, and the declining use of low-density weeds, shrubs, low-density grasses, and long-distance resources. The overall decline in diet breadth from the Early Agricultural period into the Early Ceramic period has been attributed to reductions in the risk entailed in floodplain agriculture brought about through the use of higher-quality storage containers (ceramic jars) and the concomitant reduction in losses of grain in storage.

Hohokam Pioneer Period

One feature at Clearwater was identified as a Pioneer period context. The Tucson Basin trend for the Pioneer period indicates a continued reliance on cultigens (common beans, squashes, and pumpkins were known to be available by the Pioneer period) and a further decline in the use of local shrubs and long-distance weeds; there was a slight increase in the use of wild grasses. Weeds remained important, with a slight increase in the use of low-density weeds to match a slight decline in the use of high-density weeds. The cause for the shift in low- versus high-density weeds is not obvious. The increasing use of the floodplain for cultivating domestic crops may have adversely affected the availability of key floodplain weeds such as tansy mustard or dropseed. Compensation may have been attempted by substituting some of the low-density weeds for variety or for their vegetative tissues. Alternatively, if floodplain agriculture or wild seeds became less predictable in their yields, the low-density weeds and wild grasses may have seen increased use as famine foods, or as important resources for people who, by virtue of poverty of social distance, did not have access to productive floodplain fields.

Hohokam Colonial Period

Only one Colonial period feature was identified at Clearwater, so present understandings of Colonial period subsistence practices cannot be changed. In the Tucson Basin in general, diet breadth contracted further, with primary emphasis on cultigens, cacti, and high-density (floodplain) weeds. According to Upham et al. (1987), new varieties of higher-yield flour kerneled maize appeared either during the eighth century (the start of the Colonial period) or just prior to the eighth century. The reduction in diet breadth observed in Colonial period samples is attributed to increased reliance on maize and other cultigens, with the concomitant near elimination of wild grasses and most high- and low-density weeds.

No Hohokam Sedentary period features were excavated either at Clearwater or within Block 181. Therefore, the discussion advances to the Classic period, which is the next Hohokam period in the chronological sequence represented in the Rio Nuevo project assemblages.

Hohokam Classic Period

Two Classic period features were excavated at Clearwater. Unfortunately, the Hohokam Classic period is the least well-represented period in the Tucson Basin inventory. In some ways, the anecdotal evidence from Clearwater and Los Morteros, AZ AA:12:57 (ASM), suggest the Classic saw a substantial reorganization of subsistence practices, with a return to the extensive use of wild plants. Six varieties of low-density weeds and two varieties of wild grasses augmented a subsistence strategy that also used, as much as possible, cultigens, cactus fruit or agave hearts, and mesquite. The changes may be a consequence of a reduction in the need to optimize caloric yields from the entire suite of subsistence practices. Alternatively, the changes may be attributed to some combination of declining floodplain quality, insufficient arable land to feed local populations, or a breakdown in the social organization of food production or food exchange. Any of these latter events would have increased the risk for vulnerable households (lacking either land or social ties to productive farmers) and would have caused the increased use of low-quality foods to avoid starvation.

Historic Era Occupations

The arrival of the Spaniards and later, the Americans, resulted in the introduction of a whole range of new technologies, new crops, and animal husbandry that greatly increased the yield potential and the range of resources that could be grown in the Tucson Basin. The Spaniards introduced primary staples, including wheat, peaches, oats, new varieties of squash, various fodders, and (possibly) apples. Emigrating Americans and Chinese expanded the range of taxa to include, for example, condiments (mustard, black mustard), grains (new varieties of maize, wheat, oats, rye), cover crops (typically clover, hay), new fruits (cantaloupes, dates, figs, olives, plums, raspberries, tomatoes, vine grapes, watermelons), nut masts (pecans, walnuts, pistachios), ornamental plants (China-berry, morning-glory, Osage-orange, Russian olive), vegetable crops (cabbages, lettuces), root or tuber crops (beets, carrots, potatoes), and pests (Russian thistle, tamarisk) (Diehl et al. 2002, 2003).

Ethnic and class variation evidence in Tucson lifeways remains in a nascent state of research. Studies are ongoing, although there is considerable evidence indicating historically documentable Spanish food preferences are evident in Spanish period and high-status Mexican period or Mexican-American assemblages. In particular, the Spanish and high-status Mexican preference for wheat rather than maize (Pilcher 1998; Super 1988) has been noted in previous studies of Tucson Presidio samples and high-status Mexican households (Diehl et al. 2005), as well as in the new samples recovered from the Mission Gardens and the Tucson Presidio. Chinese preferences for a very diverse diet (Chang 1977) are also evident (Diehl et al. 1998).

The abundance of different categories of foods in the Spanish period and more recent assemblages seems not to require a substantial explanation, because historical records show that Native Americans favored many of the new taxa. These taxa allowed double-cropping (as with winter wheat and maize) and they were flavorful, novel, and desirable (as with most of the new fruit taxa). Watermills for grinding grain and later mechanical, machine-driven mills eliminated the last bottlenecks in the energetic returns from grain consumption and ended the need to optimize food consumption solely based on energy returns. Impoverished people working as wage laborers may have continued to optimize, however, because some of the more desirable new cultivars (such as peaches) may have been beyond the day-to-day reach of their limited means.

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CHAPTER 15

POLLEN ANALYSIS OF THE CLEARWATER SITE, AZ BB:13:6 (ASM)

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INTRODUCTION

Pollen analysis of 52 sediment samples from the Clearwater site, AZ BB:13:6 (ASM), was conducted as part of the Rio Nuevo Archaeology project. The analysis confirms some patterns in the regional archaeological pollen record and also identifies some new features. Some shifts in the represented plant taxa indicate fluctuations in water table levels related to climatic changes or intensive irrigation.

Setting

The Clearwater site is located in the historic-era floodplain of the Santa Cruz River, 730 m elevation, 32°, 13' N; 110°, 59' W. Mean annual precipitation in Tucson, Arizona, is 287 mm, mean annual (monthly) temperature is 19.2°C (Sellers and Hill 1974). Pre-urban upland vegetation of the Tucson Basin would have been classified as Arizona Upland division of the Sonoran Desert. Characteristic plants included creosotebush (*Larrea tridentata*), paloverde (*Cercidium microphyllum*), and saguaro (*Cereus gigantea*) (Brown 1982).

Prehistoric streamside vegetation of the Santa Cruz River included trees such as cottonwood (*Populus*), ash (*Fraxinus*), willow (*Salix*), sycamore (*Platinus*), and walnut (*Juglans*), and herbaceous plants such as cattail (*Typha* spp.) and bulrushes (*Scirpus* spp.) (Davis 1994b). Arid reaches were dominated by members of the Chenopodiaceae family—including saltbush (*Atriplex canescens, A. polycarpa*) and pigweed (*Chenopodium album*), as well as carelessweed (*Amaranthus palmeri*). Dry cienega vegetation may also have been dominated by ragweeds (*Ambrosia psilostachya, A. trifida*) (Martin 1963).

Previous Studies

Pollen analysis has been performed for many archaeological sites in the Tucson Basin, spanning the Archaic and Ceramic periods and the Historic era (Figure 15.1; Table 15.1). Sites near stream channels (riparian) are more common, although upland sites (far from streams) have also been studied. The upland samples generally have lower pollen concentrations and higher percentages of deteriorated pollen. The pollen assemblages of upland sites are typically dominated by bursage (*Ambrosia*) and sunflower (other Compositae) pollen types, and sites from floodplain settings are usually dominated by the Chenopodiaceae-*Amaranthus* pollen type (see Table 15.1). Although all three of these dominant pollen types are produced by various species of weeds, they are also produced by important components of the natural vegetation.

The pollen of weeds such as spiderling (*Boerhaavia*), spurge (*Euphorbia*), globemallow (*Sphaeralcea*), and tidestroemia (*Tidestroemia*) is common in pollen samples from archaeological sites in the Tucson Basin. Ordinarily, the combined abundance is less than 5 percent, with individual values over 2 percent found usually restricted to permanent habitations. However, abundances over 20 percent have been reported (Fish 1985).

The pollen of cultivated plants is often present in Tucson Basin archaeological samples. Maize (*Zea*) pollen is generally the most abundant cultigen, although it shows considerable variability among samples from the same site. Often, only one or two grains are found, but values over 40 percent have been reported from artifacts and major habitation sites (Davis 1998).

The two archaeological sites closest to Clearwater with palynological investigations are Julian Wash, AZ BB:13:17 (ASM) (Davis 1998), and Tumamoc Hill, AZ AA:16:6 (ASM) (Davis 2004) (see Figure 15.1). These follow the pattern of other southern Arizona archaeological samples in that the Julian Wash samples are dominated by Chenopodiaceae-*Amaranthus* pollen and Tumamoc Hill samples are dominated by bursage (*Ambrosia*) and sunflower (other Compositae) pollen. Both sites have occasional pollen of streamside (riparian) vegetation. Julian Wash samples contain less than 1 percent fern spores in two of 17 samples, and Tumamoc Hill samples contain less than 1 percent fern spores in seven of 41 samples.

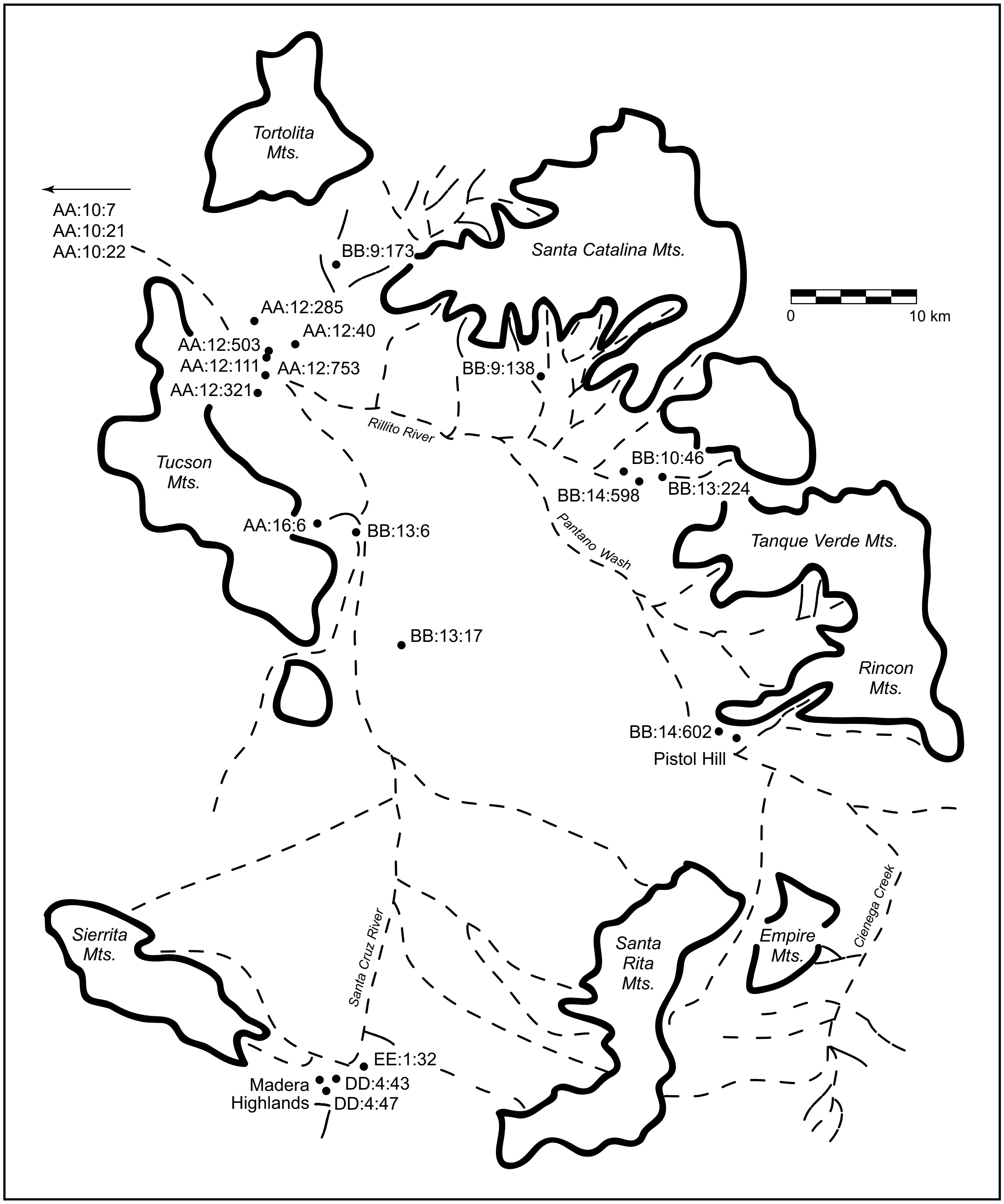

Figure 15.1. Map of the Tucson Basin, showing location of archaeological sites for which pollen analyses have been completed.

METHODS

Pollen was extracted from the sediment samples by routine acid digestion (Table 15.2). One *Lycopodium* tablet (13,911 spores) was added to each sample (volume = 5 cm^{-3}) to permit calculation of pollen concentration.

Quantification

The pollen sum—the divisor for calculating pollen percentages—includes all upland plants. Pollen of aquatic plants, spores of ferns and fungi, algae, charcoal, and other microfossils are not included in this sum. Although 300 grains, the desired goal, could

Table 15.1. Comparative pollen statistics for southern Arizona archaeological sites. (The samples are arranged by site number, riparian sites first and upland sites last.)

AZ (ASM) Site No.	Habitat	Reference	Age	Concentration (grains/cc)	Deterioration (percent)	Cheno-am (percent)	Ambrosia (percent)	Composites (percent)
AA:12:111	Riparian	Davis 2001	Archaic-modern	800-285,200	3-54	28-86	1-11	0-25
AA:12:285	Riparian	Fish 1992	Pioneer	–	–	14-74	–	6-32
AA:12:40	Riparian	Davis 1997b	Rincon	2,700-10,500	22-50	11-45	5-44	2-10
AA:12:503	Riparian	Davis 1999c	Archaic-modern	19,000-613,000	0-10	65-97	1-5	1-19
AA:12:736	Riparian	Cummings and Moutoux 2000	Archaic-modern	390-33,600	0-8	20-90	1-25	3-55
AA:12:753	Riparian	Davis 2000	Archaic-modern	790-49,000	5-35	25-90	1-8	5-25
BB:9:120	Riparian	Davis 1983	Tanque Verde	43,100-214,500	31-72	10-54	0-10	9-17
BB:9:138	Riparian	Davis 1994a	Rincon	2,000-15,000	5-28	28-61	1-22	5-19
BB:9:173	Riparian	Davis 1996c	Rincon	300-1,000	11-17	18-31	5-15	11-19
BB:10:46	Riparian	Davis 1984a	Archaic	100-38,000	48-75	2-23	0-3	3-9
BB:13:17	Riparian	Davis 1998	Colonial-Sedentary	5,000-120,000	5-30	45-91	1-3	1-4
BB:13:224	Riparian	Davis 1984b	Rincon	11,000-82,500	10-34	30-57	1-7	12-25
BB:14:598	Riparian	Davis 1996d	Rincon	322	18	22	1	27
BB:14:602	Riparian	Davis 1997a	Classic	600-6,000	11-18	2-10	0-6	50-70
DD:4:43	Riparian	Davis 1999a	–	9,500	10	76	5-30	1-70
DD:4:47	Riparian	Davis 1999b	–	9,700-22,000	6-13	72-87	0-5	1-2
EE:1:32	Riparian	Davis 1995	Contemporary	493,000	7	87	1	1
EE:1:32	Riparian	Davis 1995	Tanque Verde	12,000-430,000	1-40	46-97	0-1	1-8
AA:10:21	Upland	Davis 1997a	Pioneer	5,900-105,400	3-29	2-49	1-80	2-50
AA:10:22	Upland	Davis 1997a	Rillito	3,100-70,250	1-47	1-53	0-71	0-51
AA:10:7	Upland	Davis 1997a	Protohistoric	3,500-24,000	1-22	1-14	1-49	9-50
AA:12:321	Upland	Davis 1996a	Pioneer	950-1,225	9-17	19-22	1-2	30-44
AA:16:6	Upland	Davis 2004	Hohokam	850- 22,730	1-14	11-43	3-27	13-47
BB:14:15	Upland	Davis 1999d	–	1,000-6,000	20-60	10-50	10-35	11-45
Modern	Upland	Davis 1995	Contemporary	3,300	0	17	22	16

not be counted for all samples, more than 1,000 microfossils are routinely recorded for each sample. Pollen clumps (aggregates) were counted as four grains, and clumps were not recorded separately. Clumps may indicate local occurrence of the plant, local processing of the plant, or animal transport of the pollen (Davis and Buchmann 1994).

The pollen concentration is calculated for the pollen sum, based on *Lycopodium* tracers added to the sample at the beginning of the extraction process. The pollen concentration is an index of preservation and the sediment accumulation rate. Low concentration, combined with poor preservation, may indicate loss of pollen through deterioration, making interpretation of the pollen assemblage questionable. Alternately, good preservation and low concentration might result from rapid accumulation of the clastic sediment matrix.

Table 15.2. Pollen extraction procedure.

(1) Add one *Lycopodium* tablet (batch #710961; 13,911 grains/tablet)
(2) Swirl solution, let stand 15-20 seconds, and screen (180-micron mesh, stainless steel) into 50-ml test tubes; rinse
(3) Add 10 ml concentrated HCl; mix; add 30 ml H_2O; mix; centrifuge; decant; water rinse
(4) Add 40 ml HF overnight or 1 hour in boiling water bath; centrifuge; decant; water rinse; transfer to 15-ml glass tubes
(5) Acetolysis[a]: centrifuge, decant, water rinse
(6) Add 10 ml 10-percent KOH 2 minutes boiling water bath; centrifuge; decant; water rinse with hot water until clear
(7) Stain with safranin "O"
(8) Transfer to labeled 1-dram shell vials
(9) Add a few drops of glycerin

[a] Acetolysis: (1) 5 ml glacial acetic acid, centrifuge and decant; (2) stir sample, add 5 ml acetic anhydride (volumetric dispenser); (3) add 0.55 ml H_2SO_4 to acetic anhydride solution (volumetric pipet), mix, centrifuge, decant into glacial acetic acid; and (4) 5 ml glacial acetic acid, centrifuge and decant.

RESULTS AND INTERPRETATION

The pollen preservation in Clearwater samples is variable and frequently poor; 300 grains of upland pollen could be counted for only nine samples (Table 15.3). The pollen concentration is also quite variable; it averages a low-moderate value of 2,690 grains/cc (grains cm^{-3}), but it ranges from 35-64,000 grains/cc. Contexts and dating of the pollen samples are provided in Table 15.4.

The diversity of pollen types is moderate considering the number of samples counted ($n = 52$). A total of 48 different pollen types and spore types are identified (Figures 15.2-15.3; see Table 15.3). The pollen assemblage is dominated by Chenopodiaceae-*Amaranthus* (average = 41 percent; range = 0-78 percent), sunflower (*Ambrosia)* (average = 16 percent), and other Compositae (average = 18 percent). The values reported here are typical for Santa Cruz floodplain sites.

The pollen of weeds (*Boerhaavia,* average <1 percent; *Eriogonum; Euphorbia; Kallstroemia;* and *Sphaeralcea*) is present in all samples, indicating constant disturbance of the site. The disturbance was likely caused by a combination of human and natural processes (periodic flooding).

Maize (*Zea*) pollen is sporadically present, and its percentages are very high in four Cienega phase samples (FN 8894, 21.9 percent; FN 8513, 10.8 percent; FN 8910, 6.9 percent; FN 8590, 4.2 percent) and one Hohokam sample (FN 6929, RNA-8, 21.7 percent) (see Figures 15.2-15.3; see Table 15.3). The eight samples containing maize pollen have slightly higher percentages (4.7 percent versus 4.3 percent) of weed pollen than the other samples from the Clearwater site.

The spores of the maize smut, *Ustilago maydis*, are present in two samples—FN 8513, 1 percent *Zea*, 2 percent *Ustilago* (Cienega phase); and FN 8064, 0 percent *Zea*, 6 percent *Ustilago* (Hohokam periods). The spores are a delicacy in Mexico, said to have been eaten by the Aztecs, called *Huitlacoche* (Gourmet Sleuth 2001). This may be the first report of this pathogen in an archaeological context. If the spores can be routinely identified in archaeological samples, they might become a supporting indicator of maize cultivation. The spore is spherical, 20-25 microns in diameter, with a relatively thick, light brown, verrucate wall. One portion of the wall is distinctly thinned.

The pollen of riparian plants and aquatic spores is present in six samples, at less than 1 percent. These abundances are similar to what has been found in other sites on the Tucson Basin floodplain (see Figure 15.1). However, fern spores are unusually abundant (average = 2 percent in 11 of 52 samples). Fern spores are more abundant than the pollen or spores of riparian plants, and the fern spores do not occur in the samples containing the pollen of riparian plants.

Nearly all the ferns in the Arizona flora are rocky-slope and cliff-face plants except species of *Dryopteris*, *Athyrium*, and *Woodwardia*, which occur in wet areas of canyons generally above 5,000 ft (to 10,000 ft) elevation (Kearney and Peebles 1951). Stream transport of fern spores from a higher elevation to the Clearwater site is possible. However, this process should also deposit the pollen and spores of riparian plants, and the fern spores do not occur in the samples containing the pollen of riparian plants. Further, other floodplain archaeological sites in the Tucson Basin (see Figure 15.1) do not record such high abundances of fern spores. The shaded north slope of A-Mountain may have once harbored ferns.

Table 15.3. Pollen counts for the Clearwater site, AZ BB:13:6 (ASM), and canal feature AZ BB:13:481 (ASM), by locus.

	San Agustín Mission (RNA-2) Features						Congress Street (RNA-8/8a) Nonfeatures			
	Cienega Phase			Spanish Period			Stratum 504			
Feature Number	32.01	62.01	65.01	177	178	203	0	0	0	0
Sample (Field Number)	5846	6673	6189	6561	6525	6627	7459	7557	7559	7563
SUM	90	247	28	303	301	301	115	3	15	60
TRACERS	345	1,230	713	190	123	437	1,017	113	106	292
CONC (grains/cc)	726	559	109	4,437	6,808	1,916	315	74	394	572
DETERIORATED	17	15	6	8	15	8	2	0	2	7
UNIDENTIFIED	0	7	5	8	1	0	0	0	0	0
Cupressaceae	1	0	0	0	0	0	0	0	0	0
Cercidium	0	0	0	0	0	0	0	0	0	0
Pinus	0	3	0	3	1	3	0	0	0	0
Prosopis	0	0	0	0	0	0	1	0	0	0
Quercus	0	0	0	0	0	0	0	0	0	0
Acacia	0	0	0	0	0	0	0	0	0	0
Agave	0	0	0	0	0	1	0	0	0	0
Cylindropuntia	0	0	0	3	0	0	0	0	0	0
Ephedra	0	0	0	0	1	0	0	0	0	1
Ericaceae	0	0	0	0	0	0	0	0	0	0
Lycium	1	11	0	0	0	0	1	0	0	0
Rhus	0	0	0	0	0	0	0	0	0	0
Rosaceae	0	0	0	0	0	0	0	0	0	0
Yucca	0	0	0	0	0	0	0	0	0	0
Ambrosia	14	31	8	26	25	14	8	0	1	3
Artemisia	0	5	0	2	0	0	0	0	0	0
Liguliflorae	0	0	0	0	2	3	1	0	0	0
Other Compositae	44	28	1	16	35	41	25	2	9	8
Gramineae	2	9	1	4	2	6	0	0	0	0
Chenopodiaceae-*Amaranthus*	20	137	7	233	216	222	69	0	2	38
Sarcobatus	0	0	0	0	0	0	0	0	0	0
Abutilon	0	0	0	0	0	0	0	0	0	0
Boerhaavia	0	0	0	0	0	1	0	0	0	2
Convolvululus	0	0	0	0	2	0	0	0	0	0
Cruciferae	0	0	0	0	1	0	0	0	1	0
Eriogonum	0	1	0	0	0	1	0	1	0	1
Euphorbia	0	0	0	0	0	0	2	0	0	0
Kallstroemia	0	0	0	0	0	0	0	0	0	0
Leguminosae	0	0	0	0	0	0	0	0	0	0
Lilliaceae	1	0	0	0	0	0	0	0	0	0
Malvaceae	0	0	0	0	0	0	6	0	0	0
Nyctaginaceae	0	0	0	0	0	0	0	0	0	0
Phacelia	0	0	0	0	0	0	0	0	0	0
Plantago	0	0	0	0	0	1	0	0	0	0
Polygonum	0	0	0	0	0	0	0	0	0	0
Sphaeralcea	0	0	0	0	0	0	0	0	0	0
Tribulus	0	0	0	0	0	0	0	0	0	0
Zea	0	0	0	0	0	0	0	0	0	0
Cyperaceae	0	0	0	0	1	0	0	0	0	0
Typha	0	0	0	0	0	0	0	0	0	0
Fraxinus	0	0	0	0	0	0	0	0	0	0
Salix	0	0	0	0	1	0	0	0	0	0
Populus	0	0	0	0	0	0	0	0	0	0
Equisetum	0	0	0	0	0	0	0	0	0	0
Fern Spores	5	4	1	1	0	0	1	0	0	0
Concentricystes	0	0	0	0	0	2	0	0	0	0
Ustilago	0	0	0	0	0	0	0	0	0	0
Thecaphora	4	4	0	3	16	15	6	1	1	12
Fungal spores	277	411	123	587	597	966	297	1	124	355
Arthropod feces	25	7	0	1	26	57	2	0	42	69
Charcoal	91	2,771	1,866	792	42	340	182	0	27	51

Table 15.3. Continued.

	Congress Street (RNA-8/8a) Nonfeatures (Continued)			Congress Street (RNA-8/8a) Features				
	Stratum 503	Stratum 502		Stratum 504				
Feature Number	0	0	0	506	516	581	584	599
Sample (Field No.)	7,562	7,560	7,561	6,879	6,927	7,487	7,497	7,517
SUM	38	57	68	18	5	55	16	279
TRACERS	112	88	100	99	142	866	475	1,091
CONC (grains/cc)	944	1,802	1,892	506	98	177	94	711
DETERIORATED	2	3	6	1	0	7	5	9
UNIDENTIFIED	0	0	0	0	0	0	2	8
Cupressaceae	0	0	0	0	0	0	0	0
Cercidium	0	0	0	0	0	0	0	0
Pinus	2	5	4	0	0	0	0	0
Prosopis	0	0	0	0	0	0	0	0
Quercus	0	0	0	0	0	0	0	0
Acacia	0	0	0	0	0	0	0	0
Agave	0	0	0	0	0	0	0	0
Cylindropuntia	0	0	0	0	0	0	0	0
Ephedra	0	0	0	0	0	0	0	0
Ericaceae	0	1	0	0	0	0	0	0
Lycium	0	0	1	0	0	0	0	0
Rhus	0	0	0	0	0	0	0	0
Rosaceae	0	0	0	0	0	0	0	0
Yucca	0	0	0	0	0	0	0	0
Ambrosia	10	13	12	5	1	5	1	55
Artemisia	0	0	1	0	0	0	1	0
Liguliflorae	0	0	1	0	0	0	0	0
Other Compositae	2	4	5	1	2	10	2	23
Gramineae	3	0	0	1	0	3	0	1
Chenopodiaceae-*Amaranthus*	18	31	28	8	1	29	5	172
Sarcobatus	0	0	0	0	0	0	0	0
Abutilon	0	0	0	0	0	1	0	0
Boerhaavia	0	0	0	0	1	0	0	0
Convolvululus	0	0	0	0	0	0	0	0
Cruciferae	0	0	0	0	0	0	0	0
Eriogonum	0	0	1	0	0	0	0	1
Euphorbia	0	0	4	2	0	0	0	0
Kallstroemia	0	0	0	0	0	0	0	0
Leguminosae	1	0	0	0	0	0	0	0
Lilliaceae	0	0	0	0	0	0	0	0
Malvaceae	0	0	5	0	0	0	0	10
Nyctaginaceae	0	0	0	0	0	0	0	0
Phacelia	0	0	0	0	0	0	0	0
Plantago	0	0	0	0	0	0	0	0
Polygonum	0	0	0	0	0	0	0	0
Sphaeralcea	0	0	0	0	0	0	0	0
Tribulus	0	0	0	0	0	0	0	0
Zea	0	0	0	0	0	0	0	0
Cyperaceae	0	0	0	0	0	0	0	0
Typha	0	0	0	0	0	0	0	0
Fraxinus	0	0	0	0	0	0	0	0
Salix	0	0	0	0	0	0	0	0
Populus	0	0	0	0	0	0	0	0
Equisetum	0	0	0	0	0	0	0	0
Fern Spores	0	1	1	0	0	0	0	1
Concentricystes	1	0	0	0	0	0	0	0
Ustilago	0	0	0	0	0	0	0	0
Thecaphora	2	5	2	2	0	0	0	0
Fungal spores	778	1,320	1,279	31	55	47	98	267
Arthropod feces	18	106	50	0	0	0	15	1
Charcoal	46	32	50	4	3	3	15	27

Table 15.3. Continued.

	Congress Street (RNA-8/8a) Features (Continued)							
	Stratum 504							Hohokam Periods
Feature Number	580	580.02	580.03	608	613	624	626	308
Sample (Field No.)	7,611	7,612	7,613	7,616	7,624	7,653	7,664	6,929
SUM	32	69	104	20	31	17	71	143
TRACERS	575	1,044	1,313	582	695	1,133	1,200	613
CONC (grains/cc)	155	184	220	96	124	42	165	649
DETERIORATED	7	6	9	2	5	1	9	19
UNIDENTIFIED	4	5	4	1	5	3	5	5
Cupressaceae	0	0	0	0	0	0	0	0
Cercidium	0	0	0	0	0	0	0	0
Pinus	0	0	0	3	0	0	3	0
Prosopis	0	0	0	0	0	0	0	0
Quercus	0	0	0	0	0	0	0	0
Acacia	0	0	0	0	0	0	0	0
Agave	0	0	0	0	0	0	0	0
Cylindropuntia	0	0	6	0	1	0	0	0
Ephedra	0	0	0	0	0	0	0	0
Ericaceae	0	0	0	0	0	0	0	0
Lycium	0	0	0	0	0	0	0	0
Rhus	0	0	0	0	0	0	0	0
Rosaceae	0	0	0	0	0	0	0	0
Yucca	0	0	0	0	0	0	0	0
Ambrosia	5	16	14	0	6	3	17	19
Artemisia	1	1	1	3	0	0	2	10
Liguliflorae	0	0	0	0	0	0	0	0
Other Compositae	3	20	18	1	3	3	7	17
Gramineae	0	3	3	1	0	0	0	1
Chenopodiaceae-*Amaranthus*	11	16	34	8	10	7	14	32
Sarcobatus	0	0	1	0	0	0	2	0
Abutilon	1	1	0	0	0	0	0	0
Boerhaavia	0	0	0	0	0	0	0	0
Convolvulus	0	0	0	0	0	0	0	0
Cruciferae	0	0	0	0	0	0	0	0
Eriogonum	0	0	11	1	1	0	2	6
Euphorbia	0	0	0	0	0	0	0	0
Kallstroemia	0	0	0	0	0	0	0	0
Leguminosae	0	0	0	0	0	0	0	0
Lilliaceae	0	0	0	0	0	0	0	0
Malvaceae	0	1	0	0	0	0	0	0
Nyctaginaceae	0	0	0	0	0	0	9	3
Phacelia	0	0	0	0	0	0	0	0
Plantago	0	0	0	0	0	0	0	0
Polygonum	0	0	0	0	0	0	0	0
Sphaeralcea	0	0	1	0	0	0	1	0
Tribulus	0	0	0	0	0	0	0	0
Zea	0	0	2	0	0	0	0	31
Cyperaceae	0	0	0	0	0	0	0	0
Typha	0	0	0	0	0	0	0	0
Fraxinus	0	0	0	0	0	0	0	0
Salix	0	0	0	0	0	0	0	0
Populus	0	0	0	0	0	0	0	0
Equisetum	0	0	0	0	0	0	0	1
Fern Spores	0	0	0	0	0	0	0	0
Concentricystes	0	0	0	0	0	0	0	0
Ustilago	0	0	0	0	0	0	0	0
Thecaphora	0	0	0	0	0	1	0	0
Fungal spores	72	98	283	259	127	162	170	428
Arthropod feces	0	1	0	0	0	0	0	10
Charcoal	67	39	106	47	117	111	75	118

Table 15.3. Continued.

	Congress Street (RNA-8B) Nonfeatures						
	Stratum 504			Stratum 503		Stratum 502	
Feature Number	0	0	0	0	0	0	0
Sample (Field No.)	9,159	9,160	9,212	9,158	9,211	9,157	9,210
SUM	199	4	63	165	6	48	72
TRACERS	563	318	353	362	34	110	148
CONC (grains/cc)	983	35	497	1,268	491	1,214	1,354
DETERIORATED	25	0	9	6	0	0	1
UNIDENTIFIED	4	0	0	0	0	0	0
Cupressaceae	0	0	0	0	0	0	0
Cercidium	0	0	0	0	0	0	0
Pinus	2	0	0	1	0	2	0
Prosopis	0	0	0	0	0	0	0
Quercus	0	0	0	1	0	0	0
Acacia	0	0	0	0	0	0	1
Agave	0	0	0	0	0	0	0
Cylindropuntia	1	0	0	0	0	0	0
Ephedra	0	0	0	0	0	1	0
Ericaceae	0	0	0	0	0	0	0
Lycium	0	0	0	0	0	0	0
Rhus	0	0	0	0	0	0	2
Rosaceae	0	0	0	0	0	2	4
Yucca	0	0	0	0	0	0	0
Ambrosia	16	0	7	34	1	7	27
Artemisia	3	0	0	0	0	0	0
Liguliflorae	0	0	0	1	0	0	0
Other Compositae	24	2	42	58	4	2	4
Gramineae	5	0	0	9	1	0	0
Chenopodiaceae-*Amaranthus*	115	1	2	52	0	33	32
Sarcobatus	0	0	0	0	0	0	0
Abutilon	0	0	0	0	0	0	0
Boerhaavia	0	0	0	0	0	0	0
Convolvulus	0	0	0	0	0	0	0
Cruciferae	0	0	0	0	0	0	0
Eriogonum	3	1	0	0	0	0	1
Euphorbia	0	0	0	1	0	0	0
Kallstroemia	0	0	0	0	0	0	0
Leguminosae	0	0	0	0	0	0	0
Lilliaceae	0	0	0	0	0	0	0
Malvaceae	0	0	1	2	0	1	0
Nyctaginaceae	1	0	0	0	0	0	0
Phacelia	0	0	2	0	0	0	0
Plantago	0	0	0	0	0	0	0
Polygonum	0	0	0	0	0	0	0
Sphaeralcea	0	0	0	0	0	0	0
Tribulus	0	0	0	0	0	0	0
Zea	0	0	0	0	0	0	0
Cyperaceae	0	0	0	0	0	0	0
Typha	0	0	0	0	0	0	0
Fraxinus	0	0	0	0	0	0	0
Salix	0	0	0	0	0	0	0
Populus	0	0	0	0	0	0	0
Equisetum	0	0	0	0	0	0	0
Fern Spores	0	0	0	0	0	1	0
Concentricystes	0	0	1	0	0	0	0
Ustilago	0	0	0	0	0	0	0
Thecaphora	0	0	1	2	0	3	2
Fungal spores	104	12	373	151	48	203	332
Arthropod feces	75	0	2	6	2	67	16
Charcoal	25	5	28	6	1	7	5

Table 15.3. Continued.

	Congress Street/Brickyard (RNA-8B) Features							
	Stratum 504			Stratum 503	Cienega Phase			
Feature Number	3359	3364	3371	3374	3245.06	3270.02	3270.04	3270.05
Sample (Field No.)	9,235	9,245	9,282	9,289	8,541	8,894	8,910	8,976
SUM	8	34	159	155	21	96	72	26
TRACERS	355	374	483	648	41	271	285	400
CONC (grains/cc)	63	253	916	665	1,425	986	703	181
DETERIORATED	1	3	4	16	1	6	9	0
UNIDENTIFIED	0	0	0	1	0	3	7	0
Cupressaceae	0	0	0	0	0	0	0	0
Cercidium	0	0	0	0	0	0	0	0
Pinus	0	0	4	0	1	0	3	0
Prosopis	0	0	0	0	0	0	0	0
Quercus	0	0	0	0	0	0	0	0
Acacia	0	0	0	0	0	0	0	0
Agave	0	0	6	0	0	0	0	0
Cylindropuntia	0	0	0	0	0	0	1	0
Ephedra	0	0	0	0	0	0	0	0
Ericaceae	0	0	1	0	0	0	0	0
Lycium	0	0	0	0	0	0	0	0
Rhus	0	0	0	0	0	0	0	0
Rosaceae	0	0	1	0	0	0	0	0
Yucca	0	0	0	0	0	0	0	0
Ambrosia	0	9	9	22	4	34	29	6
Artemisia	0	0	0	2	0	0	1	0
Liguliflorae	0	0	3	0	0	0	0	0
Other Compositae	1	3	9	14	5	15	9	12
Gramineae	0	0	14	2	1	1	0	0
Chenopodiaceae-*Amaranthus*	5	15	93	97	8	16	5	2
Sarcobatus	0	0	0	0	0	0	0	0
Abutilon	0	0	0	0	0	0	0	0
Boerhaavia	0	0	0	0	0	0	0	0
Convolvululus	0	0	0	0	0	0	0	0
Cruciferae	0	0	6	0	0	0	0	0
Eriogonum	0	0	4	1	1	0	1	0
Euphorbia	0	0	0	0	0	0	0	0
Kallstroemia	0	0	0	0	0	0	0	0
Leguminosae	0	0	0	0	0	0	0	0
Lilliaceae	0	0	0	0	0	0	0	0
Malvaceae	0	3	0	0	0	0	0	6
Nyctaginaceae	0	0	0	0	0	0	2	0
Phacelia	0	0	0	0	0	0	0	0
Plantago	0	0	0	0	0	0	0	0
Polygonum	0	0	4	0	0	0	0	0
Sphaeralcea	0	0	0	0	0	0	0	0
Tribulus	1	1	0	0	0	0	0	0
Zea	0	0	1	0	0	21	5	0
Cyperaceae	0	0	0	0	0	0	0	0
Typha	0	0	0	0	0	0	0	0
Fraxinus	0	0	1	0	0	0	0	0
Salix	0	0	0	0	0	0	0	1
Populus	0	0	0	0	0	0	0	0
Equisetum	0	0	0	0	0	0	0	0
Fern Spores	0	0	0	0	0	0	0	0
Concentricystes	0	0	0	0	0	0	0	1
Ustilago	0	0	0	0	0	0	0	0
Thecaphora	0	1	1	0	3	1	0	5
Fungal spores	35	125	238	190	166	280	185	687
Arthropod feces	0	0	0	1	0	0	4	0
Charcoal	27	11	26	95	39	657	279	4,345

Table 15.3. Continued.

	Brickyard (RNA-8B) Features (Continued)					
	Cienega Phase (Continued)					Cienega Phase Canal
Feature Number	3294.01	9168	9357	9357	9372	140
Sample (Field No.)	8,917	8,590	8,504	8,416	8,513	6,825
SUM	27	120	300	122	192	72
TRACERS	158	200	436	309	201	300
CONC (grains/cc)	475	1,669	1,914	1,098	2,658	668
DETERIORATED	2	4	15	7	40	7
UNIDENTIFIED	1	0	15	6	0	0
Cupressaceae	0	0	0	0	1	0
Cercidium	0	0	0	0	0	1
Pinus	0	0	0	2	0	0
Prosopis	0	0	0	0	1	0
Quercus	0	0	0	0	0	0
Acacia	0	0	0	0	1	0
Agave	0	4	0	0	0	0
Cylindropuntia	1	0	1	7	1	1
Ephedra	0	0	0	0	0	0
Ericaceae	0	0	0	0	0	0
Lycium	0	0	0	0	0	0
Rhus	0	0	0	0	0	0
Rosaceae	0	3	0	0	0	0
Yucca	0	5	0	0	0	0
Ambrosia	7	30	143	39	5	24
Artemisia	0	0	6	4	0	0
Liguliflorae	0	3	0	0	1	0
Other Compositae	4	9	28	22	21	12
Gramineae	1	0	41	1	10	1
Chenopodiaceae-*Amaranthus*	9	46	50	32	77	23
Sarcobatus	0	0	0	0	0	0
Abutilon	0	0	0	0	0	0
Boerhaavia	0	3	0	0	6	1
Convolvululus	0	0	0	0	0	0
Cruciferae	0	0	0	0	0	0
Eriogonum	2	0	1	0	0	0
Euphorbia	0	0	0	0	0	0
Kallstroemia	0	1	0	2	0	0
Leguminosae	0	0	0	0	0	0
Lilliaceae	0	0	0	0	0	0
Malvaceae	0	6	0	0	0	0
Nyctaginaceae	0	1	0	0	0	0
Phacelia	0	0	0	0	0	0
Plantago	0	0	0	0	0	0
Polygonum	0	0	0	0	0	0
Sphaeralcea	0	0	0	0	2	0
Tribulus	0	0	0	0	0	0
Zea	0	5	0	0	20	1
Cyperaceae	0	0	0	0	0	0
Typha	0	0	0	0	0	0
Fraxinus	0	0	0	0	0	0
Salix	0	1	0	0	0	0
Populus	0	0	0	0	0	0
Equisetum	0	0	0	0	0	0
Fern Spores	1	0	0	0	0	0
Concentricystes	0	0	0	0	0	1
Ustilago	0	0	0	0	2	0
Thecaphora	0	1	0	1	6	0
Fungal spores	245	541	425	465	69	24
Arthropod feces	5	0	19	1	35	11
Charcoal	135	1,742	7	668	786	266

Table 15.3. Continued.

	Mission Gardens (RNA-11) Features				Presidio (RNA-12) Feature
	Agua Caliente Phase	Hohokam Periods			Hohokam Periods
Feature Number	3014	3001	3005	3067	380
Sample (Field No.)	7,859	7,908	8,064	7,807	3,137
SUM	302	322	317	360	301
TRACERS	296	14	83	74	149
CONC (grains/cc)	2,839	63,991	10,626	13,535	5,620
DETERIORATED	6	39	20	57	7
UNIDENTIFIED	4	0	0	0	2
Cupressaceae	0	0	0	0	0
Cercidium	0	1	0	0	0
Pinus	2	0	3	7	1
Prosopis	0	1	0	0	0
Quercus	0	1	0	2	0
Acacia	0	0	0	0	0
Agave	0	0	0	0	0
Cylindropuntia	2	3	90	16	0
Ephedra	0	0	0	0	0
Ericaceae	0	1	0	0	0
Lycium	0	0	0	0	0
Rhus	0	0	0	0	1
Rosaceae	0	0	0	0	1
Yucca	0	0	0	0	0
Ambrosia	58	8	1	3	23
Artemisia	0	0	0	0	0
Liguliflorae	0	0	0	0	0
Other Compositae	6	8	11	28	7
Gramineae	0	4	2	3	2
Chenopodiaceae-*Amaranthus*	216	250	182	230	234
Sarcobatus	0	0	0	0	0
Abutilon	0	0	0	0	0
Boerhaavia	0	2	3	3	0
Convolvululus	0	0	0	0	0
Cruciferae	0	0	0	0	0
Eriogonum	0	0	0	0	8
Euphorbia	5	1	0	0	0
Kallstroemia	0	0	0	0	0
Leguminosae	0	0	0	0	0
Lilliaceae	0	0	0	0	0
Malvaceae	0	0	0	0	0
Nyctaginaceae	3	0	0	0	13
Phacelia	0	1	0	0	0
Plantago	0	0	0	0	0
Polygonum	0	0	0	0	0
Sphaeralcea	0	0	4	9	0
Tribulus	0	0	0	0	2
Zea	0	0	0	0	0
Cyperaceae	0	0	0	0	0
Typha	0	2	0	0	0
Fraxinus	0	0	0	0	0
Salix	0	0	0	0	0
Populus	0	0	1	0	0
Equisetum	0	0	0	0	0
Fern Spores	0	0	0	0	0
Concentricystes	0	0	0	0	0
Ustilago	0	0	6	0	0
Thecaphora	0	0	0	3	2
Fungal spores	157	83	41	255	157
Arthropod feces	3	8	8	1	1
Charcoal	258	237	224	482	200

Table 15.4. Loci, contexts, and dating of pollen samples from the Rio Nuevo Archaeology project.

Field Number	Feature Number	Feature Type	Context	Comments
RNA-2 Mission Locus, Clearwater Site, AZ BB:13:6 (ASM)				
Cienega phase features (800 B.C.-A.D. 50)				
5846	32.01	Intramural feature	30	Collected from base of bell pit in pit structure
6673	62.01	Intramural feature	30	Collected from base of small pit in pit structure
6189	65.01	Intramural feature	30	Collected from base of bell pit in pit structure
Spanish period features (A.D. 1775-1821)				
6561	177	Large extramural pit	50	Collected from base of large extramural pit
6525	178	Large extramural pit	50	Collected from base of large extramural pit
6627	203	Large extramural pit	50	Collected from base of large extramural pit
RNA-8 and 8A Congress Street and Brickyard Loci, Clearwater Site, AZ BB:13:6 (ASM)				
Stratum 504 nonfeature (circa 2100 B.C.)				
7459	0	Natural stratum	504	Collected from natural stratum
7557	0	Natural stratum	504	Collected from natural stratum
7559	0	Natural stratum	504	Collected from natural stratum
7563	0	Natural stratum	504	Collected from natural stratum
Stratum 503 nonfeature (circa 2100-1200 B.C.?)				
7562	0	Natural stratum	503	Collected from natural stratum
Stratum 502 nonfeature (circa 1200 B.C.-A.D. 50?)				
7560	0	Natural stratum	502	Collected from natural stratum
7561	0	Natural stratum	502	Collected from natural stratum
Stratum 504 features (circa 2100 B.C.)				
6879	506	Possible pit structure	10	Collected from fill of possible pit structure
6927	516	Pit structure	10	Collected from fill of pit structure
7487	581	Pit structure	10	Collected from fill of pit structure
7497	584	Small extramural pit	50	Collected from fill of small extramural pit
7517	599	Small extramural pit	50	Collected from base of small extramural pit
7611	580	Pit structure	20	Collected from floor of pit structure
7612	580.02	Intramural feature	30	Collected from base of small pit in pit structure
7613	580.03	Intramural feature	30	Collected from base of small pit in pit structure
7624	608	Pit structure	20	Collected from floor of pit structure
7616	613	Small extramural pit	50	Collected from base of small extramural pit
7653	624	Small extramural pit	50	Collected from base of small extramural pit
7664	626	Small extramural pit	50	Collected from base of small extramural pit
Hohokam periods features (A.D. 750-1450)				
6929	308	Pit structure	20	Collected from floor of pit structure
RNA-8B Congress Street and Brickyard Loci, Clearwater Site, AZ BB:13:6 (ASM)				
Stratum 504 nonfeature (circa 2100 B.C.)				
9159	0	Natural stratum	504	Collected from natural stratum
9160	0	Natural stratum	504	Collected from natural stratum
9212	0	Natural stratum	504	Collected from natural stratum
Stratum 503 nonfeature (circa 2100-1200 B.C.?)				
9158	0	Natural stratum	503	Collected from natural stratum
9211	0	Natural stratum	503	Collected from natural stratum

Table 15.4. Continued.

Field Number	Feature Number	Feature Type	Context	Comments
RNA-8B Congress Street and Brickyard Loci, Clearwater Site, AZ BB:13:6 (ASM) (continued)				
Stratum 502 nonfeature (circa 1200 B.C.-A.D. 50?)				
9157	0	Natural stratum	502	Collected from natural stratum
9210	0	Natural stratum	502	Collected from natural stratum
Stratum 504 features (circa 2100 B.C.)				
9235	3359	Pit structure	20	Collected from floor of pit structure
9245	3364	Pit structure	20	Collected from floor of pit structure
9282	3371	Pit structure	20	Collected from floor of pit structure
Stratum 503 features (circa 2100-1200 B.C.?)				
9289	3374	Small extramural pit	50	Collected from base of small extramural pit
Cienega phase features (800 B.C.-A.D. 50)				
8541	3245.06	Intramural feature	30	Collected from base of possible small pit in pit structure
8894	3270.02	Intramural feature	30	Collected from base of bell pit in pit structure
8910	3270.04	Intramural feature	30	Collected from base of bell pit in pit structure
8976	3270.05	Intramural feature	30	Collected from base of bell pit in pit structure
8917	3294.01	Intramural feature	30	Collected from base of possible hearth in pit structure
8590	9168	Pit structure	20	Collected from floor of pit structure
8504	9357	Pit structure	20	Collected from floor of pit structure
8416	9357	Pit structure	20	Collected from floor of pit structure
8513	9372	Pit structure	20	Collected from floor of pit structure
RNA-8B Canal at Brickyard Locus, AZ BB:13:481 (ASM)				
Cienega phase features (800 B.C.-A.D. 50)				
6825	140	Canal	59	Collected from canal sediments
RNA-11 Mission Gardens Locus, Clearwater Site, AZ BB:13:6 (ASM)				
Agua Caliente phase features (A.D. 50-500)				
7859	3014	Pit structure	20	Collected from floor of pit structure
Hohokam periods features (A.D. 750-1450)				
7908	3001	Large extramural pit	50	Collected from base of large extramural pit
8064	3005	Pit structure	20	Collected from floor of pit structure
7807	3067	Large extramural pit	50	Collected from base of large extramural pit
RNA-12 Presidio Locus, Tucson Presidio, AZ BB:13:13 (ASM)				
Hohokam periods features (A.D. 750-1450)				
3137	380	Possible pit structure	20	Collected from floor of possible pit structure

Pollen diagrams from stratigraphic sequences of the Congress Street/Brickyard loci (RNA-8) are shown in Figure 15.2. Three strata are identified at each of three loci and are dated (uncalibrated radiocarbon ages): Stratum 502, 2600-2000 ^{14}C yr b.p.; Stratum 503, 3300-3200 ^{14}C yr b.p.; and Stratum 504, 3700-3600 ^{14}C yr b.p. (Chapter 19, this report). The combined diagram for all three strata and all three loci (see Figure 15.2) shows higher percentages of deteriorated pollen and weed pollen in Stratum 504, and a greater abundance of *Pinus* and *Ambrosia* pollen in strata 503 and 502. Gramineae (grass) pollen is most frequent in Stratum 503, as are the spores of the aquatic algae *Concentricystes*.

The samples from Block 5 and Trench 277 show transitions from "Other Compositae" dominance in

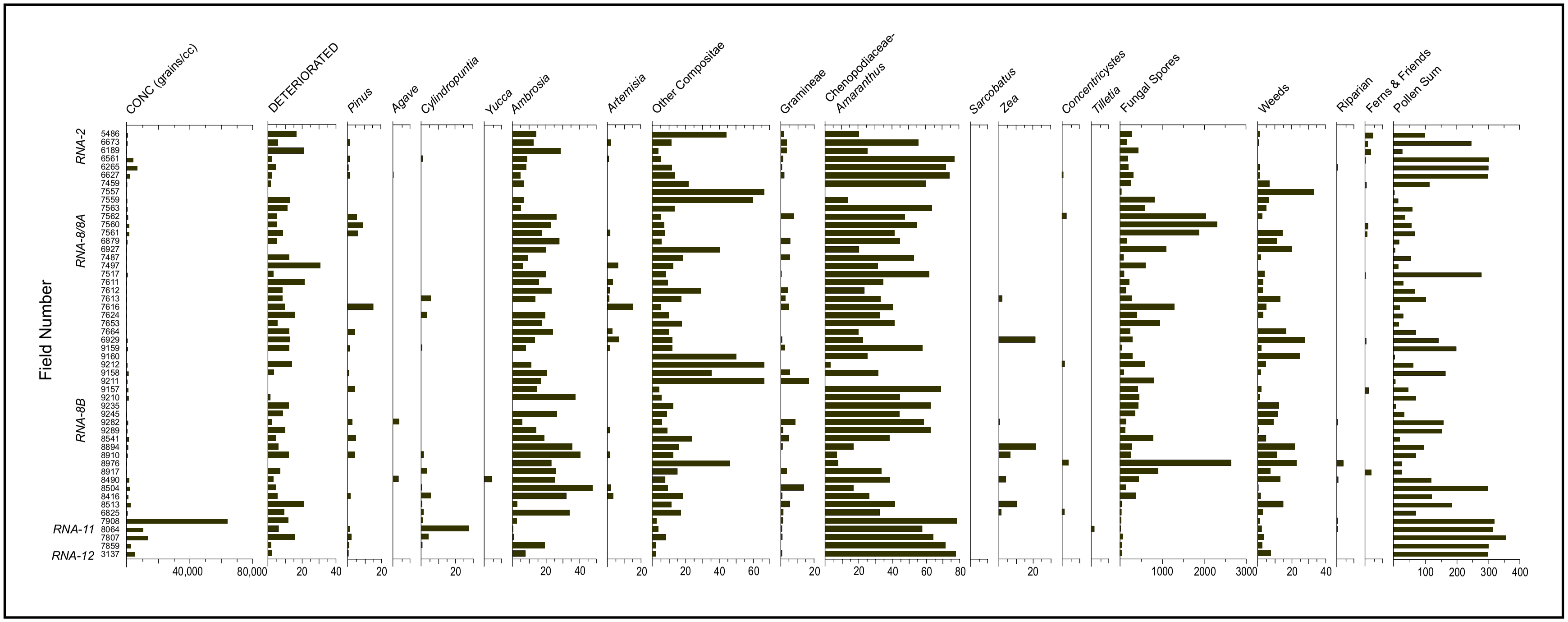

Figure 15.2. Pollen diagram for the Clearwater site, AZ BB:13:6 (ASM), Tucson, Pima County, Arizona. (Only the most abundant of the 48 types are shown; combined values for riparian-aquatic and for fern spores are shown at left.)

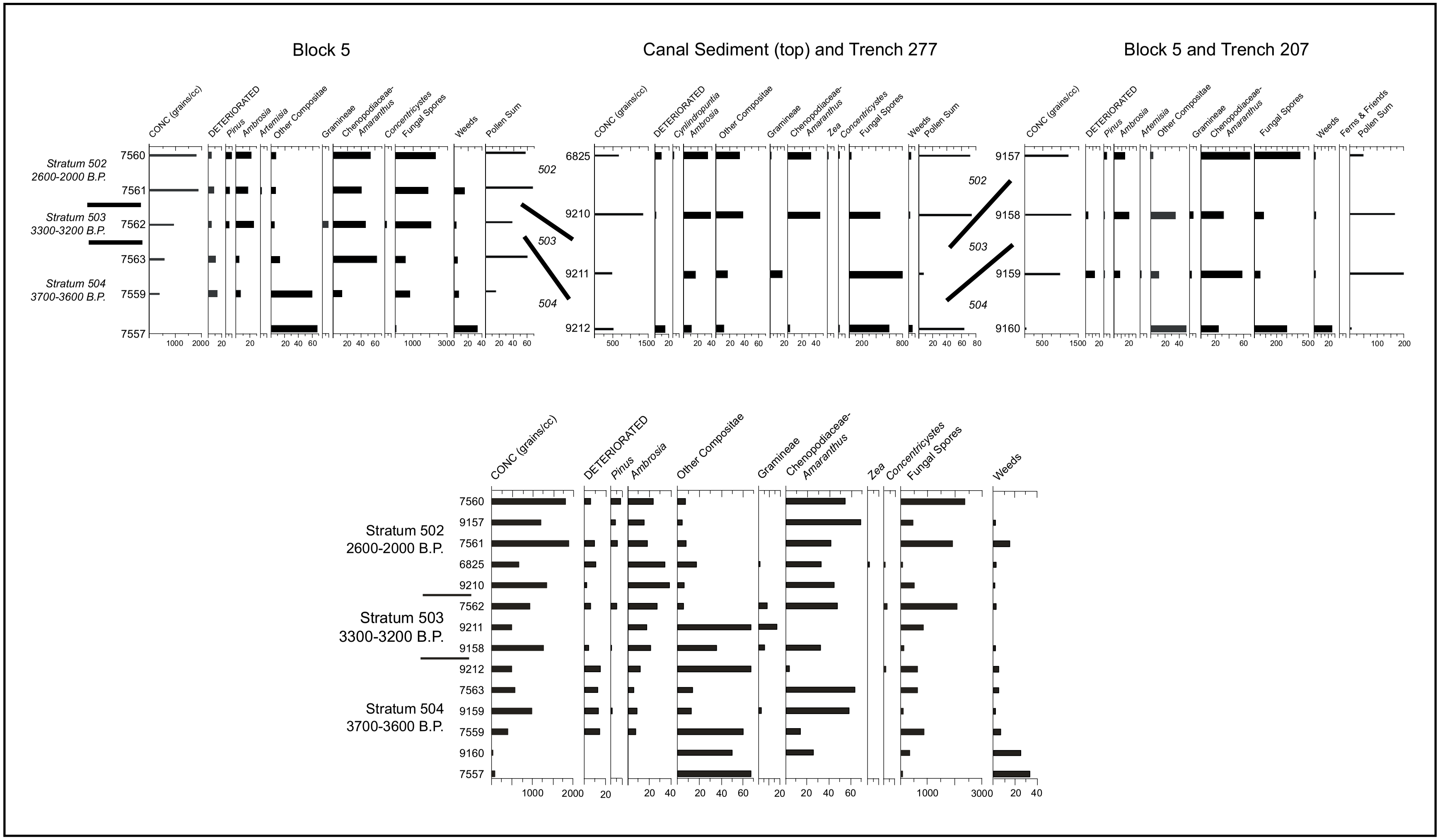

Figure 15.3. Pollen diagrams for selected loci at RNA-8, the Clearwater site, AZ BB:13:6 (ASM), Tucson, Pima County, Arizona. (Each profile spans the three Early Agricultural period stratigraphic units of the site: strata 502, 503, and 504; note uncalibrated radiocarbon ages of each stratum at left.)

strata 504 and 503 to Chenopodiaceae-*Amaranthus* dominance in Stratum 502 (see Figure 15.2). The Trench 207 profile does not show this same transition, possibly due to vegetation patterns specific at that location. However, the combined diagram (see Figure 15.2) shows the transition occurring within Stratum 503. Although the "Other Compositae" versus Chenopodiaceae-*Amaranthus* contrast characterizes the difference between upland and floodplain sites (see Table 15.2), within the floodplain, Chenopodiaceae-*Amaranthus* dominance is associated with a dry floodplain surface. For example, in the Empire Cienega, in an undissected floodplain, Chenopodiaceae-*Amaranthus* frequencies drop to less than 10 percent where *Ambrosia* or other Compositae plants dominate (Martin 1963).

According to the Santa Cruz River alluvial chronology (Waters and Haynes 2001; Chapter 20, this report), strata 504 and 503 were deposited during a period of channel filling in many reaches of the floodplain, separated from Stratum 502 by a cycle of incision dated about 2600 ^{14}C yr b.p. Elevated "Other Compositae" values in Strata 504 and 503 could reflect vegetation on an unentrenched floodplain, and high Chenopodiaceae-*Amaranthus* percentages might reflect vegetation on an entrenched floodplain during upper Stratum 502 channel filling.

However, upper Stratum 502 is a cienega deposit, which indicates the presence of a high water table. The elevated abundance of grass pollen in Stratum 503, and the sporadic appearance of *Concentricystes* spores (see Figure 15.2), may indicate greater available moisture 3300-3200 ^{14}C yr b.p. This wet period may correlate with the high stand of Lake Cochise, southeastern Arizona, dated circa 4000-3000 ^{14}C yr b.p. (3190±60 ^{14}C yr b.p.) (Waters 1989), and with the high stand of Silver Lake, southeastern California (3620±70 ^{14}C yr b.p.) (Enzel et al. 1989). In addition to this evidence of increased effective moisture in southwestern North America, an important, non-climatic cause of the higher water table and soil moisture levels during the time of deposition of Stratum 503 is canal irrigation, attested to by the canal found originating in this stratum and crossing Block 5 (Feature 152 of AZ BB:13:481 [ASM]).

SUMMARY

Pollen analysis is reported for 52 sediment samples from four loci within the Clearwater site. The pollen preservation is variable and frequently poor; 300 grain counts were possible for only nine samples. The pollen concentration is also quite variable (average = 2,690; range = 35-64,000 grains/cc). A total of 48 different pollen and spore types have been identified.

The pollen assemblage is dominated by Chenopodiaceae-*Amaranthus* pollen (average = 41 percent; range = 0-78 percent) and sunflower pollen, *Ambrosia* (average = 16 percent) and other Compositae (average = 18 percent). The pollen of weeds (*Boerhaavia,* average <1 percent; *Eriogonum; Euphorbia; Kallstroemia;* and *Sphaeralcea*) is present in all samples, indicating constant disturbance of the site. Maize (*Zea*) pollen is sporadically present, and very high percentages are associated with four Cienega phase samples (FN 8894, 21.9 percent; FN 8513, 10.8 percent; FN 8910, 6.9 percent; FN 8590, 4.2 percent) and one Hohokam sample (FN 6929, RNA-8, 21.7 percent). The spores of the corn smut, *Ustilago maydis*, are present in two samples—FN 8513, 1 percent *Zea*, 2 percent *Ustilago* (Cienega phase), and FN 8064, 0 percent *Zea*, 6 percent *Ustilago* (Hohokam periods). The pollen of riparian plants and aquatic spores is present in six samples, at less than 1 percent. Fern spores are more common (average = 2 percent in 11 samples) than the pollen or spores of riparian plants, and they do not co-occur with the pollen of riparian plants.

The analysis of three stratigraphic sequences indicates Stratum 503 in Block 5 (dated to 3300-3200 ^{14}C yr b.p.) was deposited during a wet interval, or was kept saturated by irrigation from a nearby canal (Feature 152, BB:13:481) in use at the time.

CONCLUSIONS

The analysis of pollen samples from the Clearwater site provides a valuable addition to the archaeological palynology of the Tucson Basin. It confirms the general features found in other Tucson Basin sites, and documents, through weed pollen, the continued disturbance on the upland and streamside vegetation in the area. The abundance of maize (*Zea*) pollen, particularly in Cienega phase contexts, demonstrates ongoing agriculture near Clearwater. The analysis also provides two unique findings. The spores of the maize smut, *Ustilago maydis*, are recorded for the first time in an archaeological context, and the abundance of fern spores is greater at Clearwater than at any previously investigated Tucson Basin site. Analysis of stratigraphic sequences indicates Stratum 503, dated to 3300-3200 ^{14}C yr b.p., was deposited on an unentrenched floodplain during a wet interval, or during a period of intensive irrigation.

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CHAPTER 16

ANALYSES AND INTERPRETATIONS OF CANAL OSTRACODES

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INTRODUCTION

Until recently, it was generally accepted that canals and irrigated agriculture were introduced to the Greater Southwest from Mexico during the early development of the Hohokam culture (e.g., Cheek 1994). However, recent discoveries of buried canals in the Santa Cruz River floodplain in the Tucson Basin of southern Arizona have revealed a long sequence of prehistoric canals and canal systems that argue against this hypothesis. In the Santa Cruz floodplain near downtown Tucson, the Rio Nuevo Archaeology project investigations documented several canals dating between 1500 and 100 B.C., as well as later Prehistoric, Protohistoric, and Historic canals (see descriptions in Chapter 4, this volume). At locations downstream, in the same floodplain, canals built at various times between 1200 B.C. and A.D. 50, have been identified at the sites of Santa Cruz Bend, AZ AA:12:746 (ASM) (Mabry and Archer 1997); Costello-King, AZ AA:12:503 (ASM) (Ezzo and Deaver 1998); and Las Capas, AZ AA:12:111 (ASM) (Mabry 1999, 2002, 2006).

The earliest known canals in the Santa Cruz Valley are up to 1,500 years older than the famous canals of the Hohokam culture of southern Arizona, and they are more complex, and often larger, than the earliest canals found in central Mexico (cf. Doolittle 1990, 2004). Mabry (2005a, 2005b) proposes that these canals document the earliest attempts at water control in the Southwest, in which both surface flows and groundwater tables were successfully exploited for agriculture.

How did irrigation technology and techniques evolve in this region over the last 3,500 years? A study of canal ostracode records at Las Capas shows a shift between about 1200 and 1000 B.C., from diverting episodic flood flows, to diverting the perennial base flow of the river and operating canal headgates (Palacios-Fest and Davis 2006; Palacios-Fest et al. 2001). Since the investigations of the Las Capas canals, ostracode analysis has become a useful tool in reconstructing the history of irrigation operations in the Tucson Basin. The purpose of this study is to compare and contrast the ostracode records from the long sequence of prehistoric, protohistoric, and historic canals discovered at AZ BB:13:481 (ASM), the site number assigned to the canal segments documented during the Rio Nuevo Archaeology project.

AREAS OF INVESTIGATION

A total of 36 canals was documented under the site number BB:13:481 in four different loci during the Rio Nuevo investigations (Figure 16.1a-b; Table 16.1). Eighteen canals were exposed in the area known as the Congress Street/Brickyard loci, Clearwater site, AZ BB:13:6 (ASM), located on the western side of the Santa Cruz River, between the San Agustín Mission site to the south, and Congress Street to the north. The locus known as the San Agustín Mission, also the Clearwater site, is in downtown Tucson on the western side of the Santa Cruz River, west of Interstate 10 (I-10), east of Grande Avenue, south of Congress Street, and north of Mission Lane. Five canals were exposed in this location at the base of A-Mountain. Thirteen canals were exposed in the Mission Gardens locus, also part of the Clearwater site, west of I-10, at the southeastern corner of the intersection of Mission Road and Mission Lane. Canal feature numbers are grouped by locations and periods in Table 16.1; the canals that yielded ostracode records are shown in bold.

MATERIALS AND METHODS

Out of a total of 194 sediment samples analyzed, 91 samples (47 percent) from 25 different canals contained ostracodes. The sample sizes ranged from 43 gm to 138 gm of sediment collected from a rectanguloid excavation (roughly 1 cm thick, 2 cm long, and 2 cm deep), at microstratigraphic intervals of 2 cm to 10 cm, depending on strata thickness and availability. Sediments were stored in plastic zip-lock bags, labeled, dated, and sealed. Stratigraphic contexts

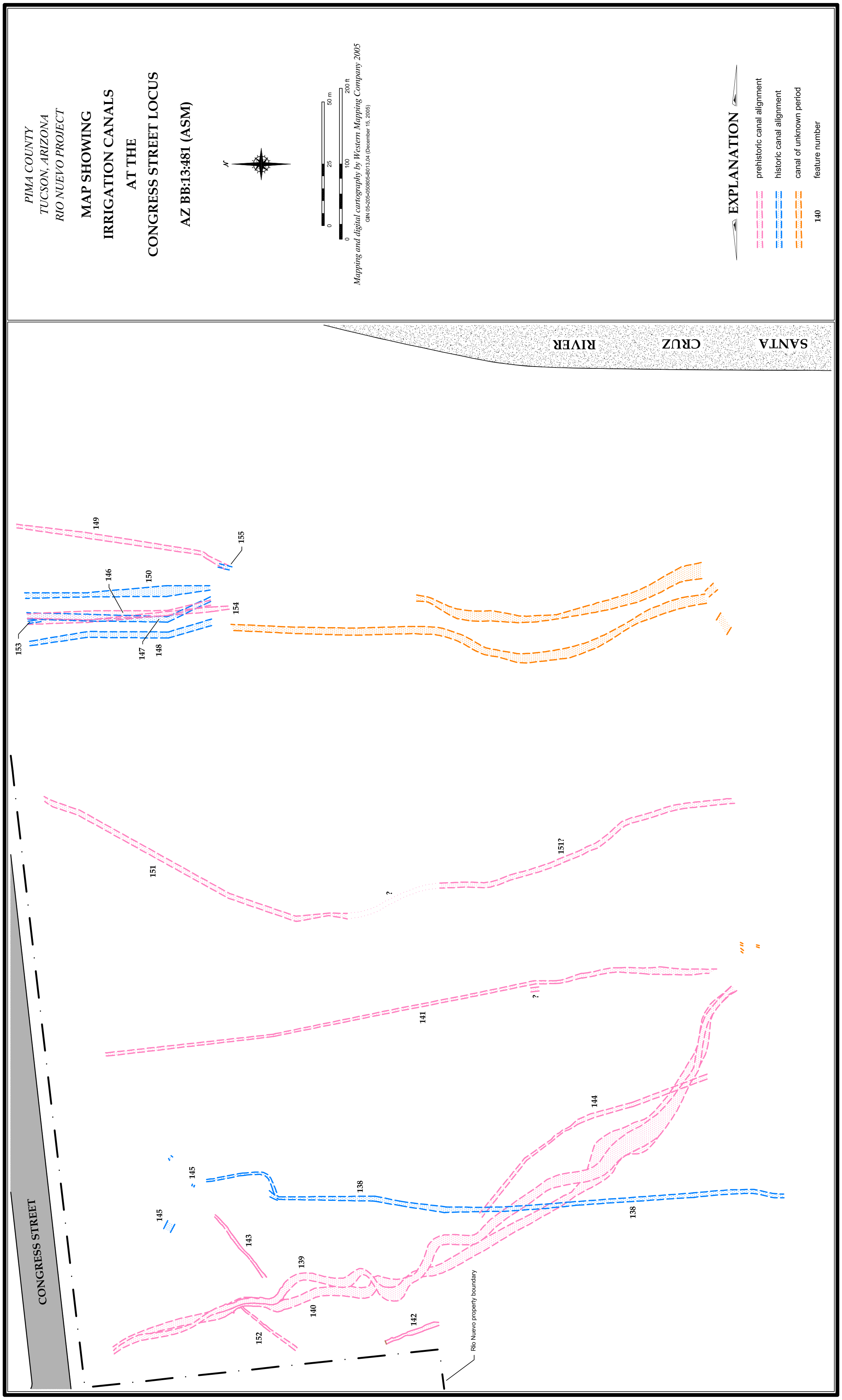

Figure 16.1a. Alignments of canals, AZ BB:13:481 (ASM), in the Congress Street/Brickyard loci, the Clearwater site, AZ BB:13:6 (ASM), identified during the Rio Nuevo Archaeology project.

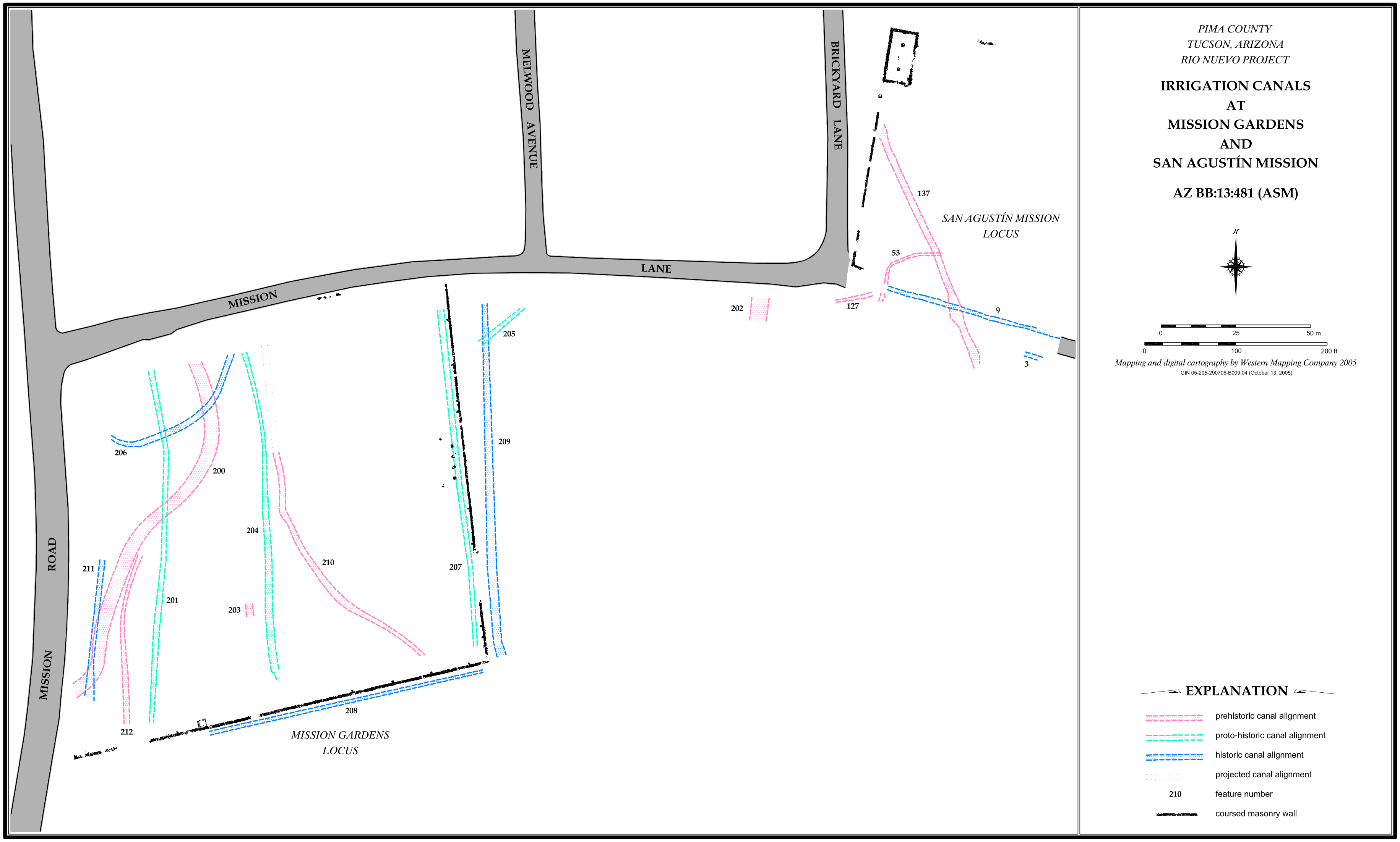

Figure 16.1b. Alignments of canals, AZ BB:13:481 (ASM), in the San Agustín Mission and Mission Gardens loci, the Clearwater site, AZ BB:13:6 (ASM), identified during the Rio Nuevo Archaeology project.

Table 16.1. Canal feature numbers at AZ BB:13:481 (ASM), by locus and period/era.

Locus	Early Agricultural	Hohokam	Protohistoric	Historic
Congress Street/Brickyard	**139, 140, 141,** 152	**142,** 143, **144, 146, 149, 151, 154**	–	**138,** 145, **147, 148, 150, 153,** 155
San Agustín Mission	**53, 127**	137	–	3, **9**
Mission Gardens	–	**200,** 202, 203, 210, 212	**201, 204, 205, 207**	**206,** 208, 209, 211

Note: Features analyzed for ostracode records in **bold**.

were marked in canal feature cross sections. Samples were prepared using routine procedures (Forester 1988), as modified by Palacios-Fest (1994). Sediment residuals were analyzed under a low-power microscope.

All fossiliferous samples were examined to identify fossil contents and faunal assemblages. Total and relative abundance was recorded. Additionally, standard taphonomic parameters, such as fragmentation, disarticulation (carapace/valve, C/V ratios), abrasion, and adult/juvenile (A/J) ratios (Delorme 1969, 1989), were recorded to establish the synecology (ecology of the communities), as opposed to the autoecology (ecology of single species) of the canals. However, autoecology was implemented to integrate the environmental framework. The specimens were placed in micropaleontological slides.

The taphonomic parameters were used to recognize degrees of transport and/or burial characteristics such as desiccation and sediment compaction. The rates of fragmentation, abrasion, and disarticulation are realistic indicators of transport; these parameters commonly show increasing damage with increasing transport. One must be cautious in using this criterion, but the nature of the deposits suggests ostracodes may reflect canal hydraulic properties.

Other features such as encrustation and coating were used to determine authigenic mineralization or stream action, respectively. The redox index and color of valves reflected burial conditions. The A/J and C/V ratios were used as indicators of biocenosis (Palacios-Fest et al. 2001).

Based on the faunal composition, a paleosalinity index was developed. The paleosalinity index considers the salinity tolerance of the species present in the canals based on current knowledge of their ecological requirements (Palacios-Fest 1994; Palacios-Fest et al. 2001). The equation used for the present study is:

SI = [4(% *Limnocythere* sp. cf. *L. paraornata*) + 3(% *Cypridopsis vidua*) + 2(% *Candona caudata*) + % *Herpetocypris brevicaudata*]-[% *Potamocypris unicaudata* + 2(% *Ilyocypris bradyi*) + 3(% *Darwinula stevensoni*) + 4(% *Physocypria pustulosa*)]

As in Palacios-Fest et al. (2001), *Limnocythere* sp. cf. *L. paraornata* is assumed here to be a salinity-tolerant species, because it is associated with cienega-like sediments but is absent during the freshwater input stages. However, Forester (personal communication 2001) indicates *L. paraornata* lives in cold, flowing waters, fresh to slightly saline (<5,000 mg l^{-1} total dissolved solids, hereafter TDS), either Ca- or HCO_3-rich waters. Its possible presence in the Southwest warm waters may expand its geographic and hydrochemical spectrum, although it could be associated with winter precipitation or snowmelt discharge. The maximum salinity tolerance for *L. paraornata* is used here as indication of the highest salinity range reached in canals in the Santa Cruz River basin.

RESULTS FROM CANALS IN THE CONGRESS STREET/BRICKYARD LOCI, THE CLEARWATER SITE, AZ BB:13:6 (ASM)

The sample identification number, stratigraphic level (measured from base of canal), bulk and residual weights, lithology, color, and color code of sediment residuals are shown in Table 16.2 (see Tables 16.2-16.5 at the end of this chapter). The samples consist primarily of pale yellowish-brown (10YR 6/2) and grayish-orange (10YR 7/4), occasionally moderate brown (5YR 3/4), gravelly sands to clay. The dominant minerals recognized in these canals are quartz, tufa (or travertine), biotite, and feldspars; fragments of charcoal, shell, and rock are also present. Pegmatite and manganese nodules are present, but rare, at the bases of canals. Other minerals occur occasionally (Table 16.3).

The biological contents of the canals and the overall taphonomic characteristics recorded are summarized in Table 16.4. Ostracodes and molluscs are the microinvertebrate groups present. The ostracode total population is provided in Table 16.5, by sample, and the total and relative abundance by species per sample. C/V and A/J ratios, by species, are also listed to establish biocenosis.

Ten species of ostracodes were identified. *Ilyocypris bradyi* was the most common and abundant, followed by *Cypridopsis vidua* and *Darwinula stevensoni*. The remaining seven species occurred only occasionally in the canals: *Herpetocypris brevicaudata*, *Limnocythere* sp. cf. *L. paraornata*, *Candona caudata*, *Candona patzcuaro*, *Physocypria pustulosa*, *Cypridopsis* sp., and *Potamocypris unicaudata*. Based on occurrence and relative abundance, three assemblages were recognized: (1) Assemblage I is dominated by *I. bradyi*, a streamflow indicator; (2) Assemblage II is dominated by *I. bradyi* and *C. vidua*, both associated with streamflow conditions; and (3) Assemblage III is dominated by *I. bradyi*, *C. vidua*, and *D. stevensoni*, reflecting long-term water permanence conditions. Assemblage I marks the beginning of water input and operation in all canals studied. Assemblage II represents a transition to more saline conditions. It occurs in canal Features 140, 146, 147, and 154. Assemblage III occurs in Features 144 and 150. The hydrochemical evolution suggested by the transition from Assemblage I to Assemblage III indicates increasing salinity; however, the water was still relatively dilute, as the *I. bradyi* and *D. stevensoni* occurrences were significant.

The presence of *D. stevensoni* at the ends of the records suggests canals held water for long periods. The faunal association is consistent with the water chemistry type I (dilute) and type II (Ca-rich, dominated by Na^+, Mg^{2+}, and SO_4^{2-}) of Eugster and Hardie (1978). Tadayon and Smith's (1994) and Tadayon's (1995) surface and groundwater analyses of the modern Rillito Creek in the Tucson Basin (sampled from August 1987 to August 1993) showed near-equivalent proportions of Ca and HCO_3, with Ca slightly dominant. This association is consistent with that suggested for canals, AZ AA:12:753 (ASM), at Las Capas (Palacios-Fest and Davis 2006; Palacios-Fest et al. 2001), and in canals at the San Agustín Mission locus (see below). Similarly, the occurrence of *Limnocythere* sp. cf. *L. paraornata* indicates a period of marshy (cienega-like) conditions.

For each canal, the sequence of species distribution and inferred paleoecology is used to interpret environmental conditions through time in the canals. The paleosalinity index developed for each canal is shown in the right-hand side of each figure. A small-to-large population (1-398 individuals per sample) and low diversity (one to eight species) characterize fossiliferous samples. Based on Delorme (1969, 1989), taphonomic parameters are used to distinguish allochthonous from autochthonous populations.

Early Agricultural Period Canals

Four canal features (Features 139, 140, 141, and 152) represent Early Agricultural period canals. Canal Feature 139, containing a charcoal fragment radiocarbon dated to 2140±40 b.p. (uncalibrated radiocarbon years before present; circa 150 B.C. calibrated) (Chapter 19, this volume), was exposed on the southern wall of Trench 201. The set of samples consisted of a reference sample (2 cm below canal base; bcb) and 12 canal fill samples, most of which contained no fossils. The top four intervals (DA-RNA8-201-139-10/13) contained ostracodes (see Table 16.5). Sediments consisted of gravelly to silty sand, gradually grading to silty clay and clay (see Table 16.2).

Fine sediments suitable for ostracodes appear sparsely some 52 cm above the canal base (acb) but settle to establish a large population at the next interval (59 cm acb). The dominant species is *I. bradyi* (Assemblage I), representing more than 90 percent of the population (Figure 16.2). The taphonomic parameters show high fragmentation and abrasion (30-100 percent) in the lower fossiliferous samples, decreasing substantially upward (5-15 percent). No signs of encrustation or coating were recorded, but the redox index ranged from strong oxidizing stains at initial stages, to no stains upward (see Table 16.4). Similarly, the A/J ratios grade from purely adult to a mixed population, upward. The C/V ratios show strong valve disarticulation. Assemblage I dominates the history of the canal (see Figure 16.2).

The set of samples collected from canal Feature 140, where it was exposed on the southern wall of

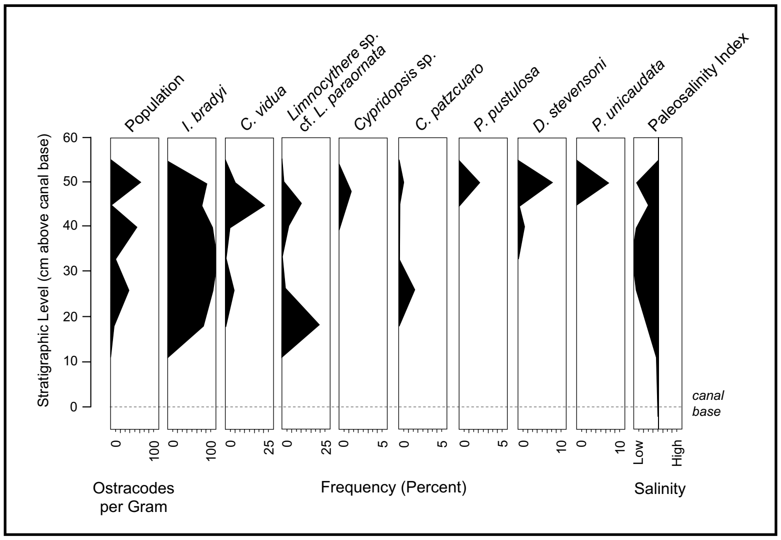

Figure 16.2. Ostracode valves per gram, relative frequencies of ostracode species, and paleosalinity index, by stratigraphic level, canal Feature 139, AZ BB:13:481 (ASM).

Trench 203, consisted of a reference sample (2 cm bcb) and seven canal fill samples, some containing a few ostracodes (1-27 specimens). Sediment textures range from gravelly sand to sandy silty clay, occasionally clay; the finer sediments were suitable to host ostracodes (see Table 16.2). Sample DA-RNA8-203-140-3 contained a stable population; other fossiliferous samples consisted of reworked specimens (see Table 16.5). The taphonomic characteristics show low-to-moderate fragmentation and abrasion (5-20 percent); no other parameters are relevant. Again, most fauna were washed into the canal, as indicated by the A/J and C/V ratios (see Table 16.4). At 10 cm acb, the biocenosis formed an Assemblage I with strong influence of *C. vidua* and *C. patzcuaro* and the occurrence of *L.* sp. cf. *L. paraornata* (Figure 16.3).

Charcoal from canal Feature 141 provided a radiocarbon date of 2470±40 b.p. (uncalibrated; circa 600 B.C. calibrated) (see Chapter 19). The set of samples collected from where it was exposed on the southern wall of Trench 219 consisted of a reference sample (2 cm bcb) and two canal in-fill samples containing no ostracodes or their fragments (see Table 16.5). Fine grain-sized sediments suitable for microinvertebrates do not explain their absence (see Table 16.2).

Canal Feature 152 is the oldest canal documented during the Rio Nuevo project; radiocarbon dates on annual plant remains from nearby pit features originating within the same stratum place the age of this canal near 1500 B.C. (see Chapter 19). The samples collected from where it was exposed on the west-southwest wall of Trench 267 consisted of a reference sample (2 cm bcb) and five canal fill samples containing no fossils or their fragments (see Table 16.5). Sediments consist of coarse-to-medium sand, rarely suitable for microinvertebrates to settle, especially ostracodes. However, toward the top of the stratigraphic sequence, particle size decreases to a sandy silt that is appropriate habitat for microinvertebrates. However, ostracodes were still absent in all samples.

Hohokam Canals

Six canal features (Features 142, 143, 144, 146, 149, and 154) can be dated to Hohokam periods based on their stratigraphic contexts. Late Rincon or Tanque Verde phase decorated sherds were collected from canal Feature 146, placing its construction between A.D. 1100-1300. Canal Feature 149 contained a variety of Classic period sherds, including Tanque Verde Red-on-brown, Sells Red, and corrugated wares, bracketing its age between A.D. 1150-1300.

Samples collected from canal Feature 142, where it was exposed on the southern wall of Trench 206, consisted of a reference sample (2 cm bcb) and five canal fill samples containing ostracodes (Figure 16.4; see Table 16.5). Seven species occur throughout the history of the canal: *I. bradyi* the most common and abundant, followed by *C. vidua* and occasionally *L.* sp. cf. *L. paraornata*, *C. patzcuaro*, *C. caudata*, *P. pustulosa,* and *P. unicaudata* (see Figure 16.4). The taphonomic parameters show low fragmentation and abrasion (5-10 percent). Evidence of authigenic mineralization and coating of the valves was recorded in some strata. The redox index ranged from no stains to light oxidizing stains. The A/J and C/V ratios indicate a stable community throughout the record. Despite some minor fluctuations, Assemblage I dominates the canal history (see Figure 16.4).

Samples from canal Feature 143 on the west-southwest wall in the Block 5 stripping area consisted of a reference sample (2 cm bcb) and three canal fill samples that held no fossils. Sediments ranged from gravelly sand to silty clay, the latter providing optimal conditions for microinvertebrates to settle. Nonetheless, no organisms or their fragments were recovered.

Samples were collected from canal Feature 144 where it was exposed on the west-northwest wall of Trench 212. The sample set consisted of a reference

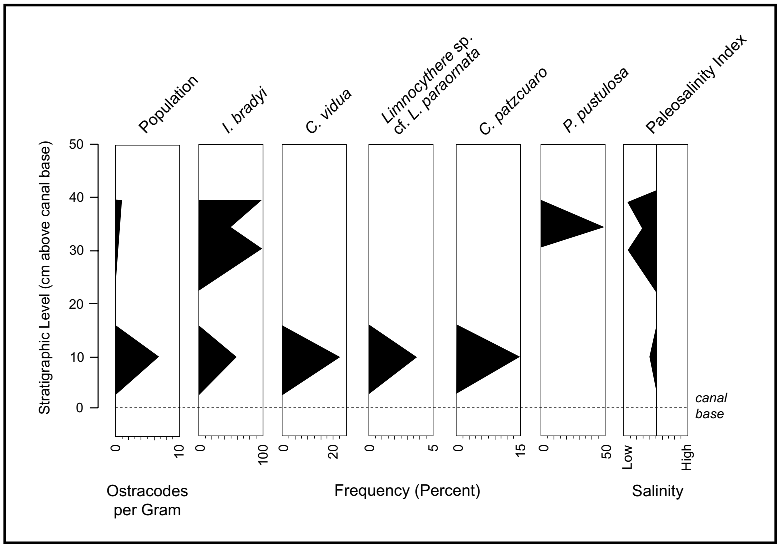

Figure 16.3. Ostracode valves per gram, relative frequencies of ostracode species, and paleosalinity index, by stratigraphic level, canal Feature 140, AZ BB:13:481 (ASM).

sample (2 cm bcb) and seven canal fill samples. Sediments consist primarily of sandy silty clay to clay suitable for microinvertebrates. Three samples—DA-RNA8-212-144-5/7—contained ostracodes. The dominant species is *I. bradyi*, representing more than 70 percent of the population, but *C. vidua*, *Cypridopsis* sp., and *D. stevensoni* became established later in the sequence (Figure 16.5). The taphonomic characteristics indicate low-to-moderate fragmentation and abrasion (5-15 percent), but no authigenic mineralization or coating. Valves are well preserved (no stains), as shown by the redox index. Adult specimens are the most abundant, but all samples include juveniles of most species (see Tables 16.3-16.4). Faunal assemblages evolved from Assemblage I to Assemblage III, and back to Assemblage I.

Canal Feature 146, exposed on the southern wall of Trench 253, provided a sample set consisting of a reference sample (2 cm bcb) and five canal fill samples. Sediments are primarily sandy silts that would have been optimal for microinvertebrates. Three samples—DA-RNA8-253-146-2/4—contained ostracodes. The dominant species, *I. bradyi,* alternates frequently with *C. vidua*, and less frequently with *H. brevicaudata* and *L.* sp. cf. *L. paraornata* (Figure 16.6). The taphonomic parameters show low-to-moderate fragmentation and abrasion (5-15 percent). No coating or authigenic mineralization is evident. The redox index shows well-preserved valves with no stains. Adults are dominant, but some species incorporated juveniles (see Tables 16.4-16.5). Throughout the record, faunal assemblages shifted from Assemblage I to Assemblage II, and returned to Assemblage I.

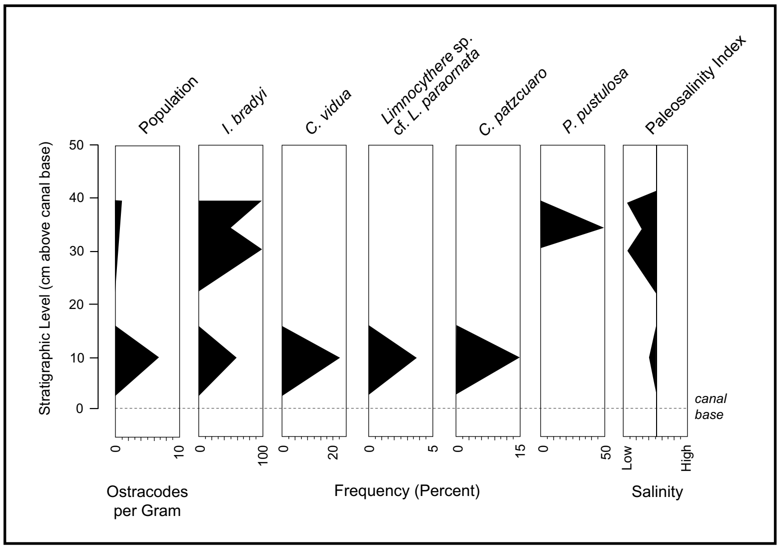

Figure 16.4. Ostracode valves per gram, relative frequencies of ostracode species, and paleosalinity index, by stratigraphic level, canal Feature 142, AZ BB:13:481 (ASM).

Samples collected from canal Feature 149 on the south-southwest wall of Trench 260 consisted of a reference sample (2 cm bcb) and six canal fill samples. Sediments range from gravelly sand to silty clay suitable for microinvertebrates. The canal was dug in cienega-like deposits. One sample, DA-RNA8-260-149-6, contained an almost monospecific ostracode record, *I. bradyi* (>96 percent), *C. vidua,* and *L.* sp. cf. *L. paraornata* (Figure 16.7). There was a low rate of fragmentation and abrasion (5-10 percent) and no evidence of coating or authigenic mineralization. Some stains are shown by the redox index. An almost-adult population was recorded (see Tables 16.4-16.5). Assemblage I entered the canal.

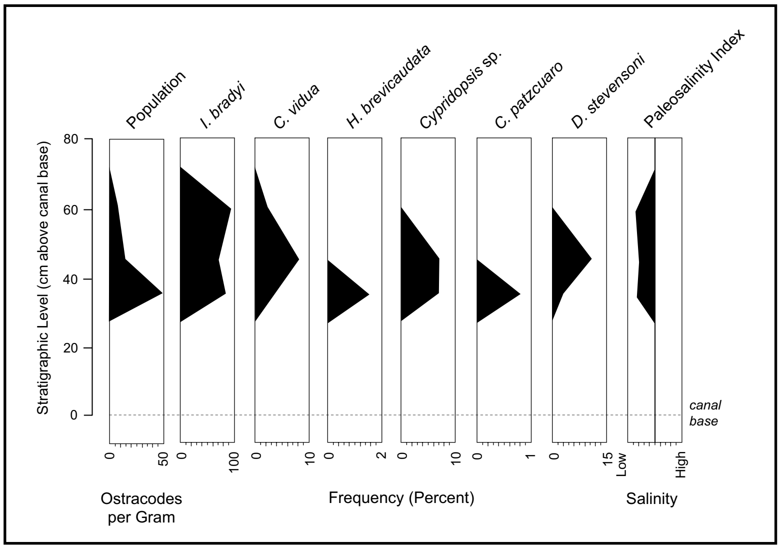

Figure 16.5. Ostracode valves per gram, relative frequencies of ostracode species, and paleosalinity index, by stratigraphic level, canal Feature 144, AZ BB:13:481 (ASM).

Samples were collected from canal Feature 154 on the southern wall of Trench 258. They consisted of two samples, one of them a reference (2 cm bcb). The canal was dug on top of a natural channel. Sediments consist of silty sand that is

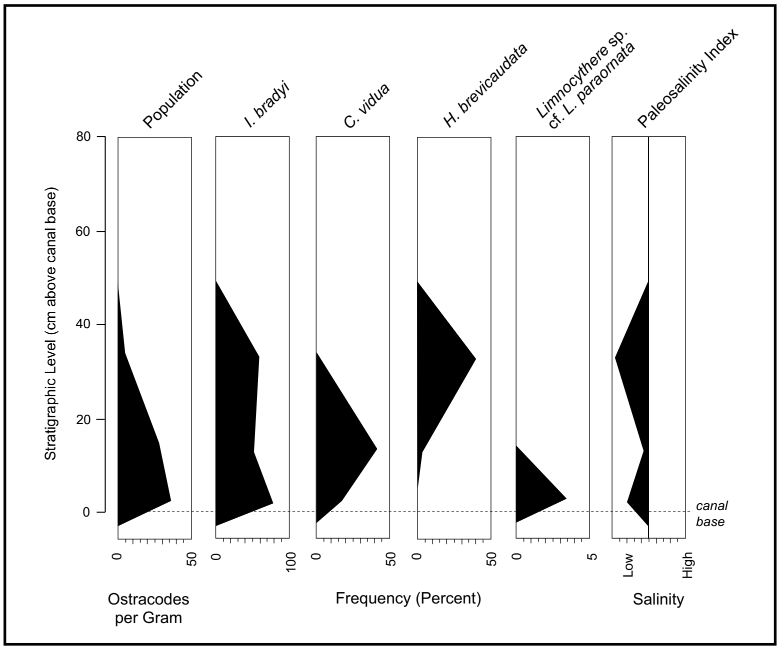

Figure 16.6. Ostracode valves per gram, relative frequencies of ostracode species, and paleosalinity index, by stratigraphic level, canal Feature 146, AZ BB:13:481 (ASM).

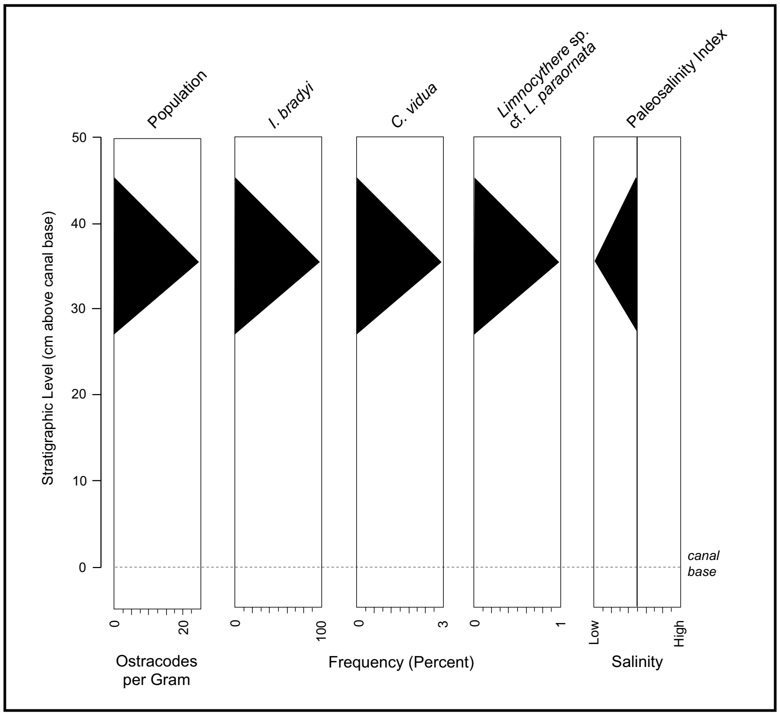

Figure 16.7. Ostracode valves per gram, relative frequencies of ostracode species, and paleosalinity index, by stratigraphic level, canal Feature 149, AZ BB:13:481 (ASM).

appropriate for microinvertebrates to settle. The two samples contained ostracodes. Surprisingly, sample DA-RNA8-258-154-1 contained some ostracodes, *I. bradyi* and *C. vidua*. This is explained by the origin of the substrate. The most diverse population is represented in sample DA-RNA8-258-154-2 (Figure 16.8), containing *I. bradyi*, *C. vidua*, *L.* sp. cf. *L. paraornata*, *Cypridopsis* sp., and *D. stevensoni*. Taphonomic parameters show low fragmentation and abrasion (5-10 percent), no authigenic mineralization or coating, and no stains (redox index). Adults dominate the assemblage, but *D. stevensoni* consisted of juveniles only (see Tables 16.4-16.5). Assemblage I entered the canal.

Historic-era Canals

Based on their stratigraphic contexts and artifact inclusions, five canal features (Features 138, 147, 148, 150, and 153) represent historic irrigation. Canal Feature 138 appears on an 1862 map as the "Acequia Madre Primera" (see Figure 1.2), and contained late nineteenth century European and Native American ceramics and other historic-era artifacts. Canal Feature 148 probably correlates with another canal shown on the 1862 map.

Samples collected from canal Feature 153 from the southern wall of Trench 258 where it overlies canal Feature 154 (see Figure 16.8) consists of two canal fill samples with a very poor ostracode record (see Table 16.5). Medium- to fine-grained sediments suitable for ostracodes are almost deprived of their fossils. A monospecific Assemblage I (*I. bradyi*) occurs in this canal. Low-to-moderate fragmentation and abrasion (5-25 percent) characterize the strata, and no other taphonomic features are relevant.

Samples from canal Feature 138 on the southern wall of Trench 202 consisted of a reference sample (2 cm bcb) and four canal fill samples

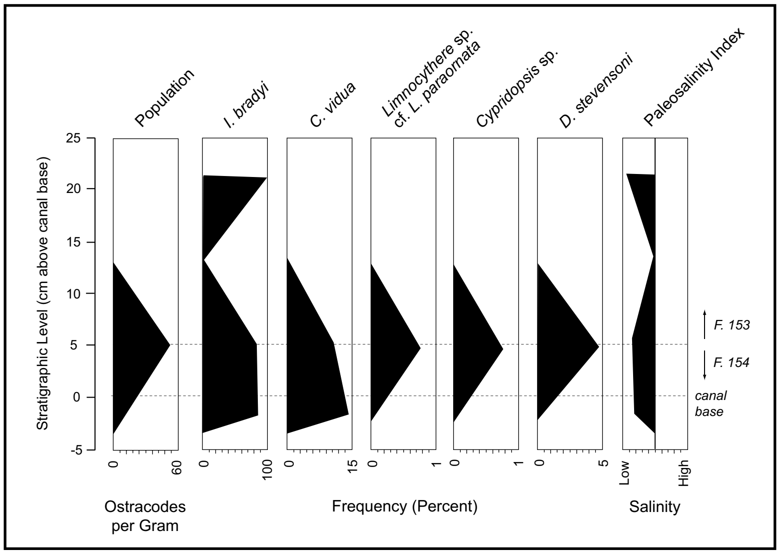

Figure 16.8. Ostracode valves per gram, relative frequencies of ostracode species, and paleosalinity index, by stratigraphic level, canal Features 153 and 154, AZ BB:13:481 (ASM).

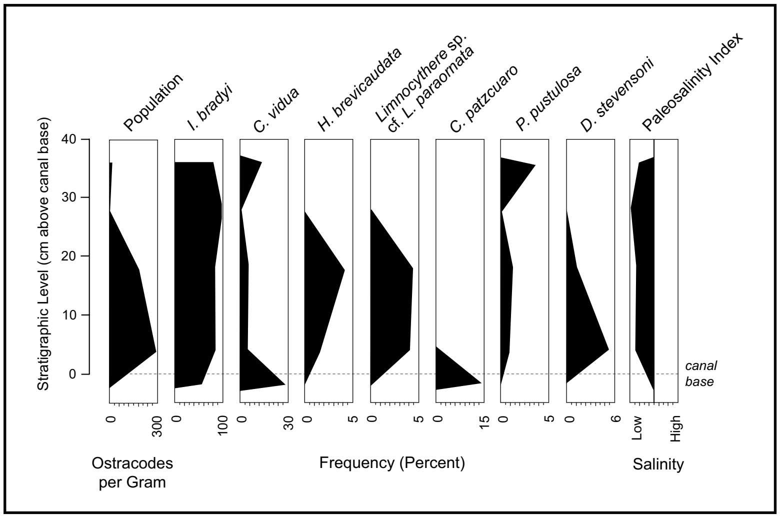

Figure 16.9. Ostracode valves per gram, relative frequencies of ostracode species, and paleosalinity index, by stratigraphic level, canal Feature 138, AZ BB:13:481 (ASM).

containing a diverse and rich ostracode fauna (see Table 16.5). Fine-grained sediments are optimal for microinvertebrates (see Table 16.2). Seven species occurred throughout the record: *I bradyi*, followed by *C. vidua* and, more randomly, *L.* sp. cf. *L. paraornata*, *P. pustulosa*, *H. brevicaudata*, and *D. stevensoni*. *C. patzcuaro* occurs only in the cienega deposits underlying the canal (Figure 16.9). Taphonomic parameters show low-to-moderate fragmentation and abrasion (5-15 percent), no authigenic mineralization or coating, but light oxidizing stains (see Table 16.4). Balanced A/J and C/V ratios characterize the sequence (see Table 16.5). Assemblage I dominates the canal history.

Canal Feature 147, on the southern wall of Trench 253, provided two canal fill samples. The feature was dug on top of the Hohokam canal Feature 146. Sediments consist of sandy silts optimal for microinvertebrates. Both samples held ostracodes, with *I. bradyi* and *C. vidua* the most abundant species. *L.* sp. cf. *L. paraornata* and *D. stevensoni* occurred occasionally (Figure 16.10). Taphonomic parameters show an increase from low-to-moderately high fragmentation and abrasion (5-30 percent). Other parameters show no or little effects on shells. For example, the redox index varies from no alteration to slightly oxidizing conditions. An adult population characterizes the sequence (see Tables 16.4-16.5). Assemblage II entered the canal, and Assemblage I replaced it until the end of the record.

Samples were collected from canal Feature 148 where it was exposed on the southern wall of Trench 253. These consisted of a reference sample (2 cm bcb) and two canal fill samples. Sediments consist primarily of silty sands suitable for microinvertebrates, but only the top sample (sandy silts) contains ostracodes—*I. bradyi*, *Cypridopsis* sp., and *D. stevensoni* (Figure 16.11). Taphonomic parameters show moderate fragmentation (15 percent) and low abrasion (5 percent), but no other effects. Adults dominate the population, but some juveniles occur (see Tables 16.4-16.5). Assemblage I settled in this canal.

Samples were collected from canal Feature 150 where it was exposed on the southern wall of Trench 253. These consisted of a reference sample (2 cm bcb) and two canal fill samples. The canal was dug into a cienega-like deposit. Upward through the sample sequence, the canal sediments grade from gravelly silty sand to silty sand. The occurrence of ostracodes in the reference sample results from the substrate origin. Five species occur: *I. bradyi*, *C. vidua*, *L.* sp. cf. *L. paraornata*, *D. stevensoni*, and *P. unicaudata* (Figure 16.12). Taphonomic features show low fragmentation

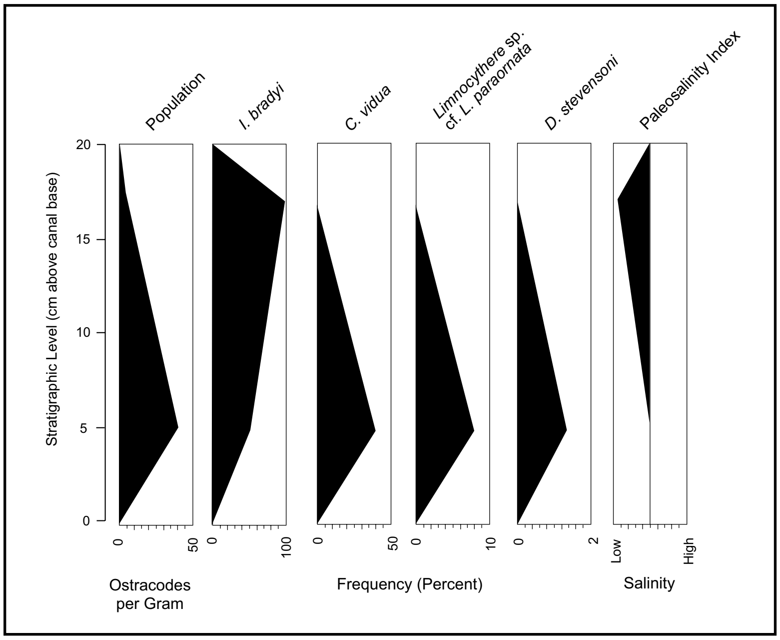

Figure 16.10. Ostracode valves per gram, relative frequencies of ostracode species, and paleosalinity index, by stratigraphic level, canal Feature 147, AZ BB:13:481 (ASM).

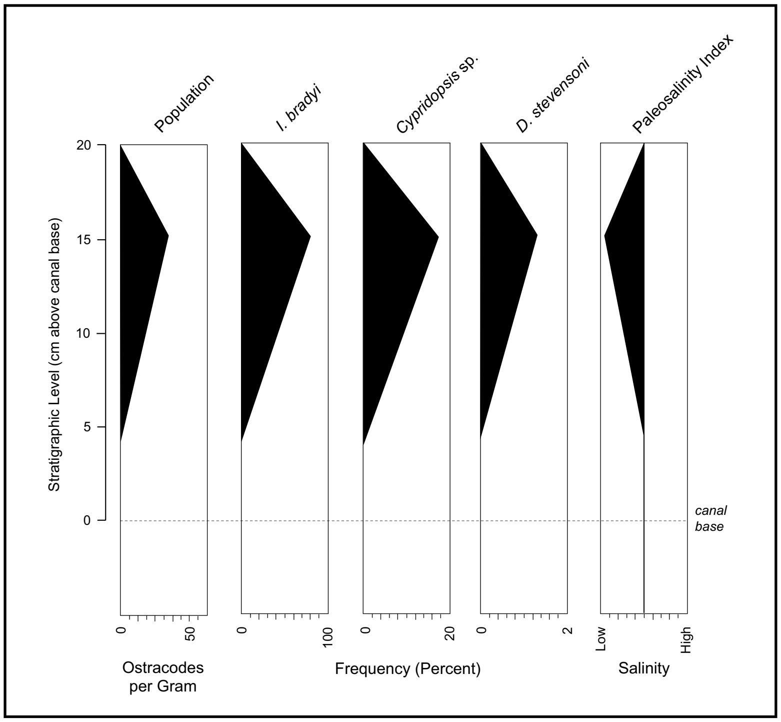

Figure 16.11. Ostracode valves per gram, relative frequencies of ostracode species, and paleosalinity index, by stratigraphic level, canal Feature 148, AZ BB:13:481 (ASM).

and abrasion (5 percent) and no other effects. Only adults occur in this canal (see Tables 16.4-16.5). Assemblage II entered the canal.

Interpretations of Canal Ostracode Records from the Congress Street/ Brickyard Loci, the Clearwater Site, AZ BB:13:6 (ASM)

Four Early Agricultural period canals were documented at the Congress Street/Brickyard loci. Canal Feature 139 is a large canal about 3.6 m wide and 71 cm deep, filled with seven lithostratigraphic units. The thicknesses of the units suggest a long-term, fast-flowing discharge that decreased gradually over time. Lack of ostracodes or their fragments in the lower 45 cm is consistent with fast flow. Occurrence of these microinvertebrates afterward implies decreasing flow that ended abruptly. A detailed sampling above the last interval would provide information about the final stages of this canal. However, current data suggest a prolonged canal operation with at least two pulses of water input before the arrival of ostracodes, and two more during late stages containing ostracodes.

The faunal Assemblage I strongly dominated by *I. bradyi* is consistent with the interpretation of dilute water input; however, it is unwarranted to place a minimum and maximum salinity range because other species occurred very randomly. *I. bradyi*'s tolerance ranges from 100-4,000 mg l^{-1} TDS (Delorme 1989; Palacios-Fest 1994); therefore, the salinity range of Feature 139 could not exceed either limit. Considering the rare occurrences of *P. pustulosa* (salinity tolerance = 100-600 mg l^{-1} TDS) and *D. stevensoni* (50-2,000 mg l^{-1} TDS), canal salinity did not exceed 600 mg l^{-1} TDS at the time of canal operation. The paleosalinity index is in good agreement with dilute water input (see Figure 16.2).

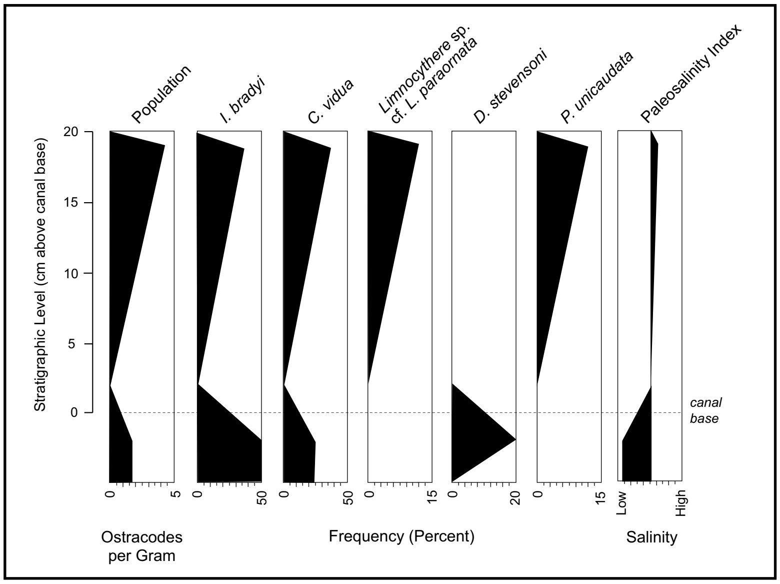

Figure 16.12. Ostracode valves per gram, relative frequencies of ostracode species, and paleosalinity index, by stratigraphic level, canal Feature 150, AZ BB:13:481 (ASM).

Canal Feature 140 is a large canal approximately 3.4 m wide and 45 cm deep, consisting of six lithostratigraphic units. The thicknesses of the sediment units suggest a continuous streamflow marked by two input pulses. Streamflow was moderate to low after initial discharge, as suggested by sediment grain sizes. The ostracode record is consistent with the canal sedimentological composition. A relatively diverse (four species) Assemblage II entered the canal. *I. bradyi* and *C. vidua,* associated with *C. patzcuaro* and *L.* sp. cf. *L. paraornata,* occur as streamflow declines. Only the first two species settled and developed communities. The other two were more likely introduced; no adults of *C. patzcuaro* and a single valve of *L.* sp. cf. *L. paraornata* occurred. The salinity tolerances of *I. bradyi* and *C. vidua* both range from 100-4,000 mg l^{-1} TDS (Delorme 1989; Palacios-Fest 1994). Occurrence of *C. patzcuaro* juveniles suggests stressful conditions for the species, preventing maturation. Presence of *L.* sp. cf. *L. paraornata* implies moderate-to-high salinity (<5,000 mg l^{-1} TDS; R. Forester, personal communication 2001) and may also indicate winter or snowmelt discharge. *C. vidua* may live in cold waters but its preferred temperature for hatching is about 13°C (Taylor 1991). Therefore, for the species to settle a biocenosis, water temperature had to be greater than 13°C; thus, the interpretation of cold-water input may be discarded. As water flow continued, more dilute conditions prevailed as *I. bradyi* and *P. pustulosa* (100-600 mg l^{-1} TDS; Delorme 1989; Palacios-Fest 1994) entered the canal. The paleosalinity index is consistent with salinity fluctuations shown in canal Feature 140 (see Figure 16.3).

Canal Feature 141 is a small (roughly 1.22 m wide) and shallow (about 40 cm deep) canal consisting of a truncated lithostratigraphic unit. The unit's thickness and sedimentological composition indicate short-term canal operation. However, loss of the upper part and lack of ostracodes prevents any further interpretation. The fact that sediment grain size declined rapidly after initial water input is consistent with a short-term canal operation (see Table 16.2).

Feature 152 is a large canal about 2.65 m wide and 56 cm deep, consisting of two lithostratigraphic units. The thickness of the units suggests a continuous water input. The slightly sandier deposit, sample DA-RNA8-267-152-3, implies an increase in streamflow that rapidly declined. It is deprived of ostracodes or their fragments. As mentioned earlier, sediment composition suggests a fast-flowing discharge followed by a rapid desiccation that left very little clay. This canal may have been used for a short time and then failed.

Six features (Features 142, 143, 144, 146, 149, and 154) provided the history of Hohokam irrigation in the area. Feature 142 is a small (circa 1.25 m wide), deep (circa 60 cm) canal consisting of two lithostratigraphic units. The thicknesses and grain-size compositions of the units suggest a sustained, slow streamflow. The ostracode record is consistent with this interpretation. Faunal Assemblage I dominates the canal history. *I. bradyi* entered the canal that was initially dug into a cienega soil (containing ostracodes as well). Other species occurred in low proportions and were introduced as juveniles unable to settle, except *C. vidua*, due to stressing conditions (see Figure 16.4). Canal operation probably lasted over a month, as the life cycle of *C. vidua* takes that long (Anderson et al. 1998; Kesling 1951). However, the duration of flow was less than three months, as other species such as *C. patzcuaro*, *C. caudata,* and *P. unicaudata* (represented by juveniles) require at least that long to reach maturity (R. Forester, personal communication 1988). Fine grain size and the thickness of the unit do not seem to support a short-term canal operation as suggested by the ostracode record; therefore, other stressing conditions may have prevented these species from completing their life cycles. All species present tolerate a similar salinity range as *I. bradyi* and *C. vidua* (100-4000 mg l^{-1} TDS), except *P. pustulosa* (100-600 mg l^{-1} TDS). Thus, other parameters in the water chemistry may be responsible for a stressful environment. The paleosalinity index is consistent with long-term freshwater input (see Figure 16.4).

Feature 143 is a small, shallow (about 1.2 m wide and 33 cm deep) Hohokam canal. In contrast with other canals of this time, it is relatively shallow and deprived of microinvertebrates. Sediment grain size (silty clay) suggests an optimal substrate for establishing a biocenosis. The relatively thin sedimentologic sequence consisting of a lithostratigraphic unit suggests a short-term canal operation. Lack of organisms may only be explained if the canal did not operate for a long time and water flow was fast enough to wash them out. The geomorphologic and sedimentologic studies will provide a better perspective to understand this canal.

Feature 144 is a medium-to-large canal roughly 1.65 m wide and 74 cm deep, with a fill consisting of three lithologic units. The thick sedimentologic sequence suggests a long-term canal operation similar to that of canal Feature 137 at the San Agustín Mission locus (see below). The canal was cut into cienega-like deposits. Fast-flow input characterized this canal. The faunal assemblage is diverse but limited to the latter stages of canal operation. The extreme abundance of *I. bradyi* throughout the record strongly suggests freshwater input (Assemblage I). Transition to Assemblage III is indicated by the occurrence of *D. stevensoni* and *H. brevicaudata*, suggesting salinity was not higher than 2,000 mg l^{-1} TDS, and more likely, much lower, because *C. patzcuaro* establishes at a minimum salinity of 200 mg l^{-1} TDS (Delorme 1989; Forester 1991; Palacios-Fest 1994). *Limnocythere staplini*, absent in this region, is not observed at any of the Tucson Basin canal sites studied to date (León Farmstead, Thiel et al. 2005; Las Capas, Palacios-Fest et al. 2001). This suggests that water chemistry remained in the pathway of type I (dilute) of Eugster and Hardie (1978), despite the presence of tufa.

The presence of an adult and a juvenile population supports a well-established biocenosis in the canal. Low-to-moderate effects of taphonomic features also suggest an autochthonous assemblage. The canal was fed during the early spring, as shown by the paleosalinity index (see Figure 16.5). The pattern is similar to that of canal Feature 137 at the San Agustín Mission locus (see below). In contrast to the latter, canal Feature 144 held an Assemblage I population the entire time. The paleosalinity index is consistent with a low salinity range throughout the record (see Figure 16.5).

Feature 146 is a medium-to-large canal about 1.5 m wide and 70 cm deep, with a fill consisting of a travertine-rich lithologic unit. The thick sedimentologic sequence suggests a long and continuous canal operation. The canal was dug into an abandoned natural channel of the Santa Cruz River. Fast-flowing input characterized this canal. The faunal assemblage is not diverse, being limited to four species—*I. bradyi*, *C. vidua*, *H. brevicaudata,* and *L.* sp. cf. *L. paraornata*—and restricted to the initial water-input stages. *I. bradyi* dominates the sequence (Assemblage I). *C. vidua* (Assemblage II) became established for a short episode and was replaced by *H. brevicaudata* (Assemblage I). The presence of *L.* sp. cf. *L. paraornata* is fortuitous (two adult valves recovered). *I. bradyi* and *C. vidua* tolerate a maximum salinity of 4,000 mg l^{-1} TDS; however, *H. brevicaudata* is limited to less than 3,000 mg l^{-1} TDS (Delorme 1989; Forester 1991; Palacios-Fest 1994). Regarding canal Feature 144 (and canals elsewhere in the Tucson Basin), the absence of *L. staplini* highlights the difference in water sources from the Phoenix Basin. The paleosalinity index is consistent with the ostracode salinity tolerance ranges (see Figure 16.6).

For a brief interval (Assemblage II), the water chemistry evolved to pathway type II (Ca-rich) of Eugster and Hardie (1978) but rapidly returned to Assemblage I, this time with the strong presence of *H. brevicaudata*, another streamflow indicator. The Assemblage I prevalent conditions are consistent with Tadayon and Smith's (1994) and Tadayon's (1995) water chemistry records for the Rillito Creek basin, which may be extended to the Santa Cruz River basin. The adult-dominated population is consistent with a permanent, fast-flowing input to the canal. Taphonomic characteristics do not indicate a reworked fauna. An explanation for the short transition to Assemblage II is that it represents a summer canal operation. The unit thickness and uniformity suggest that the canal was used for a long time and that flow was continuous. Transition to Assemblage II may have resulted from summer temperatures rather than human activity. Absence of ostracodes to the end of the record may be the result of low water temperatures from late fall to late winter, assuming this canal was used year-round (during the last year of operation).

Feature 149 is a medium-to-large canal about 1.50 m wide and 1.15 m deep, with a fill consisting of five lithologic units. The thick sedimentologic sequence suggests episodes of prolonged canal operation. Water control is evident from stratigraphy and grain-size data. The canal was cut into paleochannel sediments and across the cienega-like deposit. Episodes of fast flow characterized the canal. Ostracodes are absent throughout all units but one (see Figure 16.7). The occurrence of fossils in a sandy silty clay unit indicates streamflow decreased. *I. bradyi* dominates the assemblage (Assemblage I). A few specimens of *C. vidua* and *L.* sp. cf. *L. paraornata* entered the system.

The taphonomic parameters are not indicative of a transported fauna; however, the A/J and C/V ratios suggest an allochthonous population. Assemblage I briefly entered the canal. The paleosalinity may not be a realistic indicator of water salinity, because it is strongly biased by a single event. It does not, however, diverge from trends observed in other canals of this age (see Figure 16.7).

Feature 154 is a small- to medium-sized (approximately 1.7 m wide), shallow (circa 25 cm deep) canal with a fill consisting of two lithostratigraphic units. The thicknesses and grain-size composition of the units suggest short-term, slow-to-moderate streamflow. The ostracode record supports this hypothesis. The faunal Assemblage I dominated the history of the canal. The occurrence of *D. stevensoni* juveniles suggests the canal did not operate long enough for this species to reach maturity (six months; Andrew Cohen, personal communication 1992). *I. bradyi* and *C. vidua* settled a biocenosis; therefore, a month-long, or slightly longer, canal operation is plausible. However, at Trench 258, Feature 154 is truncated by historic canal Feature 153, limiting any further interpretation. Dilute water entered and remained in the canal, as suggested by the paleosalinity index (see Figure 16.8) and by the occurrence of *D. stevensoni* (50-2000 mg l^{-1} TDS) (Delorme 1989; Palacios-Fest 1994).

Five canal features (Features 138, 147, 148, 150, and 153) contributed to understanding irrigation during historic times. Feature 153 is a small canal (circa 90 cm wide and 25 cm deep) dug into the Hohokam canal Feature 154, and its fill consists of a single lithostratigraphic unit. Slow streamflow is suggested by the thickness and grain-size composition of the unit. However, the ostracode record is meager and monospecific toward the end of the canal history, suggesting a short-term canal operation that only introduced a few adults of *I. bradyi*. The paleosalinity index indicates freshwater input, although the signal may be biased due to the absence of other species (see Figure 16.8).

Feature 138 is a small- to medium-sized canal (about 1.15 m wide and 40 cm deep), cut by the plowzone, consisting of a single lithostratigraphic unit. The thickness and grain-size composition of the unit indicate a moderately fast discharge. The occurrence of an Assemblage I-dominated fauna is consistent with this interpretation. *I. bradyi* dominates the history of the canal, with minor occurrences of *C. vidua*, *H. brevicaudata*, *L.* sp. cf. *L. paraornata*, *P. pustulosa*, and *D. stevensoni* – all of which established communities (see Table 16.5). For *D. stevensoni* to settle implies the canal was active for a prolonged period, perhaps longer than six months; for *P. pustulosa* to be present, salinity did not exceed 600 mg l^{-1} TDS (Delorme 1989; Palacios-Fest 1994). The paleosalinity index is consistent with a permanent freshwater input during canal operation (see Figure 16.9).

Feature 147 is a medium-sized canal, wide (approximately 1.4 m) but shallow (26 cm deep), with a fill consisting of a single lithostratigraphic unit. The sedimentologic composition of this unit suggests a single, continuous use of the canal. The canal was dug into parts of two Hohokam canals, Features 146 and 154. The lithology shows no significant changes in streamflow velocity (see Table 16.2). The faunal composition is not diverse. Four species occur in this canal, with *I. bradyi* and *C. vidua* dominating, and *L.* sp. cf. *L. paraornata* and *D. stevensoni* poorly represented. Initially, all four species entered the canal and became established (Assemblage II). Later, *I. bradyi* was the only poorly represented species present (Assemblage I). The taphonomic features range from low fragmentation and abrasion (5-10 percent) and no other effects, to low-to-high fragmentation and abrasion (10-30 percent) and increasing stains in valves (indicative of oxidizing conditions). Adults dominated the sequence, although juveniles were present and well preserved, suggesting a permanent biocenosis at the time. The transition from Assemblage II to Assemblage I suggests a change in streamflow input; increasing velocity may have resulted in the monospecific assemblage.

This is not consistent, however, with the sedimentologic data. Fine particle concentration increases toward the end of the canal history, suggesting canal operation stopped, with subsequent desiccation of soils. This explanation is consistent with the monospecific and poor fossil record. The canal was used for only a brief period. The paleosalinity may not be an accurate indicator of water salinity. Regardless of the absence of *L. staplini*, salinity may have increased to the upper limits of *I. bradyi* (4,000 mg l^{-1} TDS) (Delorme 1989; Palacios-Fest 1994) as the assemblage became monospecific toward the end of the record. The paleosalinity index shows a permanent freshwater input consistent with this interpretation (see Figure 16.10).

Feature 148 is a medium-sized canal, wide (circa 1.8 m) but shallow (circa 22 cm), consisting of a single lithologic unit. Sediments suggest a single-event, moderately fast flow (see Table 16.2). The canal was cut into the paleochannel deposits across the cienega-like soil. The faunal record is strongly dominated by *I. bradyi* in the upper part of the sequence. *Cypridopsis* sp. and *D. stevensoni* also occur. The former, as well as *I. bradyi*, formed a biocenosis; the latter was more likely washed in. The moderate taphonomic parameters indicate at least part of the population was transported. In contrast, the relatively significant occurrence of juvenile valves shows a stable population. After a quick introduction to the system, ostracodes settled and formed a biocenosis. Again, Assemblage I characterizes the canal, and the paleosalinity index suggests freshwater input sustained the introduction of *D. stevensoni* (see Figure 16.11). A detailed analysis of *Cypridopsis* sp. is necessary to recognize the species and its ecological needs.

Feature 150 is a medium-sized canal, wide (about 1.5 m) but shallow (about 29 cm deep), with a fill consisting of a single lithologic unit. Like the other historic-era canals, a single event of moderately fast flow is indicated. The canal was dug into the cienega-like soil. Ostracodes occur at the contact with the cienega-like sediments and the top of the sequence. The former is evidently not significant to this study, other than to verify the source of organisms to the environment. In contrast, the latter reflects the introduction of an allochthonous fauna strongly dominated by adult *I. bradyi*, *C. vidua*, *L.* sp. cf. *L. paraornata,* and *P. unicaudata*. The occurrences of *P. unicaudata* and *L* sp. cf. *L. paraornata* are fortuitous, as they were reworked; however, they indicate increasing salinity of input water, as *P. unicaudata* tolerates ranges greater than 4,000 mg l^{-1} TDS (Delorme 1989). The exclusively adult population indicates an allochthonous Assemblage II. The paleosalinity index is consistent with this interpretation (see Figure 16.12).

Summary

Ostracode records of canals in the Congress Street/Brickyard loci allow a better understanding of the history of irrigation in the Santa Cruz River floodplain. The records are consistent with previous findings at Las Capas (Palacios-Fest and Davis 2006; Palacios-Fest et al. 2001) and at the San Agustín Mission locus (see below). The faunal composition is similar, suggesting a similar source of water (the Santa Cruz River). Also, *I. bradyi* is the most abundant species across the site, followed by *C. vidua*. Other species appeared and disappeared at several intervals.

Absence of *L. staplini* in canals in the Tucson Basin contrasts with its abundance and frequent dominance in canals in the Phoenix Basin (Palacios-Fest 1994). A preliminary interpretation is that the Tucson and Phoenix basins are fed by two substantially different fluvial systems with contrasting water chemistries (Hem 1985; Tadayon 1995; Tadayon and Smith 1994). The occurrence of *L.* sp. cf. *L. paraornata* suggests water salinity was not as high as that of the Salt River (Hem 1985). A more detailed ecological analysis of species present in the Phoenix and Tucson basins is needed.

This study of canals in the Congress Street/Brickyard loci confirms previous interpretations about the evolution of canal operation from the Early Agricultural to the Hohokam periods (Palacios-Fest et al. 2001). Further, the historic use of canals shows a different pattern. For example, ostracode faunal assemblages are significantly more diverse during Hohokam periods than they were at the earlier stages or during historic times. While the transition from Early Agricultural to Hohokam irrigation has been explained as the technological evolution of water management (Palacios-Fest et al. 2001), ostracode records of canal operation during historic times indicates a different strategy. Hohokam farmers mastered canal operation and succeeded in sustaining long-term flows in the canals. During historic times, farmers introduced fast-flowing water for short intervals, probably before the summer monsoon season. Evidence to support this interpretation is that historic-era canals hosted a primarily adult population associated with upward grading sediments in relatively thin lithologic units.

RESULTS FROM CANALS IN THE SAN AGUSTÍN MISSION LOCUS, THE CLEARWATER SITE, AZ BB:13:6 (ASM)

Sediment samples from four of the five canal features identified in the San Agustín Mission locus were analyzed for ostracode records. Canal Features 53 and 127 date to the Cienega phase (800 B.C.-A.D. 50) of the Early Agricultural period. Based on the radiocarbon dates obtained from pit structures originating in the same alluvial stratum (see Chapter 19), these canals were probably built between 500 and 400 B.C. The Hohokam canal Feature 137 cut through a Cienega phase pit structure and its fill contained plain ware pottery sherds; however, the latter were not diagnostic of a specific phase or period. Because it cuts into a pit that contained European ceramics dating to the 1850s and 1860s, the historic-era canal Feature 9 was probably dug in the 1860s, near the beginning of the American Territorial period.

Table 16.2 shows the sample identification number, stratigraphic level (from base of canal), bulk and residual weight, lithology, and color (and color code) of sediment residuals. The samples consist primarily of pale yellowish-brown (10YR 6/2) to dusky brown (5YR 2/2), occasionally moderate brown (5YR 3/4), gravelly sandy silts to silty clay. The dominant minerals recognized in these canals are quartz, tufa (or travertine) biotite, muscovite, charcoal, feldspars, and shell and rock fragments. Other common minerals present are glass, pegmatite, and manganese nodules (at the base of the Hohokam canal Feature 137). Other minerals or man-made materials occur occasionally (see Table 16.3).

The biological contents of the canals and the taphonomic characteristics recorded are summarized in Table 16.4. Ostracodes, molluscs, and gyrogonites of Characeae are shown quantitatively; the plant debris is only marked when present. Table 16.5 shows the ostracode total population by sample, as well as the total and relative abundance by species per sample. The C/V and A/J ratios, by species, are also listed to establish biocenosis.

Eight species of ostracodes were identified in samples from canals in the San Agustín Mission locus. *Ilyocypris bradyi* was the most common and abundant species present, followed by *Cypridopsis vidua* and *Darwinula stevensoni*. The remaining five species occurred occasionally in the canals: *Herpetocypris brevicaudata*, *Limnocythere* sp. cf. *L. paraornata*, *Candona caudata*, *Physocypria pustulosa*, and *Potamocypris unicaudata*. Based on the occurrence and relative abundance, three assemblages were recognized. Assemblage I is dominated by *I. bradyi*, a streamflow indicator; Assemblage II is dominated by *I. bradyi* and *C. vidua*, a transitional assemblage; and Assemblage III is dominated by *C. vidua*, reflecting increasing salinity conditions. Assemblages II and III occur in the Hohokam period Feature 137 canal and in the American Territorial period Feature 9 canal. The hydrochemical evolution suggested from Assemblage I to Assemblage III shows increasing salinity, although water remained fairly dilute as *I. bradyi* and *D. stevensoni* occurrence was significant. The faunal association is consistent with the water chemistry type I (dilute) and type II (Ca-rich, dominated by Na^+, Mg^{2+}, and SO_4^{2-}) of Eugster and Hardie (1978). This association is very similar to that found at Las Capas (Palacios-Fest and Davis 2006; Palacios Fest et al. 2001). Similarly, the occurrence of *Limnocythere* sp. cf. *L. paraornata* is related to the period of cienega-like conditions.

For each canal, the sequence of species distribution and inferred paleoecology is used to interpret environmental conditions, through time, in the canals. The paleosalinity index developed for each canal is shown in the left-hand side of each figure. All fossiliferous samples are characterized by a small population (1-99 individuals per sample) and low diversity (one to eight species). Based on Delorme (1969, 1989), taphonomic parameters are used to distinguish allochthonous from autochthonous populations.

Cienega Phase Canals

The set of samples from Feature 53 consists of 14 samples collected from several different trench exposures. From west to east, the samples are grouped as follows: DA-RNA2-53-12 to -14, the westernmost exposure (Figure 16.13a); DA-RNA2-53-1 to -3, the next exposure to the east (Figure 16.13b); DA-RNA2-53-4 and -5, east from the former (Figure 16.13c); DA-RNA2-53-6 to -9, the following exposure to the east (Figure 16.13d); DA-RNA2-53-10 and -11, the easternmost exposure (Figure 16.13e). Five ostracode species were identified along this canal: *I. bradyi*, *C. vidua*, *H. brevicaudata*, *P. unicaudata*, and *D. stevensoni*. Most samples are either monospecific (*I. bradyi*) or have two species (*I. bradyi* and *C. vidua*). The two distal segments of this canal host the remaining three species (see Figure 16.13d-e). The taphonomic properties of the specimens recovered range from no fragmentation to 50 percent, low-to-moderate abrasion (5-20 percent), low authigenic mineralization (5 percent), and occasional moderate coating (30 percent). The redox index of the specimens shows good preservation, with occasional light orange stains. Adult specimens are the most abundant, and an articulated carapace was recovered in only one sample (see Tables 16.4-16.5).

The column of samples collected from Feature 127 in the east-northeast wall of Trench 19 consisted of a reference sample 6 cm below the canal base (unfossiliferous) and four canal fill samples containing a monospecific and poor ostracode record (Figure 16.14). The main taphonomic characteristics ranged from no fragmentation to 30 percent, moderately low abrasion (10-15 percent), and no authigenic mineralization or coating. The redox index shows no stains of any kind (clear to white valves). Only disarticulated and adult valves were recovered (see Tables 16.4-16.5).

Hohokam Canal

Feature 137, with a width of 1.88 m and a depth of 1.30 m, is one of the largest prehistoric canals documented during the Rio Nuevo project. A total of 31 samples was collected from this feature, including a reference sample from the alluvial unit 1 underlying the canal. The complex canal stratigraphy allowed separate groupings and presentation of summary diagrams in Figure 16.15. Units 6 and 7 (samples 1-8 and 13-15, respectively) document a sediment unit representing the longest continuous canal operation; it is approximately 62 cm thick and contains four species (see Figure 16.15a). Unit 7b (samples 9-12) is a small segment cut by Unit 8 on the western side of the feature. The assemblage is dominated by *I. bradyi* throughout the stratigraphic column and is the only species present in the lower 30 cm of the sequence. Thereafter, it shares abundance with *C. vidua*, *H. brevicaudata,* and *D. stevensoni*.

The taphonomic parameters show a moderate-to-high fragmentation (15-40 percent), low-to-moderate abrasion (5-20 percent), no authigenic mineralization and coating in Units 6 and 7, but moderately high

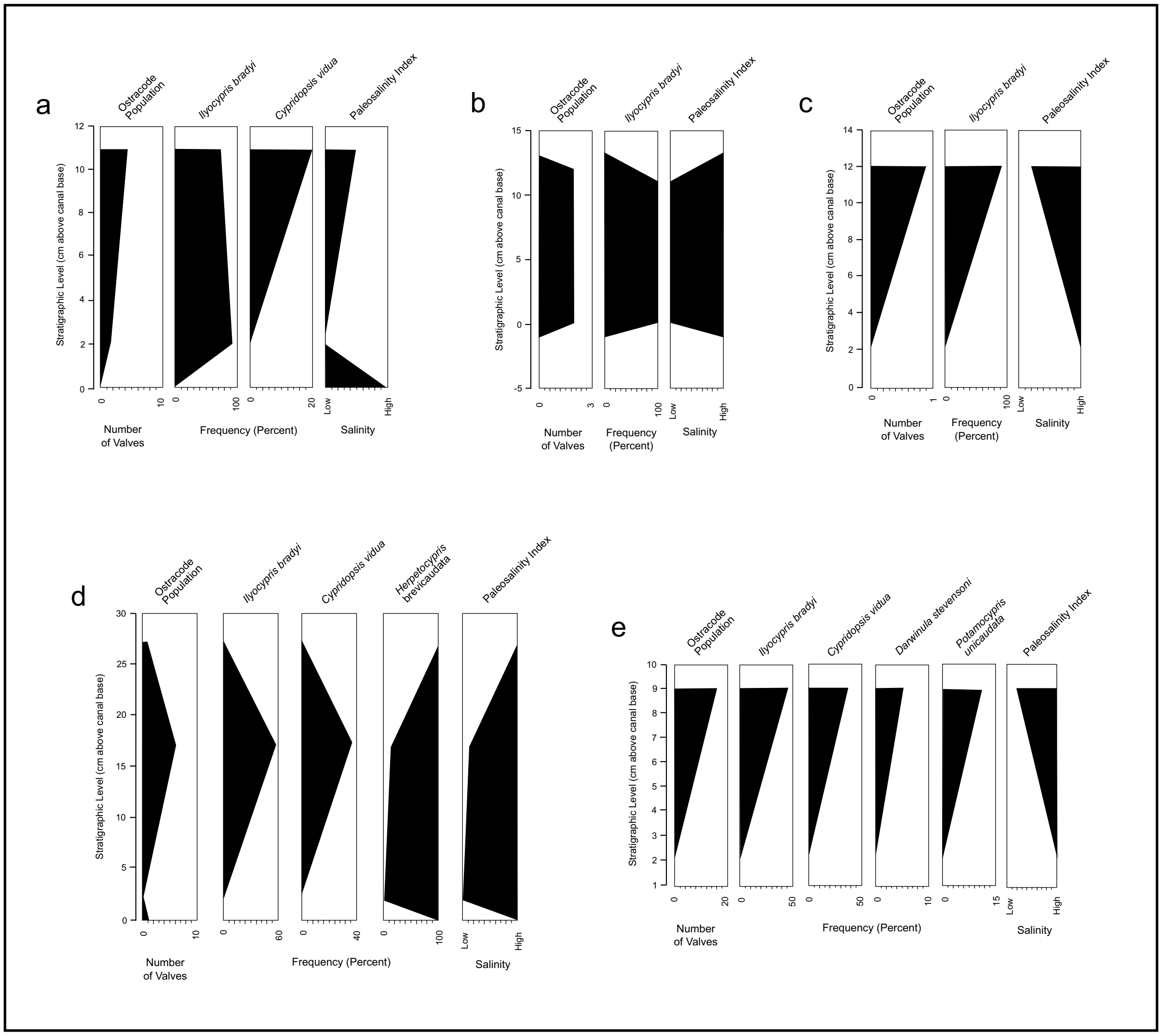

Figure 16.13. Ostracode valves per gram, relative frequencies of ostracode species, and paleosalinity index, by stratigraphic level, canal Feature 53, AZ BB:13:481 (ASM).

mineralization (30 percent) and relatively low coating (10-15 percent) in Unit 7b. The redox index shows a similar pattern—no stains in samples 1-8 but orange stains in samples 13-15. The ostracode population consists primarily of disarticulated adult valves (see Tables 16.4-16.5).

Unit 8 samples (9-12) overlap with those from Unit 7b, which filled a cut that reshaped the canal. Therefore, the Unit 8 ostracode record is shown separately (see Figure 16.15b). Six species occur in this unit, dominated by *I. bradyi* and *C. vidua*, with minor occurrences of *H. brevicaudata*, *Limnocythere* sp. cf. *L. paraornata*, *P. pustulosa,* and *D. stevensoni*. The taphonomic record indicates relatively low-to-moderate fragmentation (10-20 percent) and abrasion (10-15 percent). Authigenic mineralization and coating are low (5-10 percent), and the redox index ranges from unstained to orange valves. The ostracode record shows abundance of juveniles throughout the stratigraphic sequence but only one articulated carapace (see Tables 16.4-16.5). It is not clear if Units 8, 9, and 10 represent a continuous event or three independent flow episodes. Therefore, Units 9 and 10 are grouped separately.

Unit 9 and part of Unit 10 are grouped in Figure 16.15c, which represents another interval of long-term canal operation, followed by abandonment (samples 16-19 and 25-26). It contains seven species, with *C. vidua* as the most abundant throughout the record, associated with *I. bradyi* and the minor occurrence of *H. brevicaudata*, *Limnocythere* sp. cf. *L. paraornata*, *C. caudata*, *P. pustulosa*, and *D. stevensoni*. The taphonomic features indicate low fragmentation and abrasion (5-15 percent), but the valves show some evidence

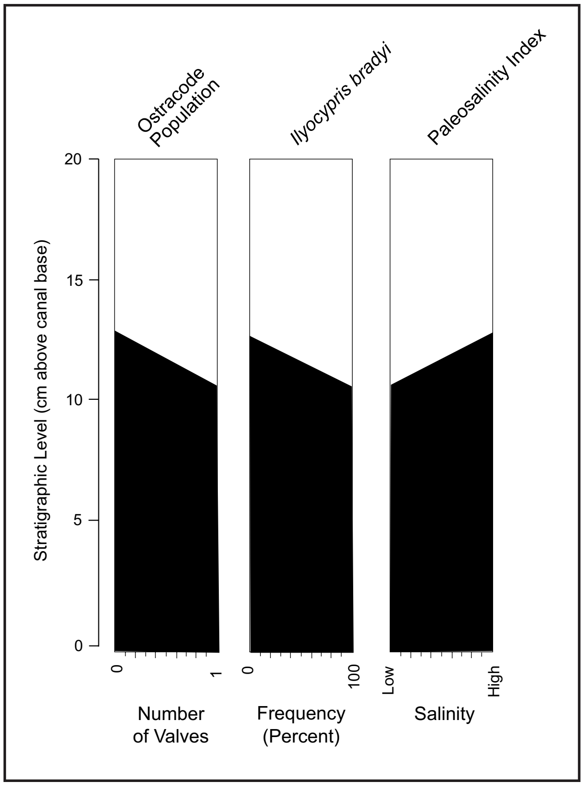

Figure 16.14. Ostracode valves per gram, relative frequencies of ostracode species, and paleosalinity index, by stratigraphic level, canal Feature 127, AZ BB:13:481 (ASM).

of authigenic mineralization and coating (5-10 percent). The redox index may be as high as brownish-orange, but usually shows no stains (see Tables 16.4-16.5).

On the western extreme of the canal exposure, a reshaped canal was sampled in part of Unit 10 (b). Five samples (20-24) document this sequence, with *I. bradyi* and *C. vidua* the dominant species (see Figure 16.15d). Other species, *Limnocythere* sp. cf. *L. paraornata* and *D. stevensoni*, occur occasionally. Fragmentation and abrasion are low (5-15 percent); authigenic mineralization and coating are also low (5-10 percent). The redox index of these valves is very low, indicating no stains (clear to white) (see Tables 16.4-16.5).

On the wall (southeast) opposite the exposure of Feature 137, overbank deposits were sampled in the attempt to correlate them with the history of the canal. Five samples (27-31) document two possible overbank deposits. The lower one, stratigraphically associated with canal-use sediments, is deprived of ostracodes. The upper overbank deposit contains ostracode valves in only the top sample (31). *I. bradyi*, *C. vidua*, and *Limnocythere* sp. cf. *L. paraornata* were the only three species present (see Figure 16.15e). Fragmentation and abrasion are low (10 percent); no evidence of authigenic mineralization or coating was recorded. The redox index shows clear valves. Articulated carapaces of adult *I. bradyi* are abundant. The other two species consist of juvenile and adult disarticulated valves (see Tables 16.4-16.5).

American Territorial Period Canals

Two canals (Features 3 and 9) were built during the American Territorial period. They were exposed at the San Agustín Mission locus in Trenches 101, 102, and 103. Feature 3 (sampled in Trench 103) contained no ostracodes, and is not discussed further. Four samples were collected from Feature 9 in Trench 101 (see Tables 16.4-16.5). At the base of the canal, Assemblage I is monospecific, consisting of *I. bradyi.* However, it suddenly reaches the highest abundance (99 individuals) and diversity (six species) among the analyzed ostracode records. It is dominated by *I. bradyi* and *C. vidua* (Assemblage II), with minor occurrence of *D. stevensoni*, *H. brevicaudata*, *P. pustulosa*, and *Limnocythere* sp. cf. *L. paraornata*. Then, *C. vidua* becomes the dominant species (Assemblage III) at the end of the record, followed by *D. stevensoni*, *I. bradyi*, *P. pustulosa*, *H. brevicaudata,* and *Limnocythere* sp. cf. *L. paraornata* (Figure 16.16). Fragmentation and abrasion are low (5-10 percent), authigenic mineralization and coating were absent or low (10 percent), and the redox index showed little staining of the valves (light orange). A diverse suite of adult and juvenile valves and carapaces was recovered (see Tables 16.4-16.5).

Interpretations of Canal Ostracode Records from the San Agustín Mission Locus, the Clearwater Site, AZ BB:13:6 (ASM)

Features 127 and 53, the Cienega phase canals, are characterized by a very similar ostracode assemblage, dominated by *I. bradyi*. The sedimentological composition in both features is also quite similar, grading to finer grain size from west to east. This characteristic is significant, because the ostracode assemblage—that is almost monospecific at Feature 127 and the first three segments of Feature 53—holds a more diverse association in the same direction. The canal appears to have been fed by a spring or high water table in a cienega in the floodplain at the base of A-Mountain. The occurrence of *C. vidua* in one of these segments, and later toward the east, supports this interpretation. The dominant adult composition and the taphonomic characteristics of the assemblage

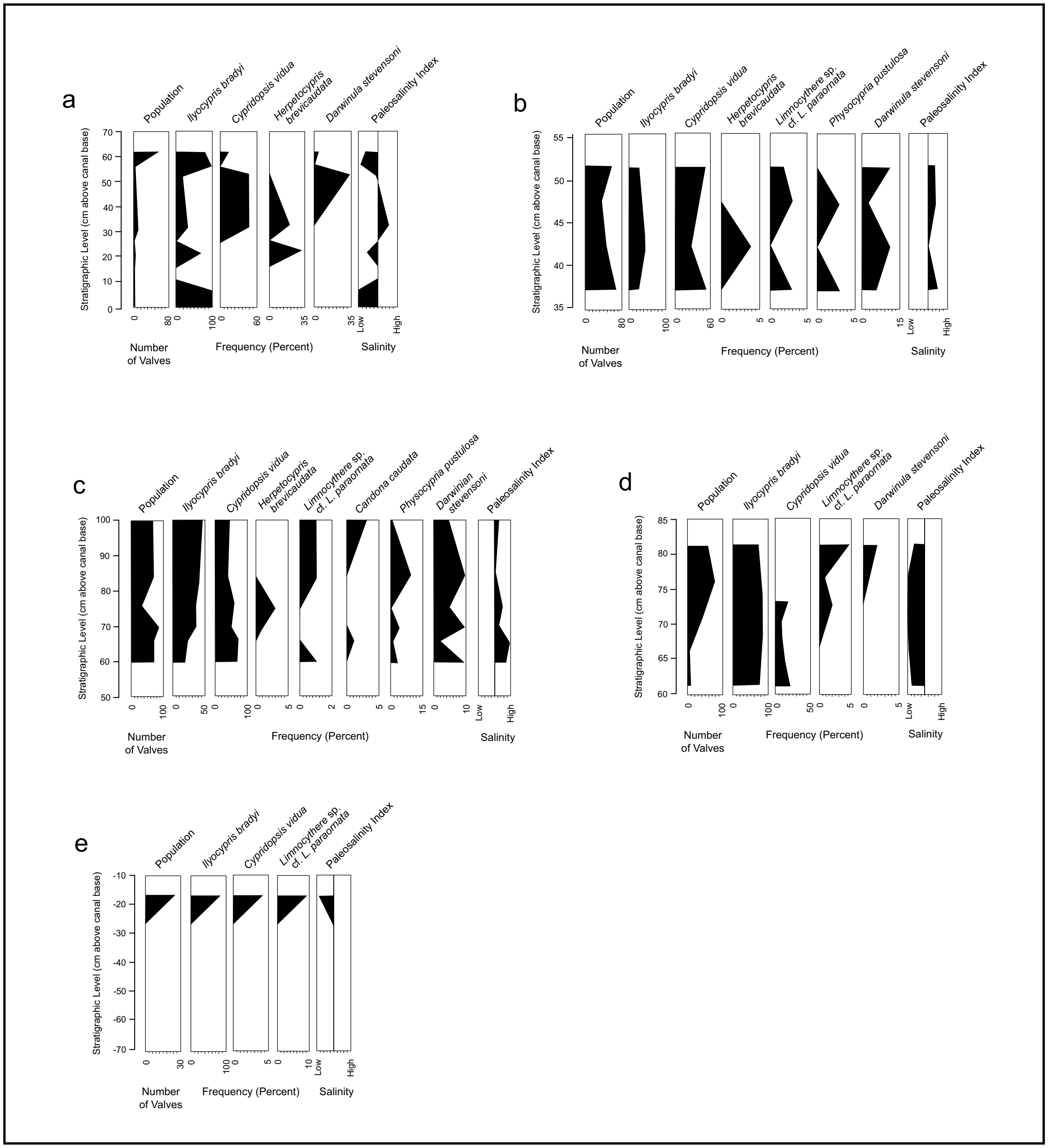

Figure 16.15. Ostracode valves per gram, relative frequencies of ostracode species, and paleosalinity index, by stratigraphic level, canal Feature 137, AZ BB:13:481 (ASM).

suggest specimens were transported to the site. The water entering this canal was dilute, as indicated by the paleosalinity index (see Figure 16.13a-e and Figure 16.14). Dilute water entered the canal and gradually increased in salinity and flow velocity, supporting the settlement of species that prefer relatively calm water flows. The operation of this canal was opportunistic (relying on natural pulses of water flow), as there are no indications of headgate operation.

The thick sediment sequence filling the Hohokam canal, Feature 137, suggests a long-term canal operation not previously recorded in the Tucson Basin. The ostracode faunal composition is the most diverse recorded at this locus. Starting with a monospecific Assemblage I (*I. bradyi*), it became gradually enriched in species composition, evolving to a transitional Assemblage II (*I. bradyi/C. vidua*) that suggests increasing salinity (see Figure 16.15a).

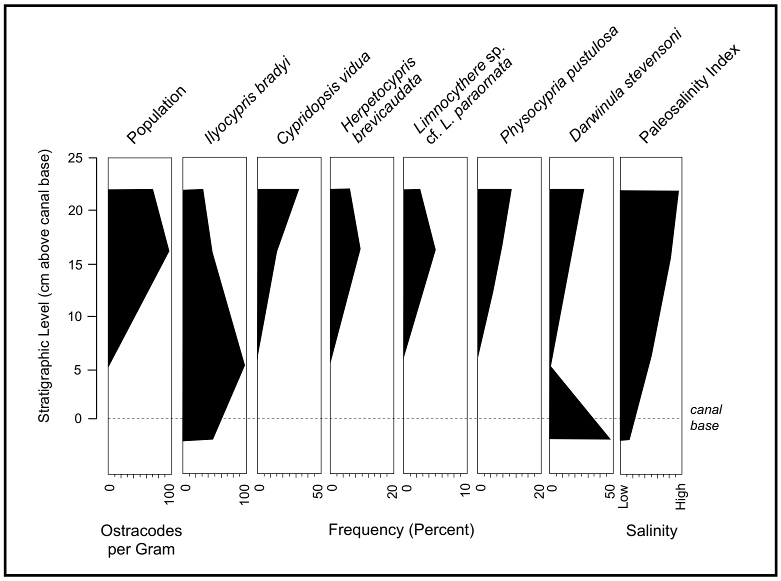

Figure 16.16. Ostracode valves per gram, relative frequencies of ostracode species, and paleosalinity index, by stratigraphic level, canal Feature 9, AZ BB:13:481 (ASM).

Salinity was not too high during the accumulations of Units 6 and 7. The canal received dilute water from the Santa Cruz River for a while and was characterized by moderately fast flow, as suggested by the adult-dominated faunal composition and taphonomic characteristics. The paleosalinity index for these units suggests the canal was operated during the early spring, when dilute water flowed in the Santa Cruz River.

Some time after the accumulation of Unit 7b, the canal was cleaned and reshaped. A new episode of canal operation is marked by a drastic change in lithology (gravelly silty sand) in Unit 8 that is associated with a diverse ostracode fauna dominated by *C. vidua*. Assemblage III characterized the waters entering the canal during this episode and indicates the highest salinity of water recorded in the site (see Figure 16.15b). During this interval, the canal probably conveyed water from the Santa Cruz River during the late spring/early summer, when increasing temperatures accelerate water salinization by evaporation. The lithology and the stable ostracode community suggest a moderate flow. The ostracode assemblage includes a suite of adult and juvenile forms, supporting the interpretation that this unit represents a long interval of canal use.

Later, canal operation continued into Units 9 and 10. Lithological and faunal continuity with respect to Unit 8 suggest another prolonged use of this canal. However, field observations indicate some discontinuity between Units 8 and 9. Therefore, the last two units are treated separately from Unit 8.

At the time of accumulation of Unit 9, coarse sediments (gravelly silty sand) are still dominant. Ostracode Assemblage III is similar to the record of the previous unit, indicating relatively saline waters entered the canal. The occurrence of *I. bradyi* and the paleosalinity index increase toward the end of the Unit 10 deposition (see Figure 16.15c), indicating a slow-flowing pulse of water during late spring/early summer. The change in lithology and faunal composition at the transition from Unit 9 to Unit 10 indicates human manipulation of the flow through headgate operations; this is a functional canal.

At the western edge of Feature 137, a smaller channel was cut into Unit 9 and accumulated the same kind of sediments reported at Unit 10. This channel is recognized as Unit 10, although it is documented separately due to its physical position in relation to the remainder of the sequence. Assemblage I (*I. bradyi*-dominated) is consistent with the assemblage reported at the end of the large canal sequence. This suggests that Unit 10, that caps the large canal, is an overflow deposit from the smaller canal situated to the west. No evidence was recorded in the field about the northwestern trench wall where the samples were collected, although overbank deposits were sampled on the opposite wall of the exposure. The paleosalinity index and the canal lithology indicate slow-flowing water inputs (see Figure 16.15d). Assuming a connection between the large canal deposits and small canal deposits, they are probably a result of human operation.

On the opposite, southeastern trench wall, a few samples were collected from overbank alluvial deposits. The assemblage is similar to that of the small canal discussed earlier. The high abundance of *I. bradyi* carapaces indicates rapid burial rather than a biocenosis (see Figure 16.15e).

The historic ditch, Feature 9, ran along the northern edge of Mission Lane. It was an almost straight ditch fed by the Santa Cruz River. The ostracode assemblages evolved from Assemblage I to Assemblage III, generating a paleosalinity index that shows gradual salinization of the water through time. The flow was controlled, as indicated by the ostracode diversity and preservation and lithology, suggesting a slow flow. The occurrence of a stable ostracode community is consistent with long-term, steady flows in the canal (see Figure 16.16).

Summary

The occurrence of canals ranging in age from the Early Agricultural period to the American Territorial period in the San Agustín Mission locus provided a unique opportunity to reconstruct the history of canal operations in the Tucson Basin reach of the Santa Cruz River valley. As reported for San Pedro phase canals a few miles downstream at Las Capas (Palacios-Fest and Davis 2006; Palacios-Fest et al. 2001), it has been possible to recognize opportunistically used canals (diverting only flood flows of the river) during the Cienega phase occupation of the San Agustín Mission locus, followed by functionally used canals (diverting the perennial baseflow of the river through the operation of headgates) during Hohokam times. The ostracode record of the American Territorial period canal shares a significant similarity with the record of the Hohokam canal: both evolve from Assemblage I to Assemblage III and consist of the same species. This similarity is noteworthy because it demonstrates that ostracode assemblages are good indicators of water chemistry evolution in canals.

Questions also emerged during this study. It is suggested here that Features 53 and 127 are segments of the same canal, but no solid evidence is available. It is also suggested that these canal segments were fed from a spring or cienega, based on the lithology of infilling sediments and ostracode assemblages; however, with the short lengths of canal segments exposed, it is not possible to determine the gradient and direction of flow of Feature 53 to test this. The stratigraphy of the Hohokam canal Feature 137 is very complex, and further data would help refine the relationships among strata and ostracode assemblages. Finally, the exposed portion of the late nineteenth century ditch Feature 9 is too short to expand any interpretation.

RESULTS FROM CANALS IN THE MISSION GARDENS LOCUS, THE CLEARWATER SITE, AZ BB:13:6 (ASM)

Table 16.2 shows the sample identification number, stratigraphic level (from base of canal), bulk and residual weight, lithology, and color (and color code) of sediment residuals. The samples consist primarily of moderate yellowish-brown (10YR 5/4) and pale yellowish-brown (10YR 6/2), occasionally dark yellowish-brown (10YR 4/2), gravelly silty sands to clay. The dominant minerals recognized in these canals are quartz, tufa (or travertine), biotite, and feldspars. Other common minerals include basalt, muscovite, and caliche. Other minerals occur occasionally, and glass, shell, and rock fragments are present (see Table 16.3).

The biological contents of the canals and the overall taphonomic characteristics recorded are summarized in Table 16.4. Ostracodes and molluscs are the groups present. Table 16.5 shows the ostracode total population, by sample, and the total and relative abundance, by species per sample. The C/V and A/J ratios, by species, are also listed to establish biocenosis.

Ten species of ostracodes were identified. *Ilyocypris bradyi* was the most common and abundant, followed by *Cypridopsis vidua* and *Darwinula stevensoni*. The remaining seven species occurred occasionally in the canals*: Herpetocypris brevicaudata*, *Limnocythere* sp. cf. *L. paraornata*, *Candona patzcuaro*, *Physocypria pustulosa*, *Cypridopsis* sp., *Chlamydotheca arcuata* (not reported in other loci), and *Potamocypris unicaudata*.

Based on the occurrence and relative abundance, three assemblages were recognized. Assemblage I is dominated by *I. bradyi*, a streamflow indicator; Assemblage II is dominated by *I. bradyi* and *C. vidua*, both associated with streamflow conditions; and Assemblage III composed by *I. bradyi*, *C. vidua*, and a minor but significant occurrence of *D. stevensoni*. Other species are less significant. Assemblage I marks the beginning of water input and operation in all canals studied. Assemblage II shows a transition to more saline conditions. It occurs in canal Features 200, 205, and 206. The hydrochemical evolution suggested from Assemblage I to Assemblage II indicates increasing salinity. Assemblage III results from prolonged water input that allowed *D. stevensoni* to settle and salinity to decrease.

The presence of *D. stevensoni* at the end of the records suggests canals held water for long periods. The faunal association is consistent with the water chemistry type I (dilute) and type II (Ca-rich, dominated by Na^+, Mg^{2+}, and SO_4^{2-}) of Eugster and Hardie (1978). Tadayon's (1995) and Tadayon and Smith's (1994) surface and groundwater analyses of the modern Rillito Creek in the Tucson Basin (sampled from August 1987 to August 1993) showed near-equivalent proportions of Ca and HCO_3, with the former slightly dominant. This association is very similar to that found at the Congress Street/Brickyard and San Agustín Mission loci (see above), as well as at Las Capas (Palacios-Fest and Davis 2006; Palacios-Fest et al. 2001). Similarly, the occurrence of *Limnocythere* sp. cf. *L. paraornata* is related to a period of cienega-like conditions.

Relative abundances of species for each canal are shown in Figures 16.17-16.19. The sequence of species distribution and inferred paleoecology is used to interpret environmental conditions in the canals, through time. The paleosalinity index developed for each canal is shown in the right-hand side of each figure. A small to large population (2-526 individuals per sample) and low diversity (two to seven species) characterize fossiliferous samples. Based on Delorme (1969, 1989), taphonomic parameters are used to distinguish allochthonous from autochthonous populations.

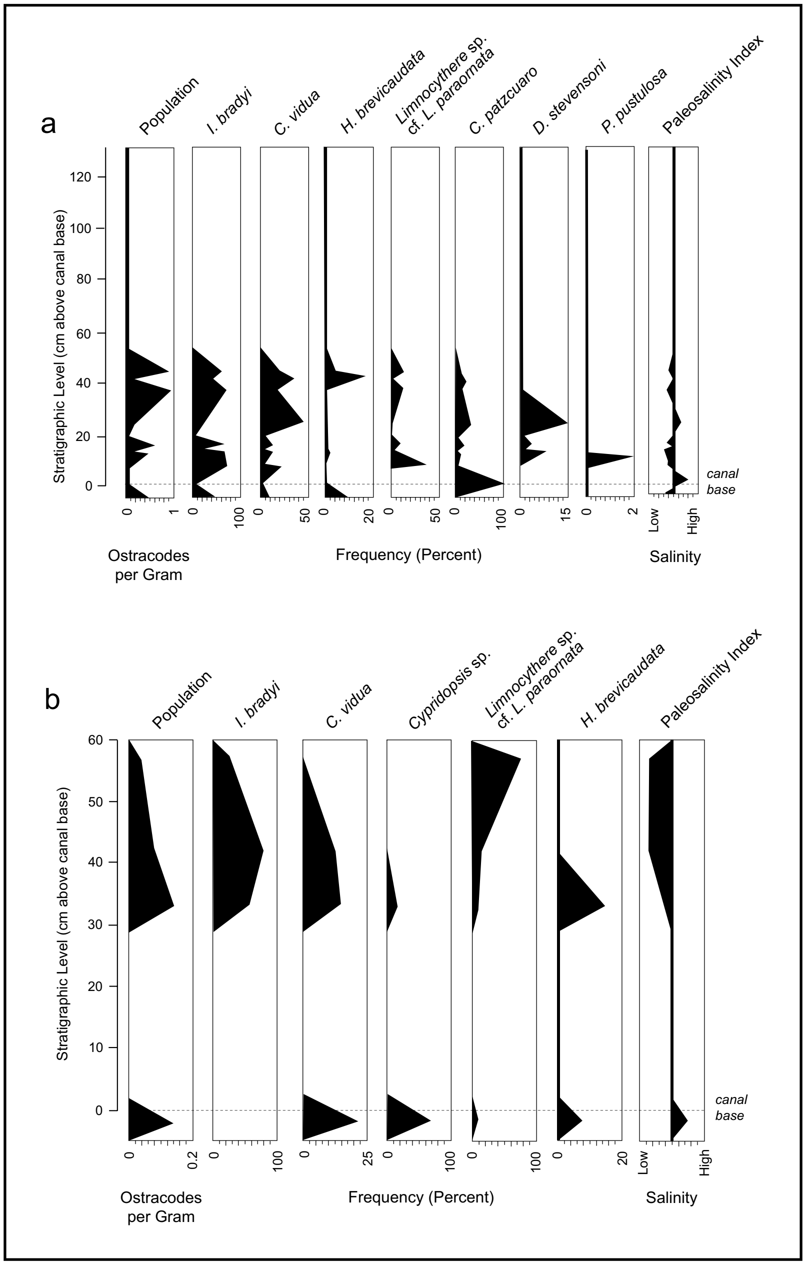

Figure 16.17. Ostracode valves per gram, relative frequencies of ostracode species, and paleosalinity index, by stratigraphic level, canal Feature 200, AZ BB:13:481 (ASM).

Hohokam Canal

Feature 200 is a Sedentary period Hohokam canal (see Figure 16.17). The samples were collected from exposures on the southern walls of Trenches 310 and 302. They consisted of reference samples (2 cm bcb) and 18 and nine samples from canal fill sediments, respectively. Trench 310 is upstream of Trench 302. Ostracodes ranged from rare to abundant, particularly in Trench 310 (see Figures 16.17a-b; see also Table 16.5). In Trench 310, ostracodes occurred from the cienega-like deposits to roughly 43 cm from the canal base (see Figure 16.17a). In Trench 302, ostracodes occurred in the cienega-like deposits and from about 30 cm above the canal base to the end of the record. Sediments consist of gravelly to silty sand, gradually grading to silty clay and clay (see Table 16.2). In Trench 310, frequent grain-size coarsening above 43 cm reflects pulses of one or more flood events. Ostracodes and sediments indicate at least two cycles of water input into this canal.

The dominant species is *I. bradyi* (Assemblage I), representing more than 50 percent of the population in most of the samples (see Figures 16.17a-b). Through time, Assemblage III (*I. bradyi*/*C. vidua*/*D. stevensoni*) characterized the canal. The taphonomic parameters show low-to-moderate fragmentation and abrasion (5-20 percent). Rare signs of encrustation or coating were recorded in Trench 302 (5 percent), but not in Trench 310. The redox index ranged from slightly oxidizing stains to no stains, upward (see Table 16.4). Similarly, the A/J ratios graded from purely adult to a mixed population upward. The C/V ratios show strong valve disarticulation. Assemblage I evolved into Assemblage III (see Figures 16.17a-b).

Protohistoric Period Canals

Four features (Features 207, 205, 204, and 201) represent Protohistoric irrigation (see Figure 16.18). Feature 207, exposed on the southern wall of Trench 300, consisted of a reference sample (2 cm bcb) and three canal in-fill samples containing ostracodes (see Figure 16.18a; see also Table 16.5). Six species occurred throughout the history of the canal—*I. bradyi* the most common and abundant, followed by *C. vidua*, *H. brevicaudata*, *L.* sp. cf. *L. paraornata*, *D. stevensoni*, and *P. pustulosa*. The taphonomic parameters show moderate-to-high fragmentation and abrasion (10-50 percent); no signs of encrustation or coating of the valves were recorded. The redox index ranged from no stains to

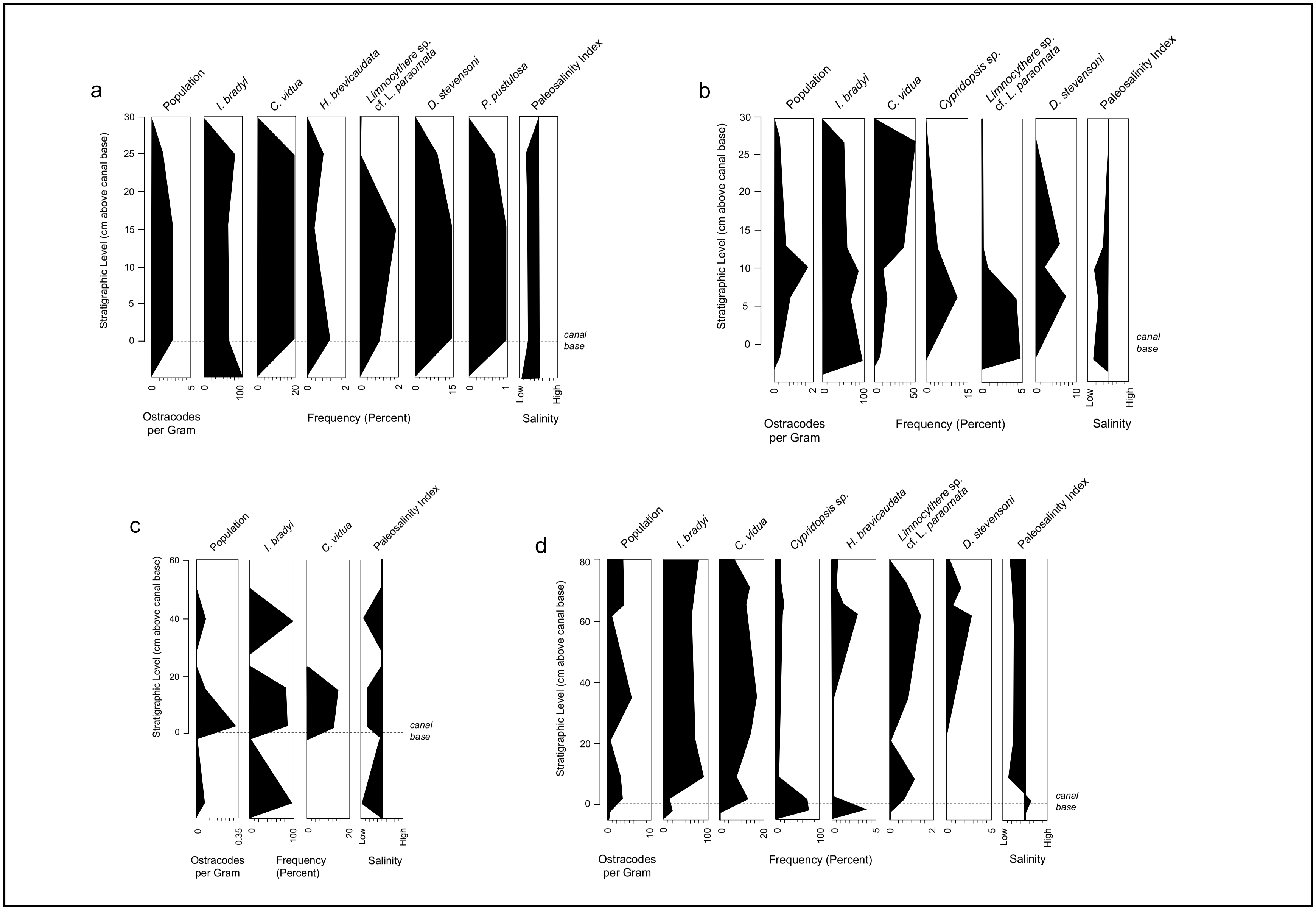

Figure 16.18. Ostracode valves per gram, relative frequencies of ostracode species, and paleosalinity index, by stratigraphic level, AZ BB:13:481 (ASM): (a) canal Feature 207; (b) canal Feature 205; (c) canal Feature 204; (d) canal Feature 201.

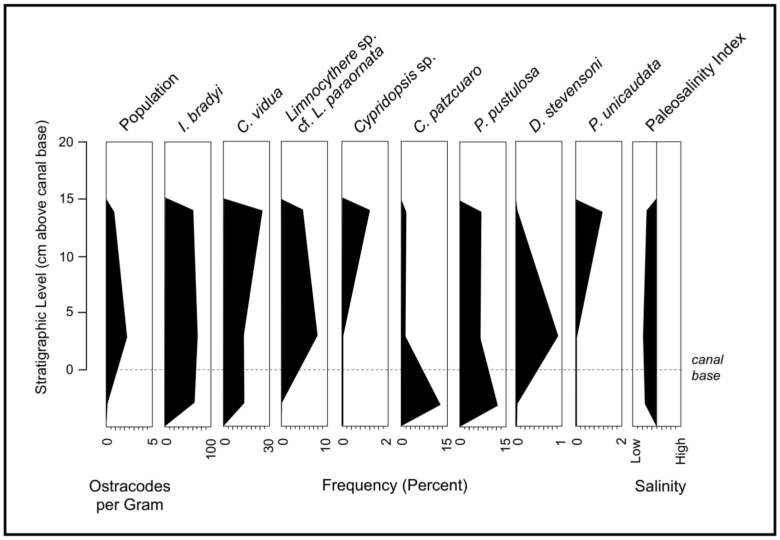

Figure 16.19. Ostracode valves per gram, relative frequencies of ostracode species, and paleosalinity index, by stratigraphic level, canal Feature 206, AZ BB:13:481 (ASM).

light oxidizing stains. The A/J and C/V ratios indicate a stable community throughout the record. Despite some minor fluctuations, Assemblage III dominates the canal history (see Figure 16.18a). A single, continuous water input is suggested by the sediments and ostracodes.

Canal Feature 205, exposed on the east-northeast wall of Trench 307, provided a reference sample (2 cm bcb) and four canal fill samples (see Figure 16.18b). Sediments consist primarily of sandy silty clay to clay suitable for microinvertebrates. All samples contained ostracodes. The dominant species is *I. bradyi*, representing more than 50 percent of the population; however, *C. vidua* became established later in the sequence. *Cypridopsis* sp., *Limnocythere* sp. cf. *L. paraornata*, and *D. stevensoni* appeared occasionally (see Figure 16.18b). The taphonomic characteristics indicate low-to-moderate fragmentation and abrasion (10-15 percent); low authigenic mineralization or coating (circa 10 percent) characterized the later stages. No stains to light oxidizing conditions also occur, as shown by the redox index. Adult specimens are the most abundant, although all samples include juveniles of most species (see Tables 16.4-16.5). Faunal assemblages fluctuated from Assemblage I to Assemblage III. Assemblage II characterizes the end of the record. A continuous, single water cycle is inferred from the sedimentology and the faunal composition.

Canal Feature 204, exposed on the southern wall of Trench 305, provided a reference sample (2 cm bcb) and seven canal fill samples (see Figure 16.18c). Sediments are mostly sandy silt to clay, optimal for microinvertebrates. Four samples contained ostracodes. The thick cienega-like deposits were monospecific (*I. bradyi*). *C. vidua* occurred occasionally at the early stages of the canal (see Figure 16.18c). The taphonomic parameters show a low-to-high rate of fragmentation and abrasion (5-70 percent). Low-to-moderate coating and authigenic mineralization (5-30 percent) is evident. The redox index fluctuated from well-preserved valves with no stains to strong oxidizing conditions. Adults are dominant (see Tables 16.4-16.5). Assemblage I characterized the canal. A continuous, single water cycle, with an input pulse at about 20 cm above the canal base, is inferred from the sedimentology and faunal record.

Canal Feature 201, exposed on the southern wall of Trench 302, provided a reference sample (2 cm bcb) and eight canal fill samples with a very rich and diverse ostracode record (see Table 16.5). Gravelly sandy clay to clay characterize the canal. *I. bradyi*, *C. vidua*, *Cypridopsis* sp., *H. brevicaudata*, *Limnocythere* sp. cf. *L. paraornata*, and *D. stevensoni* occurred in this canal (see Figure 16.18d). Low-to-moderate fragmentation and abrasion (5-25 percent) characterize the strata, authigenic mineralization and coating are low (5-10 percent), and the redox index shows no stains to light oxidizing conditions. At least two water cycles were identified, based on the sedimentology and faunal composition.

Historic-era Canals

Canal Feature 206 represents historic irrigation (see Figure 16.19). Feature 206, exposed on the southern wall of Trench 309, provided a reference sample (2 cm bcb) and two canal fill samples containing a diverse and rich ostracode fauna (see Figure 16.19; see also Table 16.5). Fine-grained sediments are optimal for microinvertebrates (see Table 16.1). Eight species occurred throughout the record: *I. bradyi*, followed in abundance by *C. vidua*, *Cypridopsis* sp., and more randomly *L.* sp. cf. *L. paraornata*, *H. brevicaudata*, *D. stevensoni*, *P. unicaudata*, and *Ch. arcuata*. Taphonomic parameters show low-to-moderate fragmentation and abrasion (5-15 percent), low authigenic mineralization (5 percent), and no coating. Light oxidizing stains are shown by the redox index (see Table 16.4). The A/J ratios indicate adult-dominated fauna, while the C/V ratios indicate mostly disarticulated specimens (see Table 16.5). Assemblage I evolved to Assemblage III during the canal history, showing a single continuous water cycle.

Interpretations of Canal Ostracode Records from the Mission Gardens Locus

Feature 200 is a large Sedentary period Hohokam canal consisting of two channels ranging in size from 6 m to 2 m wide and 150 cm to 85 cm deep; at least 18 lithostratigraphic units were recorded. The thickness of the units suggests a permanent flow discharge for the time the canal was active (0-60 cm). A sudden change in lithology is associated with a flood event that capped the canal (approximately 60-130 cm). In Trench 310, this sequence is evident; in Trench 302, the thick flood deposit is not recorded.

Ostracodes entered the canal early, as shown in Figure 16.17a; *C. patzcuaro* and *I. bradyi* established a community Assemblage I that evolved into Assemblage III, as *C. vidua* and *D. stevensoni* developed in the area between Trench 310 and Trench 302. Absence of ostracodes in the lower part of Trench 302 is not easy to explain. The upper part is consistent with the upper portion recorded in Trench 310. Canal hydraulics may be responsible for the trend observed between the two sites.

Faunal Assemblage I suggests dilute water input. Tolerance of *I. bradyi* ranges from 100 to 4,000 mg l^{-1} TDS (Delorme 1989; Palacios-Fest 1994). Therefore, the salinity range of Feature 200 does not exceed either limit. The occurrences of *P. pustulosa* (salinity tolerance 100-600 mg l^{-1} TDS) and *D. stevensoni* (50-2,000 mg l^{-1} TDS) indicate canal salinity did not exceed 600 mg l^{-1} TDS at the beginning of canal operation. *P. pustulosa* consisted of juveniles, implying the species did not reach maturity in a harsh environment. Salinity increased, but did not exceed 2,000 mg l^{-1}, as *D. stevensoni* established a community in Trench 310. Its absence in Trench 302 might be a result of canal hydraulics. The paleosalinity index is in good agreement with two pulses of dilute water input (see Figures 16.17a-b).

Four features (Features 207, 205, 204, and 201) provided the view of Protohistoric period activity in the area. Feature 207 is a small (about 1.45 m wide) and shallow (about 29 cm) canal consisting of a single lithostratigraphic unit. Its thickness and grain-size composition suggest a sustained, moderately slow water flow (see Table 16.2). The ostracode record is consistent with this interpretation.

Faunal Assemblage III dominates the canal history. *I. bradyi* entered the canal that was dug into cienega soils (containing ostracodes as well). Other species occurred in low proportions, except *C. vidua* and *D. stevensoni* (see Figure 16.18a). Canal operation probably lasted for a prolonged period, as the life cycle of *D. stevensoni* takes over six months, and this species established a biocenosis (Andrew Cohen, personal communication 1988). *I. bradyi*, *C. vidua*, and *H. brevicaudata* tolerate a similar salinity range (100-4,000 mg l^{-1} TDS), in contrast with *P. pustulosa* (100-600 mg l^{-1} TDS) and *D. stevensoni* (50-2,000 mg l^{-1}). Therefore, it is suggested that salinity did not exceed the upper limit of *D. stevensoni*. Absence of adults of *P. pustulosa* suggests the species was introduced, but did not last due to stressful conditions. The paleosalinity index is consistent with a permanent freshwater input (see Figure 16.18a).

Feature 205 is a small, shallow canal, approximately 60 cm wide and 34 cm deep. Grain size (silty and sandy clay) suggests an optimal substrate for establishing a biocenosis (see Table 16.2). The relatively thin sedimentologic sequence consisting of a lithostratigraphic unit suggests a short-term canal operation. However, the ostracode assemblage does not appear to support the interpretation of a short-term canal operation.

Faunal Assemblage I throughout the record suggests low salinity water input. Transition to Assemblage III and then to Assemblage II is indicated by the occurrences of *D. stevensoni*, and later of *C. vidua*, suggesting salinity increased over 2,000 mg l^{-1} TDS as *D. stevensoni* disappeared from the record (Delorme 1989; Forester 1991; Palacios-Fest 1994). Only *I. bradyi* and *C. vidua* occurred toward the end of the canal history (see Figure 16.18b). The paleosalinity index and grain-size diagrams are consistent with increasing salinization and decreasing water flow.

Feature 204 is a large canal approximately 2.25 m wide and 60 cm deep, consisting of a single lithostratigraphic unit with manganese stains at the base and at 36-37 cm from the base. The thick sedimentologic sequence suggests a long and continuous canal operation. The canal was dug into the cienega deposit. Moderately fast-flow input characterized this canal. The faunal assemblage is limited to *I. bradyi* and *C. vidua*. *I. bradyi* dominates the sequence (Assemblage I), and *C. vidua* became established for a short interval. Two pulses of moderately saline water and fresh water are indicated by the paleosalinity index (see Figure 16.18c). The occurrence of two saline-tolerant species (100-4,000 mg l^{-1}) at the initial stages of water discharge suggests water flow was moderately slow (*C. vidua* prefers slow-moving water) (Delorme 1989; Palacios-Fest 1994). Increasing flow velocity is indicated by the occurrence of a monospecific Assemblage I in the upper part of the record (see Figure 16.18c).

Feature 201 is a medium-to-large canal (some 1.4 m wide and 80 cm deep) dug into the cienega deposit, consisting of eight lithostratigraphic units. Moderately fast water flow, which gradually decreased, is suggested by the thickness and grain-size composition of the unit (see Table 16.2). A continuous ostracode record also suggests long-term canal operation (see Figure 16.18d). Faunal Assemblage I (*I. bradyi*) dominates the sequence. *C. vidua* is also significant and indicates a transition from Assemblage I to Assemblage II during operation of the canal. A stable community settled in the canal, allowing *D. stevensoni* to establish as the flow velocity decreased. Moderately saline water entered the canal. Salinity did not exceed 3,000 mg l^{-1} TDS (maximum tolerance of *H. brevicaudata)* (Forester 1991). Through time, salinity decreased due to a constant freshwater input favoring the settlement of *D. stevensoni*, suggesting a salinity range no greater than 2,000 mg l^{-1} TDS. Both the paleosalinity index and the grain-size diagrams are consistent in suggesting two water cycles—the first short, the second prolonged (see Figure 16.18d).

Canal Feature 206 was used during historic times. It is a small- to medium-sized canal (roughly 1.3 m wide and 16 cm deep)—dug into the cienega deposit and truncated by the plowzone—consisting of two lithostratigraphic units. The thicknesses and grain-size compositions of the units indicate a moderately slow discharge (see Table 16.2). The ostracode record suggests continuous canal operation. Assemblage I evolved into Assemblage III. *I. bradyi* dominates the history of the canal, but *C. vidua*, *Cypridopsis* sp., and *D. stevensoni* are also significant, and they increase in abundance toward the end of the record. *H. brevicaudata*, *L.* sp. cf. *L. paraornata*, *P. unicaudata*, and *Ch. arcuata* were introduced, but did not settle (see Table 16.5). For *D. stevensoni* to settle implies that the canal was active for a prolonged period, perhaps longer than six months, and that salinity did not exceed 2,000 mg l^{-1} (Delorme 1989; Palacios-Fest 1994). The paleosalinity index is consistent with a permanent, moderately freshwater input during canal operation (see Figure 16.19).

Summary

The ostracode records of canals in the Mission Gardens locus contribute new information about prehistoric Hohokam, Protohistoric, and Historic irrigation. Protohistoric canals are documented for the first time in the Tucson Basin. Further, ostracodes demonstrate that canal Feature 200, thought to be fed by groundwater due to its deep profile, received discharge from the Santa Cruz River. Two trenches were sampled, showing similar ostracode assemblages; however, they differ in terms of a faunal gap recorded at the base of the canal in Trench 302. As suggested earlier, the gap may have resulted from canal hydraulics controlled by changes in canal gradient and shape.

Despite the apparent fluvial origin of ostracodes, this interpretation could be tested by conducting stable isotope shell chemistry analysis of the shells of *I. bradyi*. Stable isotopes from the carbonate shells record the water source signal. David Dettman (personal communication 2004) proposes the possibility of identifying and quantifying the origin of hydrologic variations in response to seasonal or climatic changes, or of distinguishing between surface and groundwater origin, based on the $\delta^{18}O$ and $\delta^{13}C$ values of ostracode valves.

The canal faunal association is consistent with previous findings at Las Capas (Palacios-Fest 2001; Palacios-Fest and Davis 2006) and at the San Agustín Mission (see above). The faunal composition is similar, suggesting a not surprising similar source of water to the canals. Additionally, *I. bradyi* is the most abundant species across the site, followed by *C. vidua* and *D. stevensoni*, representing three assemblages (*I. bradyi*-dominated, *I. bradyi*/*C. vidua*-dominated, and *I. bradyi*/*C. vidua*/*D. stevensoni*-dominated). Other species appeared and disappeared at several intervals. The interpretation is that canals at the Mission Gardens were characterized by a prolonged operation and constant input, keeping salinity relatively low, below 2,000 mg l^{-1}.

The study of ostracode records of canals in the Mission Gardens locus provided new insights on canal operations through time. The strong presence of *I. bradyi* suggests all canals were river-fed; however, this species may also occur in wetlands. Therefore, it is suggested that future research include carbon and oxygen isotope analysis of ostracode shells to definitively determine water sources.

CONCLUSIONS

The results of this study may be summarized in terms of seven major conclusions that highlight the relevance of ostracode research in archaeology.

(1) The history of canal irrigation in the Tucson Basin goes back to 3500 years B.P.

(2) Early Agricultural period canal irrigationwas simple, similar to that recorded for the same time interval at Las Capas (Palacios-Fest et al. 2001).

(3) Canal irrigation during the Hohokam periods was complex; the ostracode record demonstrates the Hohokam mastered water management. Multiple cycles of canal flow, implying operation of headgates, were common during Hohokam time.

(4) Post-Hohokam canal irrigation was again apparently less sophisticated. Protohistoric and Historic canals were generally smaller and consisted of a single stratigraphic unit; canal operation was prolonged.

(5) Canal histories may not have been exactly as the cycles inferred in this study. For example, the changes recorded within the canals may represent independent events following canal clean-outs. However, the interpretation conducted here is our best approximation for understanding canal operation and the evolution of water management technology by ancient societies.

(6) Ostracodes are a powerful tool with which to reconstruct anthropogenic activities in the Santa Cruz Valley and the Tucson Basin.

(7) Future research on ostracode paleoecology should include geochemical techniques to measure trace elements and stable isotopes for paleoclimatic and water source reconstructions.

Table 16.2. Ostracode samples from AZ BB:13:481 (ASM), by identification number, stratigraphic level, bulk and residual weights, lithology, color, and color code of sediment residuals.

Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Bulk Weight (gm)	Residual Weight (gm)	>1 mm	>106 mm	>63 mm	<63 mm	>1 mm	>106 mm	>63 mm	<63 mm	Lithology	Color	Color Code
Congress Street/Brickyard														
DA-RNA8-212-144-1	-2	106.69	5.89	1.35	2.27	2.27	100.80	1.27	2.13	2.13	94.48	Clay	Pale yellowish-brown	10YR 6/2
DA-RNA8-212-144-2	4	108.96	28.79	1.55	15.89	11.35	80.17	1.42	14.58	10.42	73.58	Sandy silty clay	Pale yellowish-brown	10YR 6/2
DA-RNA8-212-144-3	17	99.88	24.15	1.45	13.62	9.08	75.73	1.45	13.64	9.09	75.82	Sandy silty clay	Moderate yellowish-brown	10YR 5/4
DA-RNA8-212-144-4	27	106.69	28.24	1.00	15.89	11.35	78.45	0.94	14.89	10.64	73.53	Sandy silty clay	Moderate yellowish-brown	10YR 5/4
DA-RNA8-212-144-5	35	118.04	45.40	2.27	31.78	11.35	72.64	1.92	26.92	9.62	61.54	Silty sand	Grayish-orange	10YR 7/4
DA-RNA8-212-144-6	45	111.23	16.39	0.50	6.81	9.08	94.84	0.45	6.12	8.16	85.26	Silty clay	Moderate yellowish-brown	10YR 5/4
DA-RNA8-212-144-7	60	113.50	21.43	1.00	11.35	9.08	92.07	0.88	10.00	8.00	81.12	Sandy silty clay	Moderate yellowish-brown	10YR 5/4
DA-RNA8-212-144-8	72	120.31	29.89	2.65	18.16	9.08	90.42	2.20	15.09	7.55	75.16	Sandy silty clay	Moderate yellowish-brown	10YR 5/4
DA-RNA8-267-152-1	-2	108.96	98.61	18.16	79.45	1.00	10.35	16.67	72.92	0.92	9.50	Gravelly sand	Grayish-orange	10YR 7/4
DA-RNA8-267-152-2	2	133.93	79.45	6.81	70.37	2.27	54.48	5.08	52.54	1.69	40.68	Gravelly sand	Grayish-orange	10YR 7/4
DA-RNA8-267-152-3	16	138.47	82.21	4.54	75.40	2.27	56.26	3.28	54.45	1.64	40.63	Gravelly sand	Grayish-orange	10YR 7/4
DA-RNA8-267-152-4	30	124.85	26.47	4.54	20.43	1.50	98.38	3.64	16.36	1.20	78.80	Sandy silt	Grayish-orange	10YR 7/4
DA-RNA8-267-152-5	50	120.31	22.70	2.27	18.16	2.27	97.61	1.89	15.09	1.89	81.13	Sandy silt	Grayish-orange	10YR 7/4
DA-RNA8-Block 5-143-1	-2	86.26	73.64	11.35	61.29	1.00	12.62	13.16	71.05	1.16	14.63	Gravelly sand	Grayish-orange	10YR 7/4
DA-RNA8-Block 5-143-2	2	102.15	22.16	2.50	18.16	1.50	79.99	2.45	17.78	1.47	78.31	Sandy silt	Pale yellowish-brown	10YR 6/2
DA-RNA8-Block 5-143-3	11	115.77	15.62	2.27	11.35	2.00	100.15	1.96	9.80	1.73	86.51	Sandy silty clay	Pale yellowish-brown	10YR 6/2

Table 16.2. Continued.

Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Bulk Weight (gm)	Residual Weight (gm)	>1 mm	>106 mm	>63 mm	<63 mm	>1 mm	>106 mm	>63 mm	<63 mm	Lithology	Color	Color Code
DA-RNA8-Block 5-143-4	22	113.50	13.35	1.00	11.35	1.00	100.15	0.88	10.00	0.88	88.24	Sandy silty clay	Pale yellowish-brown	10YR 6/2
DA-RNA8-260-149-1	-2	59.02	12.31	2.00	3.50	6.81	46.71	3.39	5.93	11.54	79.14	Silty clay	Dark yellowish-brown	10YR 4/2
DA-RNA8-260-149-2	4	111.23	88.53	24.97	61.29	2.27	22.70	22.45	55.10	2.04	20.41	Gravelly sand	Grayish-orange	10YR 7/4
DA-RNA8-260-149-3	15	88.53	20.16	2.00	9.08	9.08	68.37	2.26	10.26	10.26	77.23	Silty clay	Pale yellowish-brown	10YR 6/2
DA-RNA8-260-149-4	21	106.69	18.51	0.35	6.81	11.35	88.18	0.33	6.38	10.64	82.65	Silty clay	Grayish-orange	10YR 7/4
DA-RNA8-260-149-5	27	106.69	44.68	1.55	34.05	9.08	62.01	1.45	31.91	8.51	58.12	Silty sand	Grayish-orange	10YR 7/4
DA-RNA8-260-149-6	35	129.39	26.97	2.00	18.16	6.81	102.42	1.55	14.04	5.26	79.16	Sandy silty clay	Pale yellowish-brown	10YR 6/2
DA-RNA8-260-149-7	45	133.93	127.85	2.00	124.85	1.00	6.08	1.49	93.22	0.75	4.54	Sand	Pale yellowish-brown	10YR 6/2
DA-RNA8-253-146-1	-2	108.96	88.53	11.35	74.91	2.27	20.43	10.42	68.75	2.08	18.75	Gravelly sand	Grayish-orange	10YR 7/4
DA-RNA8-253-146-2	3	111.23	72.64	9.08	54.48	9.08	38.59	8.16	48.98	8.16	34.69	Gravelly silty sand	Pale yellowish-brown	10YR 6/2
DA-RNA8-253-146-3	14	124.85	56.75	2.27	40.86	13.62	68.10	1.82	32.73	10.91	54.55	Silty sand	Pale yellowish-brown	10YR 6/2
DA-RNA8-253-146-4	34	115.77	59.02	2.27	43.13	13.62	56.75	1.96	37.25	11.76	49.02	Sandy silt	Pale yellowish-brown	10YR 6/2
DA-RNA8-253-146-5	50	106.69	56.75	2.27	36.32	18.16	49.94	2.13	34.04	17.02	46.81	Sandy silt	Pale yellowish-brown	10YR 6/2
DA-RNA8-253-146-6	68	106.69	54.48	2.27	43.13	9.08	52.21	2.13	40.43	8.51	48.94	Sandy silt	Pale yellowish-brown	10YR 6/2
DA-RNA8-253-147-1	5	106.69	56.75	2.27	45.40	9.08	49.94	2.13	42.55	8.51	46.81	Sandy silt	Pale yellowish-brown	10YR 6/2
DA-RNA8-253-147-2	17	108.96	49.94	2.27	38.59	9.08	59.02	2.08	35.42	8.33	54.17	Sandy silt	Pale yellowish-brown	10YR 6/2
DA-RNA8-253-148-1	-2	83.99	59.02	2.27	49.94	6.81	24.97	2.70	59.46	8.11	29.73	Silty sand	Pale yellowish-brown	10YR 6/2

Table 16.2. Continued.

Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Bulk Weight (gm)	Residual Weight (gm)	>1 mm	>106 mm	>63 mm	<63 mm	>1 mm	>106 mm	>63 mm	<63 mm	Lithology	Color	Color Code
DA-RNA8-253-148-2	4	118.04	72.64	2.27	52.21	18.16	45.40	1.92	44.23	15.38	38.46	Silty sand	Grayish-orange	10YR 7/4
DA-RNA8-253-148-3	15	124.85	41.86	1.00	27.24	13.62	82.99	0.80	21.82	10.91	66.47	Sandy silt	Grayish-orange	10YR 7/4
DA-RNA8-253-150-1	-2	99.88	42.41	1.55	31.78	9.08	57.47	1.55	31.82	9.09	57.54	Sandy silt	Pale yellowish-brown	10YR 6/2
DA-RNA8-253-150-2	2	120.31	90.80	13.62	70.37	6.81	29.51	11.32	58.49	5.66	24.53	Gravelly silty sand	Pale yellowish-brown	10YR 6/2
DA-RNA8-253-150-3	19	102.15	54.48	4.54	40.86	9.08	47.67	4.44	40.00	8.89	46.67	Silty sand	Pale yellowish-brown	10YR 6/2
DA-RNA8-258-153/ 154-1	-2	106.69	63.56	2.27	54.48	6.81	43.13	2.13	51.06	6.38	40.43	Silty sand	Pale yellowish-brown	10YR 6/2
DA-RNA8-258-153/ 154-2	5	106.69	43.13	4.54	31.78	6.81	63.56	4.26	29.79	6.38	59.57	Sandy silt	Pale yellowish-brown	10YR 6/2
DA-RNA8-258-153/ 154-3	13	120.31	10.58	1.50	6.81	2.27	109.73	1.25	5.66	1.89	91.21	Silty clay	Dusky yellowish-brown	10YR 2/2
DA-RNA8-258-153/ 154-4	21	124.85	33.78	2.00	22.70	9.08	91.07	1.60	18.18	7.27	72.94	Sandy silt	Dark yellowish-brown	10YR 4/2
DA-RNA8-203-140-1	-2	59.02	50.44	6.81	43.13	0.50	8.58	11.54	73.08	0.85	14.54	Gravelly sand	Moderate brown	5YR 4/4
DA-RNA8-203-140-2	3	74.91	40.86	2.27	36.32	2.27	34.05	3.03	48.48	3.03	45.45	Gravelly sand	Moderate yellowish-brown	10YR 5/4
DA-RNA8-203-140-3	10	77.18	19.16	1.00	9.08	9.08	58.02	1.30	11.76	11.76	75.17	Sandy silt	Pale yellowish-brown	10YR 6/2
DA-RNA8-203-140-4	16	86.26	5.54	1.00	2.27	2.27	80.72	1.16	2.63	2.63	93.58	Clay	Dark yellowish-brown	10YR 4/2
DA-RNA8-203-140-5	22	74.91	36.32	2.27	29.51	4.54	38.59	3.03	39.39	6.06	51.52	Sandy silty clay	Pale yellowish-brown	10YR 6/2
DA-RNA8-203-140-6	30	68.10	26.47	1.50	18.16	6.81	41.63	2.20	26.67	10.00	61.13	Sandy silt	Pale yellowish-brown	10YR 6/2
DA-RNA8-203-140-7	34	61.29	14.12	0.50	6.81	6.81	47.17	0.82	11.11	11.11	76.96	Sandy silty clay	Pale yellowish-brown	10YR 6/2
DA-RNA8-203-140-8	39	70.37	16.89	1.00	11.35	4.54	53.48	1.42	16.13	6.45	76.00	Sandy silty clay	Pale brown	5YR 5/2

Table 16.2. Continued.

Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Bulk Weight (gm)	Residual Weight (gm)	>1 mm	>106 mm	>63 mm	<63 mm	>1 mm	>106 mm	>63 mm	<63 mm	Lithology	Color	Color Code
DA-RNA8-201-139-1	-2	68.10	61.79	13.62	47.67	0.50	6.31	20.00	70.00	0.73	9.27	Gravelly sand	Light brown	5YR 6/4
DA-RNA8-201-139-2	2	86.26	44.63	1.50	29.51	13.62	41.63	1.74	34.21	15.79	48.26	Silty sand	Pale yellowish-brown	10YR 6/2
DA-RNA8-201-139-3	9	81.72	50.19	0.25	36.32	13.62	31.53	0.31	44.44	16.67	38.58	Silty sand	Pale yellowish-brown	10YR 6/2
DA-RNA8-201-139-4	14	74.91	37.32	1.00	27.24	9.08	37.59	1.33	36.36	12.12	50.18	Silty sand	Pale yellowish-brown	10YR 6/2
DA-RNA8-201-139-5	23	86.26	34.05	11.35	20.43	2.27	52.21	13.16	23.68	2.63	60.53	Gravelly sandy silt	Moderate yellowish-brown	10YR 5/4
DA-RNA8-201-139-6	27	79.45	35.05	1.00	22.70	11.35	44.40	1.26	28.57	14.29	55.88	Sandy silt	Pale yellowish-brown	10YR 6/2
DA-RNA8-201-139-7	36	77.18	18.89	3.00	13.62	2.27	58.29	3.89	17.65	2.94	75.52	Sandy clayey silt	Pale yellowish-brown	10YR 6/2
DA-RNA8-201-139-8	40	88.53	45.13	2.00	36.32	6.81	43.40	2.26	41.03	7.69	49.02	Sandy silt	Pale yellowish-brown	10YR 6/2
DA-RNA8-201-139-9	45	81.72	42.86	2.00	34.05	6.81	38.86	2.45	41.67	8.33	47.55	Silty sand	Pale yellowish-brown	10YR 6/2
DA-RNA8-201-139-10	52	79.45	11.60	0.25	6.81	4.54	67.85	0.31	8.57	5.71	85.40	Silty clay	Dark yellowish-brown	10YR 4/2
DA-RNA8-201-139-11	59	63.56	9.58	0.50	4.54	4.54	53.98	0.79	7.14	7.14	84.93	Clay	Pale yellowish-brown	10YR 6/2
DA-RNA8-201-139-12	63	65.83	6.04	1.50	2.27	2.27	59.79	2.28	3.45	3.45	90.82	Clay	Grayish-orange	10YR 7/4
DA-RNA8-201-139-13	71	61.29	12.35	1.00	9.08	2.27	48.94	1.63	14.81	3.70	79.85	Silty clay	Pale yellowish-brown	10YR 6/2
DA-RNA8-202-138-1	-2	97.61	10.08	1.00	4.54	4.54	87.53	1.02	4.65	4.65	89.67	Silty clay	Dark yellowish-brown	10YR 4/2
DA-RNA8-202-138-2	4	81.72	58.25	1.50	47.67	9.08	23.47	1.84	58.33	11.11	28.72	Silty sand	Pale yellowish-brown	10YR 6/2
DA-RNA8-202-138-3	18	86.26	45.13	2.00	34.05	9.08	41.13	2.32	39.47	10.53	47.68	Sandy silt	Pale yellowish-brown	10YR 6/2
DA-RNA8-202-138-4	28	90.80	43.13	2.27	31.78	9.08	47.67	2.50	35.00	10.00	52.50	Sandy silt	Pale yellowish-brown	10YR 6/2

Table 16.2. Continued.

Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Bulk Weight (gm)	Residual Weight (gm)	>1 mm	>106 mm	>63 mm	<63 mm	>1 mm	>106 mm	>63 mm	<63 mm	Lithology	Color	Color Code
DA-RNA8-202-138-5	36	81.72	30.51	1.00	20.43	9.08	51.21	1.22	25.00	11.11	62.67	Sandy silt	Pale yellowish-brown	10YR 6/2
DA-RNA8-219-141-1	-2	74.91	46.90	2.27	43.13	1.50	28.01	3.03	57.58	2.00	37.39	Silty sand	Pale yellowish-brown	10YR 6/2
DA-RNA8-219-141-2	10	90.80	8.31	1.50	4.54	2.27	82.49	1.65	5.00	2.50	90.85	Silty clay	Dark yellowish-brown	10YR 4/2
DA-RNA8-219-141-3	26	77.18	8.31	1.50	4.54	2.27	68.87	1.94	5.88	2.94	89.23	Silty clay	Dark yellowish-brown	10YR 4/2
DA-RNA8-206-142-1	-2	61.29	4.79	0.25	2.27	2.27	56.50	0.41	3.70	3.70	92.18	Clay	Dark yellowish-brown	10YR 4/2
DA-RNA8-206-142-2	6	81.72	9.38	0.30	4.54	4.54	72.34	0.37	5.56	5.56	88.52	Clay	Pale yellowish-brown	10YR 6/2
DA-RNA8-206-142-3	12	99.88	13.72	0.10	6.81	6.81	86.16	0.10	6.82	6.82	86.26	Clay	Moderate yellowish-brown	10YR 5/4
DA-RNA8-206-142-4	21	93.07	15.99	0.10	9.08	6.81	77.08	0.11	9.76	7.32	82.82	Silty clay	Moderate yellowish-brown	10YR 5/4
DA-RNA8-206-142-5	50	88.53	16.04	0.15	9.08	6.81	72.49	0.17	10.26	7.69	81.88	Silty clay	Moderate yellowish-brown	10YR 5/4
DA-RNA8-206-142-6	64	52.21	9.18	0.10	4.54	4.54	43.03	0.19	8.70	8.70	82.42	Silty clay	Moderate yellowish-brown	10YR 5/4
DA-RNA8-215-139-1	-2	38.59	36.32	0.00	24.97	11.35	2.27	0.00	64.71	29.41	5.88	Sand	Pale yellowish-brown	10YR 6/2
DA-RNA8-215-139-2	2	74.91	17.19	1.30	9.08	6.81	57.72	1.74	12.12	9.09	77.05	Sandy clay	Pale yellowish-brown	10YR 6/2
DA-RNA8-215-139-3	11	77.18	10.48	1.40	4.54	4.54	66.70	1.81	5.88	5.88	86.42	Sandy silty clay	Moderate yellowish-brown	10YR 5/4
DA-RNA8-215-139-4	18	79.45	19.01	0.85	15.89	2.27	60.44	1.07	20.00	2.86	76.07	Sandy clay	Pale yellowish-brown	10YR 6/2
DA-RNA8-215-139-5	26	95.34	27.24	2.27	20.43	4.54	68.10	2.38	21.43	4.76	71.43	Sandy clay	Pale yellowish-brown	10YR 6/2
DA-RNA8-215-139-6	33	79.45	31.78	2.27	27.24	2.27	47.67	2.86	34.29	2.86	60.00	Sandy clay	Pale yellowish-brown	10YR 6/2

Table 16.2. Continued.

Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Bulk Weight (gm)	Residual Weight (gm)	>1 mm	>106 mm	>63 mm	<63 mm	>1 mm	>106 mm	>63 mm	<63 mm	Lithology	Color	Color Code
DA-RNA8-215-139-7	40	74.91	21.98	1.55	13.62	6.81	52.93	2.07	18.18	9.09	70.66	Sandy clay	Pale yellowish-brown	10YR 6/2
DA-RNA8-215-139-8	45	40.86	2.65	0.05	1.60	1.00	38.21	0.12	3.92	2.45	93.51	Clay	Moderate yellowish-brown	10YR 5/4
DA-RNA8-215-139-9	50	100.00	12.35	1.00	9.08	2.27	87.65	1.00	9.08	2.27	87.65	Clay	Moderate yellowish-brown	10YR 5/4
DA-RNA8-220-141-1	-2	68.10	26.47	2.27	22.70	1.50	41.63	3.33	33.33	2.20	61.13	Clayey sand	Pale yellowish-brown	10YR 6/2
DA-RNA8-220-141-2	10	83.99	8.11	1.30	4.54	2.27	75.88	1.55	5.41	2.70	90.34	Clay	Pale yellowish-brown	10YR 6/2
DA-RNA8-220-141-3	26	88.53	9.01	1.20	6.81	1.00	79.52	1.36	7.69	1.13	89.82	Clay	Pale yellowish-brown	10YR 6/2
DA-RNA8-265-151-1	-2	79.45	29.56	0.05	22.70	6.81	49.89	0.06	28.57	8.57	62.79	Sandy clay	Pale yellowish-brown	10YR 6/2
DA-RNA8-265-151-2	4	100.00	16.89	1.00	11.35	4.54	83.11	1.00	11.35	4.54	83.11	Sandy clay	Pale yellowish-brown	10YR 6/2
DA-RNA8-265-151-3	25	100.00	16.89	1.00	9.08	6.81	83.11	1.00	9.08	6.81	83.11	Sandy clay	Pale yellowish-brown	10YR 6/2
DA-RNA8-265-151-4	35	100.00	73.94	1.30	70.37	2.27	26.06	1.30	70.37	2.27	26.06	Sand	Pale yellowish-brown	10YR 6/2
DA-RNA8-265-151-5	48	100.00	14.62	1.00	9.08	4.54	85.38	1.00	9.08	4.54	85.38	Clay	Dark yellowish-brown	10YR 4/2
DA-RNA8-265-151-6	54	100.00	28.34	1.10	22.70	4.54	71.66	1.10	22.70	4.54	71.66	Sandy clay	Pale yellowish-brown	10YR 6/2
DA-RNA8-265-151-7	63	100.00	26.12	1.15	22.70	2.27	73.88	1.15	22.70	2.27	73.88	Sandy clay	Pale yellowish-brown	10YR 6/2
DA-RNA8-265-151-8	71	100.00	70.37	18.16	49.94	2.27	29.63	18.16	49.94	2.27	29.63	Gravelly sand	Grayish-orange	10YR 7/4
DA-RNA8-265-151-9	82	100.00	20.52	2.27	15.98	2.27	79.48	2.27	15.98	2.27	79.48	Sandy clay	Moderate yellowish-brown	10YR 5/4
DA-RNA8-265-151-10	86	83.99	6.54	1.00	4.54	1.00	77.45	1.19	5.41	1.19	92.21	Clay	Dark yellowish-brown	10YR 4/2
DA-RNA8-255-154-1	-2	100.00	68.90	4.54	63.56	0.80	31.10	4.54	63.56	0.80	31.10	Sand	Grayish-orange	10YR 7/4

Table 16.2. Continued.

Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Bulk Weight (gm)	Residual Weight (gm)	>1 mm	>106 mm	>63 mm	<63 mm	>1 mm	>106 mm	>63 mm	<63 mm	Lithology	Color	Color Code
DA-RNA8-255-154-2	5	100.00	57.45	43.13	13.62	0.70	42.55	43.13	13.62	0.70	42.55	Clayey sandy gravel	Grayish-orange	10YR 7/4
DA-RNA8-255-154-3	13	100.00	29.51	6.81	20.43	2.27	70.49	6.81	20.43	2.27	70.49	Sandy clay	Grayish-orange	10YR 7/4
San Agustín Mission														
DA-RNA2-3-1	1	72.64	24.97	–	–	–	–	–	–	–	–	Sandy silt	Moderate brown	5YR 3/4
DA-RNA2-3-2	8	83.99	31.78	–	–	–	–	–	–	–	–	Gravelly sandy silt	Moderate brown	5YR 3/4
DA-RNA2-3-3	-5	56.75	6.81	–	–	–	–	–	–	–	–	Sandy silty clay	Dusky brown	5YR 2/2
DA-RNA2-3-4	2	79.45	11.35	–	–	–	–	–	–	–	–	Sandy silty clay	Moderate brown	5YR 3/4
DA-RNA2-3-5	9	72.64	15.89	–	–	–	–	–	–	–	–	Gravelly sandy silt	Dusky brown	5YR 2/2
DA-RNA2-9-1	-2	59.02	2.27	–	–	–	–	–	–	–	–	Clay	Dusky brown	5YR 2/2
DA-RNA2-9-2	5	68.10	15.89	–	–	–	–	–	–	–	–	Sandy silty clay	Pale yellowish-brown	10YR 6/2
DA-RNA2-9-3	16	61.29	11.35	–	–	–	–	–	–	–	–	Sandy silty clay	Pale yellowish-brown	10YR 6/2
DA-RNA2-9-4	22	43.13	6.81	–	–	–	–	–	–	–	–	Sandy silty clay	Pale yellowish-brown	10YR 6/2
DA-RNA2-53-1	0	95.34	4.54	–	–	–	–	–	–	–	–	Silty clay	Dusky brown	5YR 2/2
DA-RNA2-53-2	2	72.64	9.08	–	–	–	–	–	–	–	–	Clayey silt	Pale yellowish-brown	10YR 6/2
DA-RNA2-53-3	12	72.64	6.81	–	–	–	–	–	–	–	–	Silty clay	Pale yellowish-brown	10YR 6/2
DA-RNA2-53-4	2	70.37	18.16	–	–	–	–	–	–	–	–	Gravelly sandy silt	Pale yellowish-brown	10YR 6/2
DA-RNA2-53-5	12	63.56	4.54	–	–	–	–	–	–	–	–	Clayey silt	Pale yellowish-brown	10YR 6/2

Table 16.2. Continued.

Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Bulk Weight (gm)	Residual Weight (gm)	>1 mm	>106 mm	>63 mm	<63 mm	>1 mm	>106 mm	>63 mm	<63 mm	Lithology	Color	Color Code
DA-RNA2-53-6	0	93.07	9.08	–	–	–	–	–	–	–	–	Silty clay	Dusky brown	5YR 2/2
DA-RNA2-53-7	2	68.10	22.1	–	–	–	–	–	–	–	–	Sandy silt	Pale yellowish-brown	10YR 6/2
DA-RNA2-53-8	17	72.64	9.08	–	–	–	–	–	–	–	–	Sandy silt	Pale yellowish-brown	10YR 6/2
DA-RNA2-53-9	27	70.37	6.81	–	–	–	–	–	–	–	–	Sandy silty clay	Pale yellowish-brown	10YR 6/2
DA-RNA2-53-10	2	70.37	27.24	–	–	–	–	–	–	–	–	Gravelly silty sand	Dusky brown	5YR 2/2
DA-RNA2-53-11	9	59.02	18.16	–	–	–	–	–	–	–	–	Gravelly silty sand	Pale yellowish-brown	10YR 6/2
DA-RNA2-53-12	0	68.10	6.81	–	–	–	–	–	–	–	–	Gravelly silty clay	Dusky brown	5YR 2/2
DA-RNA2-53-13	2	52.21	11.35	–	–	–	–	–	–	–	–	Gravelly clayey silt	Pale yellowish-brown	10YR 6/2
DA-RNA2-53-14	11	65.83	11.35	–	–	–	–	–	–	–	–	Sandy clayey silt	Pale yellowish-brown	10YR 6/2
DA-RNA2-127-1	-6	65.83	18.16	–	–	–	–	–	–	–	–	Gravelly sandy silt	Dusky brown	5YR 2/2
DA-RNA2-127-2	1	61.29	2.27	–	–	–	–	–	–	–	–	Sandy silty clay	Yellowish-brown	
DA-RNA2-127-3	11	59.02	2.27	–	–	–	–	–	–	–	–	Sandy silty clay	Yellowish-brown	
DA-RNA2-127-4	13	63.56	2.27	–	–	–	–	–	–	–	–	Sandy silty clay	Dusky brown	5YR 2/2
DA-RNA2-127-5	18	68.10	6.81	–	–	–	–	–	–	–	–	Sandy silty clay	Dusky brown	5YR 2/2
DA-RNA2-137-1	-30	49.94	31.78	–	–	–	–	–	–	–	–	Sand	Pale yellowish-brown	10YR 6/2
DA-RNA2-137-2	1	63.56	9.08	–	–	–	–	–	–	–	–	Sandy silty clay	Pale yellowish-brown to brown	10YR 6/2: 10YR 5/3
DA-RNA2-137-3	7	68.10	9.08	–	–	–	–	–	–	–	–	Sandy silty clay	Pale yellowish-brown to brown	10YR 6/2: 10YR 5/3

Table 16.2. Continued.

Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Bulk Weight (gm)	Residual Weight (gm)	>1 mm	>106 mm	>63 mm	<63 mm	>1 mm	>106 mm	>63 mm	<63 mm	Lithology	Color	Color Code
DA-RNA2-137-4	11	56.75	6.81	–	–	–	–	–	–	–	–	Sandy silty clay	Pale yellowish-brown to brown	10YR 6/2: 10YR 5/3
DA-RNA2-137-5	16	70.37	15.89	–	–	–	–	–	–	–	–	Sandy silty clay	Pale yellowish-brown to brown	10YR 6/2: 10YR 5/3
DA-RNA2-137-6	22	70.37	22.70	–	–	–	–	–	–	–	–	Sandy silty clay	Pale yellowish-brown to brown	10YR 6/2: 10YR 5/3
DA-RNA2-137-7	26	70.37	22.70	–	–	–	–	–	–	–	–	Sandy silty clay	Pale yellowish-brown to brown	10YR 6/2: 10YR 5/3
DA-RNA2-137-8	32	70.37	24.97	–	–	–	–	–	–	–	–	Sandy silty clay	Pale yellowish-brown to brown	10YR 6/2: 10YR 5/3
DA-RNA2-137-9	37	68.10	34.05	–	–	–	–	–	–	–	–	Gravelly silty sand	Pale yellowish-brown	10YR 6/2
DA-RNA2-137-10	42	70.37	29.51	–	–	–	–	–	–	–	–	Gravelly silty sand	Pale yellowish-brown	10YR 6/2
DA-RNA2-137-11	47	68.10	31.78	–	–	–	–	–	–	–	–	Gravelly silty sand	Pale yellowish-brown	10YR 6/2
DA-RNA2-137-12	51	74.91	36.32	–	–	–	–	–	–	–	–	Gravelly silty sand	Pale yellowish-brown	10YR 6/2
DA-RNA2-137-13	53	61.29	13.62	–	–	–	–	–	–	–	–	Sandy silty clay	Pale yellowish-brown to brown	10YR 6/2: 10YR 5/3
DA-RNA2-137-14	56	65.83	13.62	–	–	–	–	–	–	–	–	Sandy silty clay	Pale yellowish-brown to brown	10YR 6/2: 10YR 5/3
DA-RNA2-137-15	62	72.64	20.43	–	–	–	–	–	–	–	–	Sandy silty clay	Pale yellowish-brown to brown	10YR 6/2: 10YR 5/3
DA-RNA2-137-16	59	65.83	27.24	–	–	–	–	–	–	–	–	Gravelly silty sand	Pale yellowish-brown	10YR 6/2
DA-RNA2-137-17	65	70.37	34.05	–	–	–	–	–	–	–	–	Gravelly silty sand	Pale yellowish-brown	10YR 6/2
DA-RNA2-137-18	69	70.37	31.78	–	–	–	–	–	–	–	–	Gravelly silty sand	Pale yellowish-brown	10YR 6/2
DA-RNA2-137-19	75	81.72	40.86	–	–	–	–	–	–	–	–	Gravelly silty sand	Pale yellowish-brown	10YR 6/2

Table 16.2. Continued.

Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Bulk Weight (gm)	Residual Weight (gm)	>1 mm	>106 mm	>63 mm	<63 mm	>1 mm	>106 mm	>63 mm	<63 mm	Lithology	Color	Color Code
DA-RNA2-137-20	61	79.45	22.70	–	–	–	–	–	–	–	–	Sandy silty clay	Dusky brown	5YR 2/2
DA-RNA2-137-21	66	74.91	20.43	–	–	–	–	–	–	–	–	Sandy silty clay	Dusky brown	5YR 2/2
DA-RNA2-137-22	72	65.83	13.62	–	–	–	–	–	–	–	–	Sandy silty clay	Dusky brown	5YR 2/2
DA-RNA2-137-23	76	70.37	11.35	–	–	–	–	–	–	–	–	Sandy silty clay	Dusky brown	5YR 2/2
DA-RNA2-137-24	81	83.99	13.62	–	–	–	–	–	–	–	–	Sandy silty clay	Dusky brown	5YR 2/2
DA-RNA2-137-25	84	65.83	24.97	–	–	–	–	–	–	–	–	Sandy silty clay	Dusky brown	5YR 2/2
DA-RNA2-137-26	100	83.99	34.09	–	–	–	–	–	–	–	–	Sandy silty clay	Dusky brown	5YR 2/2
DA-RNA2-137-27	-59	74.91	22.70	–	–	–	–	–	–	–	–	Gravelly sandy clay	Dusky brown	5YR 2/2
DA-RNA2-137-28	-48	70.37	11.35	–	–	–	–	–	–	–	–	Sandy silty clay	Dusky brown	5YR 2/2
DA-RNA2-137-29	-38	70.37	6.81	–	–	–	–	–	–	–	–	Sandy silty clay	Dusky brown	5YR 2/2
DA-RNA2-137-30	-28	65.83	9.08	–	–	–	–	–	–	–	–	Sandy silty clay	Pale yellowish-brown	10YR 6/2
DA-RNA2-137-31	-18	79.45	13.62	–	–	–	–	–	–	–	–	Sandy silty clay	Pale yellowish-brown	10YR 6/2
DA-RNA2-Cienega		56.75	6.81	–	–	–	–	–	–	–	–	Sandy silty clay	Dusky brown	5YR 2/2
Mission Gardens														
DA-RNA11-310-200-1	-5	100.00	9.08	2.27	4.54	2.27	90.92	2.27	4.54	2.27	90.92	Clay	Dark yellowish-brown	10YR 4/2
DA-RNA11-310-200-2	0	100.00	7.81	1.00	2.27	4.54	92.19	1.00	2.27	4.54	92.19	Clay	Pale brown	5YR 5/2
DA-RNA11-310-200-3	6	100.00	7.31	0.50	2.27	4.54	92.69	0.50	2.27	4.54	92.69	Clay	Dark yellowish-brown	10YR 4/2

Table 16.2. Continued.

Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Bulk Weight (gm)	Residual Weight (gm)	>1 mm	>106 mm	>63 mm	<63 mm	>1 mm	>106 mm	>63 mm	<63 mm	Lithology	Color	Color Code
DA-RNA11-310-200-4	15	100.00	23.25	0.55	13.62	9.08	76.75	0.55	13.62	9.08	76.75	Sandy clay	Moderate yellowish-brown	10YR 5/4
DA-RNA11-310-200-5	36	100.00	60.02	1.00	52.21	6.81	39.98	1.00	52.21	6.81	39.98	Clayey silty sand	Moderate yellowish-brown	10YR 5/4
DA-RNA11-310-200-6	43	100.00	43.48	0.35	36.32	6.81	56.52	0.35	36.32	6.81	56.52	Sandy silty clay	Moderate yellowish-brown	10YR 5/4
DA-RNA11-310-200-7	7	100.00	21.73	1.30	15.89	4.54	78.27	1.30	15.89	4.54	78.27	Silty sandy clay	Moderate yellowish-brown	10YR 5/4
DA-RNA11-310-200-8	23	100.00	19.16	1.00	11.35	6.81	80.84	1.00	11.35	6.81	80.84	Silty sandy clay	Moderate yellowish-brown	10YR 5/4
DA-RNA11-310-200-9	13	100.00	30.66	1.15	24.97	4.54	69.34	1.15	24.97	4.54	69.34	Silty sandy clay	Pale yellowish-brown	10YR 6/2
DA-RNA11-310-200-10	52	100.00	61.29	4.54	49.94	6.81	38.71	4.54	49.94	6.81	38.71	Clayey silty sand	Pale yellowish-brown	10YR 6/2
DA-RNA11-310-200-11	12	100.00	18.81	0.65	6.81	11.35	81.19	0.65	6.81	11.35	81.19	Silty clay	Moderate yellowish-brown	10YR 5/4
DA-RNA11-310-200-12	40	100.00	20.93	0.50	15.89	4.54	79.07	0.50	15.89	4.54	79.07	Silty sandy clay	Moderate yellowish-brown	10YR 5/4
DA-RNA11-310-200-13	18	100.00	86.50	0.70	83.53	2.27	13.50	0.70	83.53	2.27	13.50	Sand	Pale yellowish-brown	10YR 6/2
DA-RNA11-310-200-14	70	100.00	90.80	4.54	83.99	2.27	9.20	4.54	83.99	2.27	9.20	Sand	Moderate yellowish-brown	10YR 5/4
DA-RNA11-310-200-15	90	97.60	89.53	6.81	81.72	1.00	8.07	6.98	83.73	1.02	8.27	Sand	Moderate yellowish-brown	10YR 5/4
DA-RNA11-310-200-16	109	100.00	83.99	4.54	77.18	2.27	16.01	4.54	77.18	2.27	16.01	Sand	Moderate yellowish-brown	10YR 5/4
DA-RNA11-310-200-17	129	100.00	70.37	2.27	63.56	4.54	29.63	2.27	63.56	4.54	29.63	Silty sand	Moderate yellowish-brown	10YR 5/4
DA-RNA11-310-200-18	75	100.00	48.40	3.00	38.59	6.81	51.60	3.00	38.59	6.81	51.60	Sandy silt	Moderate yellowish-brown	10YR 5/4
DA-RNA11-300-207-1	-5	100.00	6.69	0.15	2.00	4.54	93.31	0.15	2.00	4.54	93.31	Clay	Moderate yellowish-brown	10YR 5/4

Table 16.2. Continued.

Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Bulk Weight (gm)	Residual Weight (gm)	>1 mm	>106 mm	>63 mm	<63 mm	>1 mm	>106 mm	>63 mm	<63 mm	Lithology	Color	Color Code
DA-RNA11-300-207-2	0	100.00	47.67	2.27	34.05	11.35	52.33	2.27	34.05	11.35	52.33	Sandy clayey silt	Pale yellowish-brown	10YR 6/2
DA-RNA11-300-207-3	15	100.00	42.36	1.50	27.24	13.62	57.64	1.50	27.24	13.62	57.64	Sandy clayey silt	Pale yellowish-brown	10YR 6/2
DA-RNA11-300-207-4	25	100.00	37.32	1.00	22.70	13.62	62.68	1.00	22.70	13.62	62.68	Sandy clayey silt	Pale yellowish-brown	10YR 6/2
DA-RNA11-307-205-1	-2	100.00	12.35	1.00	6.81	4.54	87.65	1.00	6.81	4.54	87.65	Clay	Pale yellowish-brown	10YR 6/2
DA-RNA11-307-205-2	6	100.00	18.16	2.27	11.35	4.54	81.84	2.27	11.35	4.54	81.84	Clay	Pale yellowish-brown	10YR 6/2
DA-RNA11-307-205-3	10	100.00	28.49	1.25	18.16	9.08	71.51	1.25	18.16	9.08	71.51	Silty clay	Pale yellowish-brown	10YR 6/2
DA-RNA11-307-205-4	13	100.00	27.24	2.27	15.89	9.08	72.76	2.27	15.89	9.08	72.76	Sandy silty clay	Pale yellowish-brown	10YR 6/2
DA-RNA11-307-205-5	27	100.00	24.97	2.27	13.62	9.08	75.03	2.27	13.62	9.08	75.03	Sandy silty clay	Moderate yellowish-brown	10YR 5/4
DA-RNA11-302-200-1	-2	100.00	12.65	1.30	9.08	2.27	87.35	1.30	9.08	2.27	87.35	Silty clay	Moderate yellowish-brown	10YR 5/4
DA-RNA11-302-200-2	2	100.00	61.29	2.27	54.48	4.54	38.71	2.27	54.48	4.54	38.71	Silty sand	Moderate yellowish-brown	10YR 5/4
DA-RNA11-302-200-3	25	100.00	70.37	13.62	47.67	9.08	29.63	13.62	47.67	9.08	29.63	Gravelly silty sand	Moderate yellowish-brown	10YR 5/4
DA-RNA11-302-200-4	29	100.00	56.75	4.54	40.86	11.35	43.25	4.54	40.86	11.35	43.25	Silty gravelly sand	Moderate yellowish-brown	10YR 5/4
DA-RNA11-302-200-5	15	100.00	14.12	0.50	9.08	4.54	85.88	0.50	9.08	4.54	85.88	Silty clay	Moderate yellowish-brown	10YR 5/4
DA-RNA11-302-200-6	8	100.00	7.15	0.30	2.10	4.75	92.85	0.30	2.10	4.75	92.85	Clay	Moderate yellowish-brown	10YR 5/4
DA-RNA11-302-200-7	21	100.00	3.37	0.10	2.27	1.00	96.63	0.10	2.27	1.00	96.63	Clay	Moderate yellowish-brown	10YR 5/4
DA-RNA11-302-200-8	33	100.00	39.94	1.35	29.51	9.08	60.06	1.35	29.51	9.08	60.06	Clayey silty sand	Pale yellowish-brown	10YR 6/2

Table 16.2. Continued.

Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Bulk Weight (gm)	Residual Weight (gm)	>1 mm	>106 mm	>63 mm	<63 mm	>1 mm	>106 mm	>63 mm	<63 mm	Lithology	Color	Color Code
DA-RNA11-302-200-9	42	100.00	17.14	1.25	11.35	4.54	82.86	1.25	11.35	4.54	82.86	Silty sandy clay	Moderate yellowish-brown	10YR 5/4
DA-RNA11-302-200-10	57	100.00	43.48	0.35	29.51	13.62	56.52	0.35	29.51	13.62	56.52	Sandy silt	Moderate yellowish-brown	10YR 5/4
DA-RNA11-302-201-1	-2	100.00	5.64	1.10	2.27	2.27	94.36	1.10	2.27	2.27	94.36	Clay	Dark yellowish-brown	10YR 4/2
DA-RNA11-302-201-2	2	100.00	36.32	2.27	29.51	4.54	63.68	2.27	29.51	4.54	63.68	Sandy silt	Pale yellowish-brown	10YR 6/2
DA-RNA11-302-201-3	9	100.00	18.96	0.80	11.35	6.81	81.04	0.80	11.35	6.81	81.04	Sandy silt	Moderate yellowish-brown	10YR 5/4
DA-RNA11-302-201-4	21	100.00	44.13	1.00	36.32	6.81	55.87	1.00	36.32	6.81	55.87	Sandy silt	Moderate yellowish-brown	10YR 5/4
DA-RNA11-302-201-5	35	100.00	34.05	11.35	18.16	4.54	65.95	11.35	18.16	4.54	65.95	Gravelly sandy clay	Pale yellowish-brown	10YR 6/2
DA-RNA11-302-201-6	62	100.00	29.51	11.35	13.62	4.54	70.49	11.35	13.62	4.54	70.49	Silty clay	Moderate yellowish-brown	10YR 5/4
DA-RNA11-302-201-7	65	100.00	27.24	2.27	15.89	9.08	72.76	2.27	15.89	9.08	72.76	Silty clay	Moderate yellowish-brown	10YR 5/4
DA-RNA11-302-201-8	71	100.00	17.39	1.50	9.08	6.81	82.61	1.50	9.08	6.81	82.61	Silty clay	Moderate yellowish-brown	10YR 5/4
DA-RNA11-302-201-9	80	97.61	15.89	2.27	9.08	4.54	81.72	2.33	9.30	4.65	83.72	Silty clay	Moderate yellowish-brown	10YR 5/4
DA-RNA11-309-206-1	-3	100.00	28.24	1.00	18.16	9.08	71.76	1.00	18.16	9.08	71.76	Sandy silty clay	Moderate yellowish-brown	10YR 5/4
DA-RNA11-309-206-2	3	100.00	43.13	2.27	34.05	6.81	56.87	2.27	34.05	6.81	56.87	Sandy silt	Pale yellowish-brown	10YR 6/2
DA-RNA11-309-206-3	14	100.00	52.21	4.54	38.59	9.08	47.79	4.54	38.59	9.08	47.79	Silty sand	Pale yellowish-brown	10YR 6/2
DA-RNA11-305-204-1	-25	100.00	7.31	0.50	4.54	2.27	92.69	0.50	4.54	2.27	92.69	Clay	Dark yellowish-brown	10YR 4/2
DA-RNA11-305-204-2	-2	93.07	20.43	2.27	2.27	15.89	72.64	2.44	2.44	17.07	78.05	Silty clay	Moderate yellowish-brown	10YR 5/4

Table 16.2. Continued.

Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Bulk Weight (gm)	Residual Weight (gm)	>1 mm	>106 mm	>63 mm	<63 mm	>1 mm	>106 mm	>63 mm	<63 mm	Lithology	Color	Color Code
DA-RNA11-305-204-3	2	100.00	30.11	0.60	20.43	9.08	69.89	0.60	20.43	9.08	69.89	Sandy silty clay	Pale yellowish-brown	10YR 6/2
DA-RNA11-305-204-4	15	100.00	36.72	0.40	27.24	9.08	63.28	0.40	27.24	9.08	63.28	Sandy silt	Pale yellowish-brown	10YR 6/2
DA-RNA11-305-204-5	23	100.00	56.75	2.27	45.40	9.08	43.25	2.27	45.40	9.08	43.25	Silty sand	Moderate yellowish-brown	10YR 5/4
DA-RNA11-305-204-6	28	100.00	47.97	0.30	38.59	9.08	52.03	0.30	38.59	9.08	52.03	Sandy silt	Moderate yellowish-brown	10YR 5/4
DA-RNA11-305-204-7	40	100.00	40.86	2.27	31.78	6.81	59.14	2.27	31.78	6.81	59.14	Sandy silt	Pale yellowish-brown	10YR 6/2
DA-RNA11-305-204-8	51	100.00	18.46	0.30	6.81	11.35	81.54	0.30	6.81	11.35	81.54	Silty clay	Moderate yellowish-brown	10YR 5/4

Table 16.3. Minerals and other materials present in ostracode samples, AZ BB:13:481 (ASM).

		Minerology																							
Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Quartz	Feldspars	Pegmatite	Magnetite	Biotite	Muscovite	Gneiss	Schist	Glass	Basalt	Manganese Nodules	Tufa	Calcareous Concretions	Caliche	Clay Clumps	Charcoal	Shell Fragments	Rock Fragments	Ostracode Fragments	Calcified Wood	Bone Fragments	Metal Fragments	Pottery Sherds	Flakes
Congress Street/Brickyard																									
DA-RNA8-212-144-1	-2	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	–	–	–	–	–	–	–
DA-RNA8-212-144-2	4	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	X	–
DA-RNA8-212-144-3	17	X	–	–	–	X	–	–	–	–	–	–	X	–	X	–	X	X	X	–	–	–	–	–	–
DA-RNA8-212-144-4	27	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA8-212-144-5	35	X	–	–	–	X	X	–	–	–	–	–	X	–	–	–	X	X	X	X	–	–	–	X	–
DA-RNA8-212-144-6	45	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	–	X	X	–	–	–	–	–	–
DA-RNA8-212-144-7	60	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	–	X	X	–	–	–	–	–	–
DA-RNA8-212-144-8	72	X	–	–	–	X	X	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA8-267-152-1	-2	X	X	X	–	X	–	–	–	X	–	–	X	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-267-152-2	2	X	X	X	–	X	–	–	–	–	–	–	X	–	–	–	X	–	X	–	–	–	–	–	–
DA-RNA8-267-152-3	16	X	X	X	–	X	–	–	–	–	–	–	X	–	–	–	–	–	X	–	–	–	–	–	–
DA-RNA8-267-152-4	30	X	X	X	–	X	–	–	–	–	–	–	X	–	–	–	–	–	X	–	–	–	–	–	–
DA-RNA8-267-152-5	50	X	X	X	–	X	–	–	–	–	–	–	X	–	–	–	–	–	X	–	–	–	–	–	–
DA-RNA8-Block 5-143-1	-2	X	X	X	–	X	–	–	–	X	–	–	X	–	–	–	–	–	X	–	–	–	–	–	–
DA-RNA8-Block 5-143-2	2	X	X	–	–	X	–	–	–	–	–	–	X	–	–	–	–	–	X	–	–	–	–	–	–
DA-RNA8-Block 5-143-3	11	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	–	–	X	–	–	–	–	–	–
DA-RNA8-Block 5-143-4	22	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	–	–	X	–	–	–	–	–	–

Table 16.3. Continued.

		Minerology																							
Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Quartz	Feldspars	Pegmatite	Magnetite	Biotite	Muscovite	Gneiss	Schist	Glass	Basalt	Manganese Nodules	Tufa	Calcareous Concretions	Caliche	Clay Clumps	Charcoal	Shell Fragments	Rock Fragments	Ostracode Fragments	Calcified Wood	Bone Fragments	Metal Fragments	Pottery Sherds	Flakes
DA-RNA8-260-149-1	-2	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	–	X	–	–	–	–	–	–
DA-RNA8-260-149-2	4	X	–	X	–	X	–	X	X	–	–	–	–	–	–	–	–	–	X	–	–	–	–	–	–
DA-RNA8-260-149-3	15	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	–	X	–	–	–	–	–	–
DA-RNA8-260-149-4	21	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	–	X	–	–	–	–	–	–
DA-RNA8-260-149-5	27	X	X	X	–	X	–	–	–	–	–	–	X	–	–	–	X	–	X	–	–	–	–	–	–
DA-RNA8-260-149-6	35	X	X	X	–	X	–	–	–	–	–	–	X	–	–	–	X	–	X	–	–	–	–	–	–
DA-RNA8-260-149-7	45	X	X	–	–	X	–	–	–	X	–	–	X	–	–	–	–	–	X	–	–	–	–	–	–
DA-RNA8-253-146-1	-2	X	X	–	–	X	–	–	–	–	–	–	–	–	–	–	–	–	X	–	–	–	–	–	–
DA-RNA8-253-146-2	3	X	X	X	–	X	–	X	X	X	–	–	–	–	–	–	X	X	X	X	–	–	–	–	–
DA-RNA8-253-146-3	14	X	–	–	–	X	–	X	–	X	–	–	X	–	–	–	–	X	X	–	–	–	–	–	–
DA-RNA8-253-146-4	34	X	X	X	–	X	–	–	X	X	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA8-253-146-5	50	X	X	–	–	X	–	–	–	X	–	–	–	–	–	–	–	X	X	–	–	–	–	–	–
DA-RNA8-253-146-6	68	X	X	–	–	X	X	–	–	X	–	–	–	–	–	–	–	X	X	–	–	–	–	–	–
DA-RNA8-253-147-1	5	X	X	–	–	X	X	–	–	X	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA8-253-147-2	17	X	X	–	–	X	–	–	–	X	–	–	X	–	–	–	X	–	X	–	–	–	–	–	–
DA-RNA8-253-148-1	-2	X	–	–	–	X	–	X	–	X	–	–	X	–	–	–	–	–	X	–	–	–	–	–	–
DA-RNA8-253-148-2	4	X	X	–	–	X	–	X	–	X	–	–	X	–	–	–	X	–	X	–	–	–	–	–	–
DA-RNA8-253-148-3	15	X	X	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	X	–	–	–	–	–
DA-RNA8-253-150-1	-2	X	X	–	–	X	–	–	–	X	–	–	X	–	–	–	X	X	X	X	–	–	–	–	–
DA-RNA8-253-150-2	2	X	X	X	–	X	–	–	–	–	–	–	X	–	–	–	–	–	X	–	–	–	–	–	–
DA-RNA8-253-150-3	19	X	X	–	–	X	–	–	–	X	–	–	X	–	–	–	X	X	X	X	–	–	–	–	–

Table 16.3. Continued.

Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Minerology																							
		Quartz	Feldspars	Pegmatite	Magnetite	Biotite	Muscovite	Gneiss	Schist	Glass	Basalt	Manganese Nodules	Tufa	Calcareous Concretions	Caliche	Clay Clumps	Charcoal	Shell Fragments	Rock Fragments	Ostracode Fragments	Calcified Wood	Bone Fragments	Metal Fragments	Pottery Sherds	Flakes
DA-RNA8-258-153/154-1	-2	X	X	–	–	X	–	–	–	X	–	X	X	–	–	–	–	X	X	X	–	–	–	–	–
DA-RNA8-258-153/154-2	5	X	X	X	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	X	–	–	–	–	–
DA-RNA8-258-153/154-3	13	X	X	–	–	X	–	–	–	X	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA8-258-153/154-4	21	X	X	–	–	X	–	–	–	X	–	–	X	–	–	–	X	X	X	X	–	–	–	–	–
DA-RNA8-203-140-1	-2	X	X	–	–	X	–	–	–	X	–	–	–	–	–	–	–	–	X	–	–	–	–	–	–
DA-RNA8-203-140-2	3	X	–	–	–	X	–	–	–	X	–	–	X	–	–	–	X	–	X	–	–	–	–	–	–
DA-RNA8-203-140-3	10	X	–	–	–	X	–	–	–	X	–	–	X	–	–	–	X	–	X	–	–	–	–	–	–
DA-RNA8-203-140-4	16	X	X	–	–	X	–	–	–	X	–	–	X	–	–	–	–	–	X	–	–	–	–	–	–
DA-RNA8-203-140-5	22	X	X	–	–	X	–	–	–	X	–	–	X	–	–	–	X	–	X	–	–	–	X	–	–
DA-RNA8-203-140-6	30	X	X	–	–	X	–	–	X	X	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA8-203-140-7	34	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	–	–	–	–	–	–	–	–
DA-RNA8-203-140-8	39	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA8-201-139-1	-2	X	X	–	–	X	–	–	X	–	–	–	–	–	–	–	–	–	X	–	–	–	–	–	–
DA-RNA8-201-139-2	2	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	–	X	–	–	–	–	–	–
DA-RNA8-201-139-3	9	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	–	–	–	–	–	–	–	–
DA-RNA8-201-139-4	14	X	X	–	–	X	–	–	–	X	–	–	X	–	–	–	X	–	–	–	–	–	X	–	–
DA-RNA8-201-139-5	23	X	X	–	–	X	–	–	–	–	–	–	X	–	–	–	–	–	X	–	–	–	–	–	–
DA-RNA8-201-139-6	27	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	–	X	–	–	–	–	–	–
DA-RNA8-201-139-7	36	X	X	–	–	X	X	–	–	–	–	–	X	–	–	–	X	–	–	–	–	–	–	–	–
DA-RNA8-201-139-8	40	X	X	–	–	X	–	–	–	–	–	–	X	–	–	–	–	–	X	–	–	–	X	–	–

Table 16.3. Continued.

Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Minerology																							
		Quartz	Feldspars	Pegmatite	Magnetite	Biotite	Muscovite	Gneiss	Schist	Glass	Basalt	Manganese Nodules	Tufa	Calcareous Concretions	Caliche	Clay Clumps	Charcoal	Shell Fragments	Rock Fragments	Ostracode Fragments	Calcified Wood	Bone Fragments	Metal Fragments	Pottery Sherds	Flakes
DA-RNA8-201-139-9	45	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	X	X	–
DA-RNA8-201-139-10	52	X	–	–	–	X	–	–	–	X	–	–	X	–	–	–	X	X	X	–	–	–	X	–	–
DA-RNA8-201-139-11	59	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	X	–	–	–	–	–
DA-RNA8-201-139-12	63	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	–	X	–	–	–	–	–
DA-RNA8-201-139-13	71	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	–	X	–	–	–	–	–	–
DA-RNA8-202-138-1	-2	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	–	–	–	–	–	X	–	–
DA-RNA8-202-138-2	4	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	–	–	–	–	–	–	–
DA-RNA8-202-138-3	18	X	–	–	–	X	–	–	–	X	–	–	X	–	–	–	X	X	X	X	–	–	–	–	–
DA-RNA8-202-138-4	28	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA8-202-138-5	36	X	–	–	–	X	–	–	–	X	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA8-219-141-1	-2	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	–	–	X	–	–	–	–	–	–
DA-RNA8-219-141-2	10	X	–	–	–	X	–	–	–	X	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA8-219-141-3	26	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	–	–	–	–	–	–	–
DA-RNA8-206-142-1	-2	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	–	X	–	–	–	–	–	–	–
DA-RNA8-206-142-2	6	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	–	X	–	–	–	–	–	–	–
DA-RNA8-206-142-3	12	X	–	–	–	X	–	–	–	X	–	–	X	–	–	–	X	X	–	–	–	–	–	–	–
DA-RNA8-206-142-4	21	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	–	–	–	–	–	–	–
DA-RNA8-206-142-5	50	X	–	–	–	X	–	–	–	X	–	–	X	–	–	–	X	X	–	–	–	–	–	–	–
DA-RNA8-206-142-6	64	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	–	–	–	–	–	–	–
DA-RNA8-215-139-1	-2	X	X	–	–	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-215-139-2	2	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	–	–	–	–	–	–	–

Table 16.3. Continued.

		Minerology																							
Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Quartz	Feldspars	Pegmatite	Magnetite	Biotite	Muscovite	Gneiss	Schist	Glass	Basalt	Manganese Nodules	Tufa	Calcareous Concretions	Caliche	Clay Clumps	Charcoal	Shell Fragments	Rock Fragments	Ostracode Fragments	Calcified Wood	Bone Fragments	Metal Fragments	Pottery Sherds	Flakes
DA-RNA8-215-139-3	11	X	X	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	–	–	–	–	–	–	–
DA-RNA8-215-139-4	18	X	X	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	–	–	–	–	–	–	–
DA-RNA8-215-139-5	26	X	–	–	–	X	–	–	–	–	–	–	X	–	–	X	X	X	–	–	–	–	–	–	–
DA-RNA8-215-139-6	33	X	X	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA8-215-139-7	40	X	–	–	–	X	–	–	–	–	–	–	X	–	–	X	X	X	X	–	–	–	–	–	–
DA-RNA8-215-139-8	45	X	X	–	–	X	–	–	–	–	–	–	–	–	–	–	–	X	X	–	–	–	–	–	–
DA-RNA8-215-139-9	50	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA8-220-141-1	-2	X	X	–	–	X	–	–	–	X	–	–	X	–	–	–	X	–	X	–	–	–	–	–	–
DA-RNA8-220-141-2	10	X	–	–	–	–	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA8-220-141-3	26	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA8-265-151-1	-2	X	X	–	–	X	–	–	–	–	–	–	X	–	–	–	X	–	X	–	–	–	–	–	–
DA-RNA8-265-151-2	4	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA8-265-151-3	25	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA8-265-151-4	35	X	–	–	–	X	–	–	–	–	–	–	–	–	–	–	X	X	X	–	–	–	–	X	–
DA-RNA8-265-151-5	48	X	X	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	–	–	–	–	–	–	–
DA-RNA8-265-151-6	54	X	–	–	–	X	X	–	–	X	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA8-265-151-7	63	X	–	–	–	X	–	–	–	X	–	–	X	–	–	–	X	X	–	–	–	–	–	–	–
DA-RNA8-265-151-8	71	X	X	–	–	X	–	–	–	X	–	–	–	–	–	–	–	X	X	–	–	–	–	–	–
DA-RNA8-265-151-9	82	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	–	–	–	–	–	–	–
DA-RNA8-265-151-10	86	X	–	–	–	–	–	–	–	–	–	–	X	–	–	X	X	X	X	–	–	–	–	–	–

Table 16.3. Continued.

Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Minerology																							
		Quartz	Feldspars	Pegmatite	Magnetite	Biotite	Muscovite	Gneiss	Schist	Glass	Basalt	Manganese Nodules	Tufa	Calcareous Concretions	Caliche	Clay Clumps	Charcoal	Shell Fragments	Rock Fragments	Ostracode Fragments	Calcified Wood	Bone Fragments	Metal Fragments	Pottery Sherds	Flakes
DA-RNA8-255-154-1	-2	X	X	–	–	X	–	–	–	–	–	–	–	–	–	–	–	–	X	–	–	–	–	–	–
DA-RNA8-255-154-2	5	X	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	X	–	–	–	–	–	–
DA-RNA8-255-154-3	13	X	–	–	–	X	–	–	–	X	–	–	X	–	–	–	–	X	X	–	–	–	–	X	–
San Agustín Mission																									
DA-RNA2-3-1	1	X	X	X	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	X	–	–
DA-RNA2-3-2	8	X	X	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA2-3-3	-5	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	–	X	X	–	–	–	–	–	–
DA-RNA2-3-4	2	X	X	X	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA2-3-5	9	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA2-9-1	-2	X	X	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA2-9-2	5	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	X	–	–	–	–	–
DA-RNA2-9-3	16	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	X	–
DA-RNA2-9-4	22	X	X	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA2-53-1	0	X	–	–	–	–	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA2-53-2	2	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	X	–	–	–	–	–
DA-RNA2-53-3	12	X	X	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	X	–	–	–	–	–
DA-RNA2-53-4	2	X	X	–	–	X	–	–	–	–	–	–	X	–	–	–	–	–	X	–	–	–	–	–	–
DA-RNA2-53-5	12	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA2-53-6	0	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	–	X	–	–	–	–	–	–	–
DA-RNA2-53-7	2	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	–	X	–	–	–	–	–	–

Table 16.3. Continued.

		Minerology																							
Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Quartz	Feldspars	Pegmatite	Magnetite	Biotite	Muscovite	Gneiss	Schist	Glass	Basalt	Manganese Nodules	Tufa	Calcareous Concretions	Caliche	Clay Clumps	Charcoal	Shell Fragments	Rock Fragments	Ostracode Fragments	Calcified Wood	Bone Fragments	Metal Fragments	Pottery Sherds	Flakes
DA-RNA2-53-8	17	X	X	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA2-53-9	27	X	X	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA2-53-10	2	X	X	X	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA2-53-11	9	X	X	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA2-53-12	0	X	X	–	–	X	–	–	–	–	–	–	X	–	–	–	–	–	X	–	–	–	–	–	–
DA-RNA2-53-13	2	X	X	X	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	X	–	–	–	–	–
DA-RNA2-53-14	11	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA2-127-1	-6	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	–	X	–	–	–	–	–	–
DA-RNA2-127-2	1	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	–	–	–	–	X	–	–	–
DA-RNA2-127-3	11	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	–	–	–	–	–	–	–
DA-RNA2-127-4	13	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	–	–	–	–	–	–	–	–
DA-RNA2-127-5	18	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	–	–	–	–	–	–	–
DA-RNA2-137-1	-30	X	X	–	–	X	–	–	–	–	–	X	X	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-2	1	X	–	–	–	X	–	–	–	–	–	X	X	–	–	–	X	X	–	–	–	–	–	–	–
DA-RNA2-137-3	7	X	–	–	–	X	–	–	–	–	–	X	X	–	–	–	X	X	X	X	–	–	–	–	–
DA-RNA2-137-4	11	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	–	X	X	X	–	–	–	–	–
DA-RNA2-137-5	16	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA2-137-6	22	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	–	X	X	X	–	–	–	–	–
DA-RNA2-137-7	26	X	X	X	–	X	–	–	–	–	–	–	X	–	–	–	–	X	–	–	–	–	–	–	–
DA-RNA2-137-8	32	X	–	–	X	X	–	–	–	–	–	–	X	–	–	–	–	X	X	X	–	–	–	–	–
DA-RNA2-137-9	37	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–

Table 16.3. Continued.

Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Minerology																							
		Quartz	Feldspars	Pegmatite	Magnetite	Biotite	Muscovite	Gneiss	Schist	Glass	Basalt	Manganese Nodules	Tufa	Calcareous Concretions	Caliche	Clay Clumps	Charcoal	Shell Fragments	Rock Fragments	Ostracode Fragments	Calcified Wood	Bone Fragments	Metal Fragments	Pottery Sherds	Flakes
DA-RNA2-137-10	42	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	–	–	–	–	–	–	–
DA-RNA2-137-11	47	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	–	X	X	–	–	–	–	–	–
DA-RNA2-137-12	51	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA2-137-13	53	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	–	X	–	–	–	–	–	–	–
DA-RNA2-137-14	56	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA2-137-15	62	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA2-137-16	59	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA2-137-17	65	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA2-137-18	69	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA2-137-19	75	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	–	X	X	–	–	X	–	–	–
DA-RNA2-137-20	61	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA2-137-21	66	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	–	–	–	X	–	–	–
DA-RNA2-137-22	72	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA2-137-23	76	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA2-137-24	81	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA2-137-25	84	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA2-137-26	100	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	X	–	–	–	–	–
DA-RNA2-137-27	-59	X	–	–	–	X	–	–	–	–	–	–	X	–	–	X	X	–	X	–	–	–	–	–	–
DA-RNA2-137-28	-48	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	–	X	–	–	–	–	–	–
DA-RNA2-137-29	-38	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	–	X	X	–	–	–	–	–	–

Table 16.3. Continued.

		Minerology																							
Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Quartz	Feldspars	Pegmatite	Magnetite	Biotite	Muscovite	Gneiss	Schist	Glass	Basalt	Manganese Nodules	Tufa	Calcareous Concretions	Caliche	Clay Clumps	Charcoal	Shell Fragments	Rock Fragments	Ostracode Fragments	Calcified Wood	Bone Fragments	Metal Fragments	Pottery Sherds	Flakes
DA-RNA2-137-30	-28	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	–	X	–	–	–	–	–	–
DA-RNA2-137-31	-18	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA2-Cienega		X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
Mission Gardens																									
DA-RNA11-310-200-1	-5	X	–	–	–	–	–	–	–	–	–	–	X	–	–	–	–	X	–	–	–	–	–	–	–
DA-RNA11-310-200-2	0	X	–	–	–	–	–	–	–	–	–	–	X	–	–	–	–	X	–	–	–	–	–	–	–
DA-RNA11-310-200-3	6	X	–	–	–	X	–	–	–	X	–	–	X	–	–	–	X	–	–	X	–	–	–	–	–
DA-RNA11-310-200-4	15	X	–	–	–	X	–	–	–	X	–	–	X	–	–	–	X	X	X	X	–	–	–	–	–
DA-RNA11-310-200-5	36	X	X	–	–	X	–	–	–	X	–	–	X	–	–	–	–	X	X	X	–	–	–	–	–
DA-RNA11-310-200-6	43	X	–	–	–	X	–	–	–	X	–	–	X	–	–	–	X	X	X	X	–	–	–	–	–
DA-RNA11-310-200-7	7	X	X	–	–	X	–	–	–	X	–	–	X	–	–	–	X	X	X	X	–	–	–	–	–
DA-RNA11-310-200-8	23	X	X	–	–	X	–	–	–	X	–	–	X	–	–	–	X	X	X	X	–	–	–	–	–
DA-RNA11-310-200-9	13	X	X	–	–	X	–	–	–	X	–	–	X	–	–	–	–	X	X	–	–	–	–	–	–
DA-RNA11-310-200-10	52	X	X	–	–	X	–	–	–	–	–	–	X	–	–	–	–	–	X	–	–	X	–	X	X
DA-RNA11-310-200-11	12	X	–	–	–	X	–	–	–	X	–	–	X	–	–	–	X	X	X	X	–	–	–	–	–
DA-RNA11-310-200-12	40	X	–	–	–	X	–	–	–	X	–	–	X	–	–	–	X	X	X	X	–	–	–	–	–
DA-RNA11-310-200-13	18	X	X	–	–	X	–	–	–	X	–	–	–	–	–	–	–	–	X	–	–	–	–	–	–
DA-RNA11-310-200-14	70	X	X	–	–	X	–	–	–	–	–	–	–	–	–	–	–	–	X	–	–	–	–	–	–
DA-RNA11-310-200-15	90	X	X	–	–	X	–	–	–	–	–	–	X	–	–	–	–	–	X	–	–	–	–	–	–
DA-RNA11-310-200-16	109	X	X	–	–	X	–	–	–	X	–	–	–	–	–	–	–	–	X	–	–	–	–	–	–

Table 16.3. Continued.

Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Minerology																							
		Quartz	Feldspars	Pegmatite	Magnetite	Biotite	Muscovite	Gneiss	Schist	Glass	Basalt	Manganese Nodules	Tufa	Calcareous Concretions	Caliche	Clay Clumps	Charcoal	Shell Fragments	Rock Fragments	Ostracode Fragments	Calcified Wood	Bone Fragments	Metal Fragments	Pottery Sherds	Flakes
DA-RNA11-310-200-17	129	X	X	–	–	X	–	–	–	X	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA11-310-200-18	75	X	X	–	–	X	–	–	–	–	–	–	–	–	–	–	X	–	X	–	–	–	–	–	–
DA-RNA11-300-207-1	-5	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	X	–	–	–	–	–
DA-RNA11-300-207-2	0	X	X	–	–	X	–	–	–	X	–	–	X	–	–	–	X	X	X	X	–	–	–	–	–
DA-RNA11-300-207-3	15	X	X	–	–	X	–	–	–	X	–	–	X	–	–	–	X	X	X	X	–	X	–	X	–
DA-RNA11-300-207-4	25	X	X	–	–	X	–	–	–	X	–	–	X	X	–	–	X	X	X	X	–	–	–	–	–
DA-RNA11-307-205-1	-2	X	X	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	–	–	–	–	–	–	–
DA-RNA11-307-205-2	6	X	X	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	–	–	–	–	–	X	–
DA-RNA11-307-205-3	10	X	X	–	–	X	–	–	–	–	–	–	X	X	–	–	X	X	–	–	–	–	–	–	–
DA-RNA11-307-205-4	13	X	–	–	–	X	–	–	–	X	–	–	–	X	–	–	X	X	X	–	–	–	–	–	–
DA-RNA11-307-205-5	27	X	–	–	–	X	–	–	–	X	–	–	–	X	–	–	X	–	X	–	–	–	–	X	–
DA-RNA11-302-200-1	-2	X	X	–	–	X	–	–	–	X	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA11-302-200-2	2	X	X	–	–	X	–	–	–	X	–	–	–	–	–	–	–	X	–	–	–	–	–	–	–
DA-RNA11-302-200-3	25	X	X	–	–	X	–	–	–	X	–	–	–	–	–	X	–	–	X	–	–	–	–	–	–
DA-RNA11-302-200-4	29	X	X	–	–	X	–	–	–	–	–	–	–	–	–	X	X	–	–	–	–	–	–	–	–
DA-RNA11-302-200-5	15	X	–	–	–	X	–	–	–	X	–	–	X	–	–	–	X	–	–	–	–	–	–	–	–
DA-RNA11-302-200-6	8	X	–	–	–	X	X	–	–	X	–	–	X	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-200-7	21	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-200-8	33	X	X	–	–	X	–	–	–	X	–	–	X	X	–	–	X	X	–	–	–	–	–	–	–
DA-RNA11-302-200-9	42	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	–	–	–	–	–	–	–
DA-RNA11-302-200-10	57	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	X	–	X	–	–

Table 16.3. Continued.

Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Minerology																							
		Quartz	Feldspars	Pegmatite	Magnetite	Biotite	Muscovite	Gneiss	Schist	Glass	Basalt	Manganese Nodules	Tufa	Calcareous Concretions	Caliche	Clay Clumps	Charcoal	Shell Fragments	Rock Fragments	Ostracode Fragments	Calcified Wood	Bone Fragments	Metal Fragments	Pottery Sherds	Flakes
DA-RNA11-302-201-1	-2	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	–	–	–	–	–	–	–
DA-RNA11-302-201-2	2	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA11-302-201-3	9	X	–	–	–	X	–	–	–	–	X	–	X	–	–	–	X	X	–	–	–	–	–	–	–
DA-RNA11-302-201-4	21	X	X	–	–	X	–	–	–	–	X	–	X	–	–	–	X	X	–	–	X	–	–	–	–
DA-RNA11-302-201-5	35	X	X	–	–	X	–	–	X	–	–	–	X	–	–	–	X	X	X	–	–	–	–	X	–
DA-RNA11-302-201-6	62	X	X	–	–	X	–	–	–	X	–	–	X	–	X	–	X	X	–	–	–	X	–	X	–
DA-RNA11-302-201-7	65	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	X	–	–	–	–
DA-RNA11-302-201-8	71	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	X
DA-RNA11-302-201-9	80	X	–	–	–	X	–	–	–	–	X	–	X	–	–	X	X	X	–	–	–	–	–	–	–
DA-RNA11-309-206-1	-3	X	X	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	–	–	–	–
DA-RNA11-309-206-2	3	X	–	–	–	X	–	–	–	–	–	–	X	–	X	–	X	X	X	–	–	–	–	–	–
DA-RNA11-309-206-3	14	X	–	–	–	X	–	–	–	–	–	–	X	–	X	–	–	X	X	–	–	–	–	X	–
DA-RNA11-305-204-1	-25	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	X	–	–	–	–
DA-RNA11-305-204-2	-2	X	–	–	–	X	X	–	–	–	X	–	X	–	–	X	X	–	–	–	–	–	–	–	–
DA-RNA11-305-204-3	2	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	X	–	–	X	–	–	–
DA-RNA11-305-204-4	15	X	X	–	–	X	X	–	–	–	–	–	X	–	–	–	X	X	–	–	–	–	–	–	–
DA-RNA11-305-204-5	23	X	–	–	–	X	X	–	–	–	X	–	X	–	–	X	X	X	–	–	–	–	–	–	–
DA-RNA11-305-204-6	28	X	X	–	–	X	–	–	–	–	–	–	X	–	–	–	–	X	X	–	–	–	–	–	–
DA-RNA11-305-204-7	40	X	X	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	–	–	X	–	–	–	–
DA-RNA11-305-204-8	51	X	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X	X	–	–	X	–	–	–	–

Table 16.4. Biological contents and taphonomic characteristics of ostracode samples, AZ BB:13:481 (ASM).

		Fossils						Taphonomy					
Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Ostracodes	Molluscs	Fish Bones	Gyrogonites	Plant Debris	Calcareous Spherules	Fragmentation	Abrasion	Encrustation	Coating	Redox Index	Color
Congress Street/Brickyard													
DA-RNA8-212-144-1	-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-212-144-2	4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-212-144-3	17	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-212-144-4	27	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-212-144-5	35	129	8	–	–	–	–	15	10	0	0	0	Clear
DA-RNA8-212-144-6	45	99	3	–	–	–	–	10	5	0	0	0	Clear
DA-RNA8-212-144-7	60	44	7	–	–	–	–	15	5	0	0	0	Clear
DA-RNA8-212-144-8	72	–	1	–	–	–	–	15	5	0	0	0	White
DA-RNA8-267-152-1	-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-267-152-2	2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-267-152-3	16	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-267-152-4	30	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-267-152-5	50	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-Block 5-143-1	-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-Block 5-143-2	2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-Block 5-143-3	11	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-Block 5-143-4	22	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-260-149-1	-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-260-149-2	4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-260-149-3	15	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-260-149-4	21	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-260-149-5	27	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-260-149-6	35	114	1	–	–	–	–	10	5	0	0	1	Light orange
DA-RNA8-260-149-7	45	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-146-1	-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-146-2	3	56	22	–	–	–	–	10	5	0	0	0	Clear
DA-RNA8-253-146-3	14	66	14	–	–	–	–	5	5	0	0	0	Clear
DA-RNA8-253-146-4	34	10	6	–	–	–	–	15	5	0	0	1	Light orange
DA-RNA8-253-146-5	50	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-146-6	68	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-147-1	5	74	86	–	–	–	–	10	5	0	0	0	Clear
DA-RNA8-253-147-2	17	8	16	–	–	–	–	30	10	0	0	1	Light orange

Table 16.4. Continued.

		Fossils						Taphonomy					
Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Ostracodes	Molluscs	Fish Bones	Gyrogonites	Plant Debris	Calcareous Spherules	Fragmentation	Abrasion	Encrustation	Coating	Redox Index	Color
DA-RNA8-253-148-1	-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-148-2	4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-148-3	15	78	5	–	–	–	–	15	5	0	0	0	Clear
DA-RNA8-253-150-1	-2	4	3	–	–	–	–	0	0	0	0	0	Clear
DA-RNA8-253-150-2	2	–	14	–	–	–	–	15	10	0	0	0	White
DA-RNA8-253-150-3	19	8	16	–	–	–	–	5	5	0	0	0	Clear
DA-RNA8-258-153/154-1	-2	14	7	–	–	–	–	10	5	0	0	0	Clear
DA-RNA8-258-153/154-2	5	127	14	–	–	–	–	10	5	0	0	0	Clear
DA-RNA8-258-153/154-3	13	–	1	–	–	X	–	25	5	0	0	0	White
DA-RNA8-258-153/154-4	21	4	11	–	–	X	–	25	5	0	0	0	Clear
DA-RNA8-203-140-1	-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-203-140-2	3	–	–	–	–	X	–	–	–	–	–	–	–
DA-RNA8-203-140-3	10	27	–	–	–	X	–	10	5	0	0	0	Clear
DA-RNA8-203-140-4	16	–	–	–	–	X	–	–	–	–	–	–	–
DA-RNA8-203-140-5	22	–	–	–	–	X	–	–	–	–	–	–	–
DA-RNA8-203-140-6	30	1	2	–	–	X	–	20	10	0	0	0	Clear
DA-RNA8-203-140-7	34	2	–	–	–	X	–	5	5	0	0	0	Clear
DA-RNA8-203-140-8	39	4	2	–	–	X	–	10	5	0	0	0	Clear
DA-RNA8-201-139-1	-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-2	2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-3	9	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-4	14	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-5	23	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-6	27	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-7	36	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-8	40	–	–	–	–	X	–	–	–	–	–	–	–
DA-RNA8-201-139-9	45	–	2	1	–	X	–	100	40	0	0	0	White
DA-RNA8-201-139-10	52	4	–	–	–	X	–	70	30	0	0	2	Orange
DA-RNA8-201-139-11	59	227	13	–	–	X	–	15	10	0	0	1	Light orange
DA-RNA8-201-139-12	63	54	–	–	–	X	–	5	5	0	0	0	Clear
DA-RNA8-201-139-13	71	15	3	–	–	–	–	5	5	0	0	0	Clear
DA-RNA8-202-138-1	-2	7	–	–	–	X	–	0	0	0	0	0	Clear
DA-RNA8-202-138-2	4	398	14	–	8	–	–	15	5	0	0	1	Light orange

Table 16.4. Continued.

		Fossils						Taphonomy					
Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Ostracodes	Molluscs	Fish Bones	Gyrogonites	Plant Debris	Calcareous Spherules	Fragmentation	Abrasion	Encrustation	Coating	Redox Index	Color
DA-RNA8-202-138-3	18	344	23	–	8	–	–	10	5	0	0	1	Light orange
DA-RNA8-202-138-4	28	5	8	–	–	X	–	0	0	0	0	0	Clear
DA-RNA8-202-138-5	36	29	8	–	3	X	–	15	10	0	0	1	Light orange
DA-RNA8-219-141-1	-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-219-141-2	10	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-219-141-3	26	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-206-142-1	-2	13	1	–	1	–	–	10	5	0	0	0	Clear
DA-RNA8-206-142-2	6	28	–	–	–	–	–	10	5	0	0	0	Clear
DA-RNA8-206-142-3	12	70	5	–	–	X	–	10	5	5	5	1	Light orange
DA-RNA8-206-142-4	21	92	1	–	1	X	–	5	5	5	5	1	Light orange
DA-RNA8-206-142-5	50	39	1	–	–	–	–	5	5	5	0	1	Light orange
DA-RNA8-206-142-6	64	9	2	–	–	X	–	5	5	0	0	0	Clear
DA-RNA8-215-139-1	-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-215-139-2	2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-215-139-3	11	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-215-139-4	18	25	–	–	–	X	–	15	15	15	10	1	Light orange
DA-RNA8-215-139-5	26	131	–	–	–	X	–	10	20	15	10	1	Light orange
DA-RNA8-215-139-6	33	23	12	–	–	X	–	10	10	5	5	1	Light orange
DA-RNA8-215-139-7	40	187	26	–	–	X	–	10	10	5	5	1	Light orange
DA-RNA8-215-139-8	45	10	–	–	–	X	–	5	0	0	0	0	Clear
DA-RNA8-215-139-9	50	505	29	–	2	X	–	5	5	0	0	0	Clear
DA-RNA8-220-141-1	-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-220-141-2	10	130	2	–	–	X	–	15	15	10	10	2	Orange
DA-RNA8-220-141-3	26	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-265-151-1	-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-265-151-2	4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-265-151-3	25	14	–	–	–	X	–	10	10	0	0	0	Clear
DA-RNA8-265-151-4	35	–	2	–	–	–	–	50	50	0	0	0	White
DA-RNA8-265-151-5	48	253	3	–	4	X	–	10	10	0	5	0	Clear
DA-RNA8-265-151-6	54	82	3	–	3	X	–	10	10	0	0	1	Light orange
DA-RNA8-265-151-7	63	15	–	–	–	X	–	5	5	0	0	0	Clear
DA-RNA8-265-151-8	71	2	1	–	–	–	–	10	5	0	0	0	Clear
DA-RNA8-265-151-9	82	–	–	–	–	–	–	–	–	–	–	–	–

Table 16.4. Continued.

		Fossils						Taphonomy					
Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Ostracodes	Molluscs	Fish Bones	Gyrogonites	Plant Debris	Calcareous Spherules	Fragmentation	Abrasion	Encrustation	Coating	Redox Index	Color
DA-RNA8-265-151-10	86	4	2	–	–	X	–	30	10	0	0	0	Clear
DA-RNA8-255-154-1	-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-255-154-2	5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-255-154-3	13	159	–	–	–	–	–	10	10	0	0	0	Clear
San Agustín Mission													
DA-RNA2-3-1	1	–	–	–	–	X	–	–	–	–	–	–	–
DA-RNA2-3-2	8	–	–	–	–	X	–	–	–	–	–	–	–
DA-RNA2-3-3	-5	–	–	–	–	X	–	–	–	–	–	–	–
DA-RNA2-3-4	2	–	–	–	–	X	–	–	–	–	–	–	–
DA-RNA2-3-5	9	–	–	–	–	X	–	–	–	–	–	–	–
DA-RNA2-9-1	-2	2	1	–	–	–	–	0	0	0	0	0	Clear
DA-RNA2-9-2	5	1	–	–	–	–	–	10	10	10	0	1	Light orange
DA-RNA2-9-3	16	99	16	–	6	–	–	10	0	0	0	1	Light orange
DA-RNA2-9-4	22	74	6	–	5	–	–	10	5	0	0	1	Light orange
DA-RNA2-53-1	0	2	1	–	–	X	–	10	5	0	0	1	Light orange
DA-RNA2-53-2	2	2	2	–	–	–	–	10	5	0	0	1	Light orange
DA-RNA2-53-3	12	2	1	–	–	X	–	0	5	0	0	0	Clear
DA-RNA2-53-4	2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-5	12	1	6	–	–	–	–	0	5	5	0	1	Light orange
DA-RNA2-53-6	0	1	1	–	–	–	–	50	20	0	30	1	Light orange
DA-RNA2-53-7	2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-8	17	6	1	–	–	–	–	30	10	0	5	1	Light orange
DA-RNA2-53-9	27	1	–	–	–	–	–	0	5	0	5	1	Light orange
DA-RNA2-53-10	2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-11	9	19	7	–	–	–	–	25	10	0	5	0	Clear
DA-RNA2-53-12	0	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-13	2	2	1	–	–	–	–	0	5	0	0	0	Clear
DA-RNA2-53-14	11	5	1	–	–	–	–	15	5	0	5	0	Clear
DA-RNA2-127-1	-6	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-127-2	1	1	–	–	–	–	–	0	10	0	0	1	Light orange
DA-RNA2-127-3	11	1	–	–	–	–	–	30	15	10	0	0	Clear
DA-RNA2-127-4	13	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-127-5	18	–	–	–	–	–	–	–	–	–	–	–	–

Table 16.4. Continued.

		Fossils						Taphonomy					
Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Ostracodes	Molluscs	Fish Bones	Gyrogonites	Plant Debris	Calcareous Spherules	Fragmentation	Abrasion	Encrustation	Coating	Redox Index	Color
DA-RNA2-137-1	-30	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-2	1	2	1	–	–	–	–	0	5	0	0	0	Clear
DA-RNA2-137-3	7	3	2	–	–	–	–	30	5	0	0	0	Clear
DA-RNA2-137-4	11	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-5	16	–	1	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-6	22	3	1	–	–	–	–	15	10	0	0	0	Clear
DA-RNA2-137-7	26	–	1	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-8	32	10	3	–	–	–	–	15	10	0	0	1	Light orange
DA-RNA2-137-9	37	67	17	–	–	–	–	20	15	10	10	2	Orange
DA-RNA2-137-10	42	46	6	–	1	–	–	20	10	5	10	1	Light orange
DA-RNA2-137-11	47	36	10	–	–	–	–	10	10	0	5	0	Clear
DA-RNA2-137-12	51	56	15	–	–	–	–	10	10	0	0	0	Clear
DA-RNA2-137-13	53	6	3	–	–	–	–	40	20	30	15	2	Orange
DA-RNA2-137-14	56	6	–	–	–	–	–	30	10	30	10	2	Orange
DA-RNA2-137-15	62	54	5	–	–	–	–	15	10	30	15	2	Orange
DA-RNA2-137-16	59	79	6	–	–	–	–	15	15	10	10	2	Orange
DA-RNA2-137-17	65	81	14	–	–	–	–	10	10	10	10	0	Clear
DA-RNA2-137-18	69	92	10	–	–	–	–	10	10	10	10	3	Brownish-orange
DA-RNA2-137-19	75	38	10	–	–	–	–	10	10	0	0	0	Clear
DA-RNA2-137-20	61	10	4	–	–	–	–	15	15	10	5	0	Clear
DA-RNA2-137-21	66	7	3	–	–	–	–	15	15	10	10	1	Light orange
DA-RNA2-137-22	72	57	4	–	–	–	–	10	10	5	5	1	Light orange
DA-RNA2-137-23	76	80	2	–	–	–	–	10	10	10	10	0	Clear
DA-RNA2-137-24	81	62	13	–	–	–	–	5	5	0	0	0	Clear
DA-RNA2-137-25	84	79	7	–	–	–	–	5	5	0	0	0	Clear
DA-RNA2-137-26	100	74	13	–	–	–	–	15	10	5	5	0	Clear
DA-RNA2-137-27	-59	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-28	-48	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-29	-38	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-30	-28	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-31	-18	27	2	–	–	–	–	10	10	0	0	0	Clear
DA-RNA2-Cienega		–	–	–	–	–	–	–	–	–	–	–	–

Table 16.4. Continued.

		Fossils						Taphonomy					
Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Ostracodes	Molluscs	Fish Bones	Gyrogonites	Plant Debris	Calcareous Spherules	Fragmentation	Abrasion	Encrustation	Coating	Redox Index	Color
Mission Gardens													
DA-RNA11-310-200-1	-5	53	6	–	–	–	–	5	0	0	0	0	Clear
DA-RNA11-310-200-2	0	3	–	–	–	–	–	15	0	0	0	0	Clear
DA-RNA11-310-200-3	6	5	–	–	–	–	–	20	0	0	0	0	Clear
DA-RNA11-310-200-4	15	68	3	–	–	–	–	15	5	0	0	0	Clear
DA-RNA11-310-200-5	36	110	6	2	–	–	–	20	10	0	0	0	Clear
DA-RNA11-310-200-6	43	104	10	–	–	–	–	15	15	0	0	0	Clear
DA-RNA11-310-200-7	7	3	1	–	–	–	–	20	5	0	0	0	Clear
DA-RNA11-310-200-8	23	14	2	–	–	–	–	20	10	0	0	0	Clear
DA-RNA11-310-200-9	13	–	2	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-10	52	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-11	12	54	6	–	–	–	–	20	10	0	0	0	Clear
DA-RNA11-310-200-12	40	6	3	–	–	–	–	0	0	0	0	0	Clear
DA-RNA11-310-200-13	18	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-14	70	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-15	90	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-16	109	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-17	129	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-18	75	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-300-207-1	-5	2	–	–	–	–	–	50	30	0	0	0	Clear
DA-RNA11-300-207-2	0	272	79	–	–	–	–	15	10	0	0	1	Light orange
DA-RNA11-300-207-3	15	272	60	–	1	–	–	15	10	0	0	1	Light orange
DA-RNA11-300-207-4	25	135	48	–	–	–	2	15	10	0	0	1	Light orange
DA-RNA11-307-205-1	-2	22	9	–	–	X	–	10	0	0	0	0	Clear
DA-RNA11-307-205-2	6	73	27	–	–	X	–	10	10	0	0	0	Clear
DA-RNA11-307-205-3	10	166	45	–	1	X	–	15	15	10	10	1	Light orange
DA-RNA11-307-205-4	13	55	32	–	–	–	–	15	15	10	10	1	Light orange
DA-RNA11-307-205-5	27	26	6	–	–	X	6	10	10	5	0	1	Light orange
DA-RNA11-302-200-1	-2	14	3	–	–	X	–	20	5	0	0	1	Light orange
DA-RNA11-302-200-2	2	–	1	–	–	X	–	0	0	0	0	0	White
DA-RNA11-302-200-3	25	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-200-4	29	–	–	–	–	X	–	–	–	–	–	–	–
DA-RNA11-302-200-5	15	–	1	–	–	X	–	0	0	0	0	0	White
DA-RNA11-302-200-6	8	–	–	–	–	–	–	–	–	–	–	–	–

Table 16.4. Continued.

		Fossils						Taphonomy					
Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Ostracodes	Molluscs	Fish Bones	Gyrogonites	Plant Debris	Calcareous Spherules	Fragmentation	Abrasion	Encrustation	Coating	Redox Index	Color
DA-RNA11-302-200-7	21	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-200-8	33	14	4	–	–	X	–	5	5	0	5	1	Light orange
DA-RNA11-302-200-9	42	8	2	–	–	X	–	0	0	0	0	0	Clear
DA-RNA11-302-200-10	57	4	–	–	–	X	–	10	10	0	0	0	Clear
DA-RNA11-302-201-1	-2	26	–	–	–	X	–	5	5	0	0	0	Clear
DA-RNA11-302-201-2	2	325	20	–	–	X	–	25	15	0	0	0	Clear
DA-RNA11-302-201-3	9	277	4	–	–	X	–	15	10	10	5	1	Light orange
DA-RNA11-302-201-4	21	44	–	–	–	X	–	15	10	0	0	1	Light orange
DA-RNA11-302-201-5	35	526	68	–	–	X	–	15	10	0	0	0	Clear
DA-RNA11-302-201-6	62	73	14	–	–	X	–	10	10	10	10	1	Light orange
DA-RNA11-302-201-7	65	337	31	–	–	X	–	10	10	10	10	1	Light orange
DA-RNA11-302-201-8	71	371	12	–	–	X	–	10	10	10	10	1	Light orange
DA-RNA11-302-201-9	80	342	49	–	–	X	–	10	10	10	10	1	Light orange
DA-RNA11-309-206-1	-3	8	4	–	–	X	–	5	5	5	0	1	Light orange
DA-RNA11-309-206-2	3	222	281	–	–	X	–	15	10	0	0	1	Light orange
DA-RNA11-309-206-3	14	87	264	–	–	X	–	15	10	5	0	1	Light orange
DA-RNA11-305-204-1	-25	6	–	–	–	–	–	5	5	5	5	0	Clear
DA-RNA11-305-204-2	-2	–	1	–	–	X	–	0	0	0	0	0	White
DA-RNA11-305-204-3	2	33	6	–	–	–	–	10	5	5	5	2	Orange
DA-RNA11-305-204-4	15	7	4	–	–	–	–	5	5	0	0	1	Light orange
DA-RNA11-305-204-5	23	–	4	–	–	–	–	70	30	0	0	0	White
DA-RNA11-305-204-6	28	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-305-204-7	40	7	4	–	–	X	–	15	10	0	0	1	Light orange
DA-RNA11-305-204-8	51	–	–	–	–	–	–	–	–	–	–	–	–

Table 16.5. Ostracode populations by sample number, stratigraphic level, weight, and adult/juvenile and carapace/valve ratios, AZ BB:13:481 (ASM).

						L. cf. *L. paraornata*				*C. vidua*			
Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Bulk Weight (gm)	Residual Weight (gm)	Ostra-codes	Ostra-codes/ gm	No.	%	A/J	C/V	No.	%	A/J	C/V
Congress Street/Brickyard													
DA-RNA8-212-144-1	-2	106.69	5.89	–	–	–	–	–	–	–	–	–	–
DA-RNA8-212-144-2	4	108.96	28.79	–	–	–	–	–	–	–	–	–	–
DA-RNA8-212-144-3	17	99.88	24.15	–	–	–	–	–	–	–	–	–	–
DA-RNA8-212-144-4	27	106.69	28.24	–	–	–	–	–	–	–	–	–	–
DA-RNA8-212-144-5	35	118.04	45.40	129	49.62	–	–	–	–	2	1.55	0.50	0.00
DA-RNA8-212-144-6	45	111.23	16.39	99	14.59	2	2.02	1.00	0.00	8	8.08	0.38	0.00
DA-RNA8-212-144-7	60	113.50	21.43	44	8.31	–	–	–	–	1	2.27	1.00	0.00
DA-RNA8-212-144-8	72	120.31	29.89	–	–	–	–	–	–	–	–	–	–
DA-RNA8-267-152-1	-2	108.96	98.61	–	–	–	–	–	–	–	–	–	–
DA-RNA8-267-152-2	2	133.93	79.45	–	–	–	–	–	–	–	–	–	–
DA-RNA8-267-152-3	16	138.47	82.21	–	–	–	–	–	–	–	–	–	–
DA-RNA8-267-152-4	30	124.85	26.47	–	–	–	–	–	–	–	–	–	–
DA-RNA8-267-152-5	50	120.31	22.70	–	–	–	–	–	–	–	–	–	–
DA-RNA8-Block 5-143-1	-2	86.26	73.64	–	–	–	–	–	–	–	–	–	–
DA-RNA8-Block 5-143-2	2	102.15	22.16	–	–	–	–	–	–	–	–	–	–
DA-RNA8-Block 5-143-3	11	115.77	15.62	–	–	–	–	–	–	–	–	–	–
DA-RNA8-Block 5-143-4	22	113.5	13.35	–	–	–	–	–	–	–	–	–	–
DA-RNA8-260-149-1	-2	59.02	12.31	–	–	–	–	–	–	–	–	–	–
DA-RNA8-260-149-2	4	111.23	88.53	–	–	–	–	–	–	–	–	–	–
DA-RNA8-260-149-3	15	88.53	20.16	–	–	–	–	–	–	–	–	–	–
DA-RNA8-260-149-4	21	106.69	18.51	–	–	–	–	–	–	–	–	–	–
DA-RNA8-260-149-5	27	106.69	44.68	–	–	–	–	–	–	–	–	–	–
DA-RNA8-260-149-6	35	129.39	26.97	114	23.76	1	0.88	1.00	0.00	3	2.63	0.67	0.00
DA-RNA8-260-149-7	45	133.93	127.85	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-146-1	-2	108.96	88.53	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-146-2	3	111.23	72.64	56	36.57	2	3.57	1.00	0.00	10	17.86	1.00	0.00

Table 16.5. Continued.

	C. patzcuaro				*C. caudata*				*I. bradyi*			
Locus/ Sample ID Number	No.	%	A/J	C/V	No.	%	A/J	C/V	No.	%	A/J	C/V
Congress Street/Brickyard (contd.)												
DA-RNA8-212-144-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-212-144-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-212-144-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-212-144-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-212-144-5	1	0.78	1.00	0.00	–	–	–	–	111	86.05	0.82	0.00
DA-RNA8-212-144-6	–	–	–	–	–	–	–	–	71	71.72	0.51	0.00
DA-RNA8-212-144-7	–	–	–	–	–	–	–	–	43	97.73	0.70	0.00
DA-RNA8-212-144-8	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-267-152-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-267-152-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-267-152-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-267-152-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-267-152-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-Block 5-143-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-Block 5-143-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-Block 5-143-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-Block 5-143-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-260-149-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-260-149-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-260-149-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-260-149-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-260-149-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-260-149-6	–	–	–	–	–	–	–	–	110	96.49	0.95	0.00
DA-RNA8-260-149-7	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-146-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-146-2	–	–	–	–	–	–	–	–	44	78.57	0.91	0.00

Table 16.5. Continued.

Locus/	*H. brevicaudata*				*Ch. Arcuata*				*D. stevensoni*			
Sample ID Number	No.	%	A/J	C/V	No.	%	A/J	C/V	No.	%	A/J	C/V
Congress Street/Brickyard (contd.)												
DA-RNA8-212-144-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-212-144-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-212-144-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-212-144-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-212-144-5	2	1.55	0.50	0.00	–	–	–	–	4	3.10	1.00	0.00
DA-RNA8-212-144-6	–	–	–	–	–	–	–	–	11	11.11	0.64	0.00
DA-RNA8-212-144-7	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-212-144-8	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-267-152-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-267-152-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-267-152-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-267-152-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-267-152-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-Block 5-143-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-Block 5-143-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-Block 5-143-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-Block 5-143-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-260-149-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-260-149-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-260-149-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-260-149-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-260-149-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-260-149-6	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-260-149-7	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-146-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-146-2	–	–	–	–	–	–	–	–	–	–	–	–

Table 16.5. Continued.

Locus/ Sample ID Number	*P. unicaudata*				*P. pustulosa*				*Cypridopsis* sp.			
	No.	%	A/J	C/V	No.	%	A/J	C/V	No.	%	A/J	C/V
Congress Street/Brickyard (contd.)												
DA-RNA8-212-144-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-212-144-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-212-144-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-212-144-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-212-144-5	–	–	–	–	–	–	–	–	9	6.98	0.56	0.00
DA-RNA8-212-144-6	–	–	–	–	–	–	–	–	7	7.07	0.29	–
DA-RNA8-212-144-7	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-212-144-8	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-267-152-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-267-152-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-267-152-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-267-152-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-267-152-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-Block 5-143-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-Block 5-143-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-Block 5-143-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-Block 5-143-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-260-149-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-260-149-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-260-149-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-260-149-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-260-149-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-260-149-6	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-260-149-7	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-146-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-146-2	–	–	–	–	–	–	–	–	–	–	–	–

Table 16.5. Continued.

						L. cf. *L. paraornata*				*C. vidua*			
Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Bulk Weight (gm)	Residual Weight (gm)	Ostra-codes	Ostra-codes/ gm	No.	%	A/J	C/V	No.	%	A/J	C/V
Congress Street/Brickyard													
DA-RNA8-253-146-3	14	124.85	56.75	66	30.00	–	–	–	–	28	42.42	0.71	0.00
DA-RNA8-253-146-4	34	115.77	59.02	10	5.10	–	–	–	–	–	–	–	–
DA-RNA8-253-146-5	50	106.69	56.75	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-146-6	68	106.69	54.48	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-147-1	5	106.69	56.75	73	38.83	6	8.22	1.00	0.00	30	41.10	1.00	0.00
DA-RNA8-253-147-2	17	108.96	49.94	8	3.67	–	–	–	–	–	–	–	–
DA-RNA8-253-148-1	-2	83.99	59.02	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-148-2	4	118.04	72.64	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-148-3	15	124.85	41.86	78	26.15	–	–	–	–	–	–	–	–
DA-RNA8-253-150-1	-2	99.88	42.41	4	1.70	–	–	–	–	1	25.00	1.00	0.00
DA-RNA8-253-150-2	2	120.31	90.80	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-150-3	19	102.15	54.48	8	4.27	1	12.50	1.00	0.00	3	37.50	1.00	0.00
DA-RNA8-258-153/154-1	-2	106.69	63.56	14	8.34	–	–	–	–	2	14.29	1.00	0.00
DA-RNA8-258-153/154-2	5	106.69	43.13	127	51.34	1	0.79	1.00	0.00	14	11.02	0.86	0.29
DA-RNA8-258-153/154-3	13	120.31	10.58	–	–	–	–	–	–	–	–	–	–
DA-RNA8-258-153/154-4	21	124.85	33.78	4	1.08	–	–	–	–	–	–	–	–
DA-RNA8-203-140-1	-2	59.02	50.44	–	–	–	–	–	–	–	–	–	–
DA-RNA8-203-140-2	3	74.91	40.86	–	–	–	–	–	–	–	–	–	–
DA-RNA8-203-140-3	10	77.18	19.16	27	6.70	1	3.70	1.00	0.00	6	22.22	0.83	0.00
DA-RNA8-203-140-4	16	86.26	5.54	–	–	–	–	–	–	–	–	–	–
DA-RNA8-203-140-5	22	74.91	36.32	–	–	–	–	–	–	–	–	–	–
DA-RNA8-203-140-6	30	68.10	26.47	1	0.39	–	–	–	–	–	–	–	–
DA-RNA8-203-140-7	34	61.29	14.12	2	0.46	–	–	–	–	–	–	–	–
DA-RNA8-203-140-8	39	70.37	16.89	4	0.96	–	–	–	–	–	–	–	–
DA-RNA8-201-139-1	-2	68.10	61.79	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-2	2	86.26	44.63	–	–	–	–	–	–	–	–	–	–

Table 16.5. Continued.

Locus/ Sample ID Number	*C. patzcuaro*				*C. caudata*				*I. bradyi*			
	No.	%	A/J	C/V	No.	%	A/J	C/V	No.	%	A/J	C/V
Congress Street/Brickyard (contd.)												
DA-RNA8-253-146-3	–	–	–	–	–	–	–	–	36	54.55	0.71	0.00
DA-RNA8-253-146-4	–	–	–	–	–	–	–	–	6	60.00	1.00	0.00
DA-RNA8-253-146-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-146-6	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-147-1	–	–	–	–	–	–	–	–	36	49.32	0.94	0.00
DA-RNA8-253-147-2	–	–	–	–	–	–	–	–	8	100.00	0.75	0.00
DA-RNA8-253-148-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-148-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-148-3	–	–	–	–	–	–	–	–	61	78.21	0.90	0.00
DA-RNA8-253-150-1	–	–	–	–	–	–	–	–	2	50.00	0.50	0.00
DA-RNA8-253-150-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-150-3	–	–	–	–	–	–	–	–	3	37.50	1.00	0.00
DA-RNA8-258-153/154-1	–	–	–	–	–	–	–	–	12	85.71	1.00	0.00
DA-RNA8-258-153/154-2	–	–	–	–	–	–	–	–	105	82.68	0.68	0.04
DA-RNA8-258-153/154-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-258-153/154-4	–	–	–	–	–	–	–	–	4	100.00	0.75	0.00
DA-RNA8-203-140-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-203-140-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-203-140-3	4	14.81	0.00	0.00	–	–	–	–	16	59.26	0.75	0.00
DA-RNA8-203-140-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-203-140-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-203-140-6	–	–	–	–	–	–	–	–	1	100.00	1.00	0.00
DA-RNA8-203-140-7	–	–	–	–	–	–	–	–	1	50.00	1.00	0.00
DA-RNA8-203-140-8	–	–	–	–	–	–	–	–	4	100.00	0.75	0.00
DA-RNA8-201-139-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-2	–	–	–	–	–	–	–	–	–	–	–	–

Table 16.5. Continued.

Locus/	*H. brevicaudata*				*Ch. Arcuata*				*D. stevensoni*			
Sample ID Number	No.	%	A/J	C/V	No.	%	A/J	C/V	No.	%	A/J	C/V
Congress Street/Brickyard (contd.)												
DA-RNA8-253-146-3	2	3.03	0.00	0.00	–	–	–	–	–	–	–	–
DA-RNA8-253-146-4	4	40.00	0.00	0.00	–	–	–	–	–	–	–	–
DA-RNA8-253-146-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-146-6	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-147-1	–	–	–	–	–	–	–	–	1	1.37	1.00	0.00
DA-RNA8-253-147-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-148-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-148-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-148-3	–	–	–	–	–	–	–	–	1	1.28	1.00	0.00
DA-RNA8-253-150-1	–	–	–	–	–	–	–	–	1	25.00	1.00	0.00
DA-RNA8-253-150-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-150-3	–	–	–	–	1	12.50	1.00	0.00	–	–	–	–
DA-RNA8-258-153/154-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-258-153/154-2	–	–	–	–	–	–	–	–	6	4.72	0.00	0.33
DA-RNA8-258-153/154-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-258-153/154-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-203-140-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-203-140-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-203-140-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-203-140-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-203-140-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-203-140-6	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-203-140-7	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-203-140-8	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-2	–	–	–	–	–	–	–	–	–	–	–	–

Table 16.5. Continued.

Locus/ Sample ID Number	*P. unicaudata*				*P. pustulosa*				*Cypridopsis* sp.			
	No.	%	A/J	C/V	No.	%	A/J	C/V	No.	%	A/J	C/V
Congress Street/Brickyard (contd.)												
DA-RNA8-253-146-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-146-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-146-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-146-6	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-147-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-147-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-148-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-148-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-148-3	–	–	–	–	–	–	–	–	16	20.51	0.69	0.00
DA-RNA8-253-150-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-150-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-253-150-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-258-153/154-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-258-153/154-2	–	–	–	–	–	–	–	–	1	0.79	0.00	0.00
DA-RNA8-258-153/154-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-258-153/154-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-203-140-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-203-140-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-203-140-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-203-140-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-203-140-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-203-140-6	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-203-140-7	–	–	–	–	1	50.00	1.00	0.00	–	–	–	–
DA-RNA8-203-140-8	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-2	–	–	–	–	–	–	–	–	–	–	–	–

Table 16.5. Continued.

Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Bulk Weight (gm)	Residual Weight (gm)	Ostra-codes	Ostra-codes/ gm	*L.* cf. *L. paraornata*				*C. vidua*			
						No.	%	A/J	C/V	No.	%	A/J	C/V
Congress Street/Brickyard													
DA-RNA8-201-139-3	9	81.72	50.19	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-4	14	74.91	37.32	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-5	23	86.26	34.05	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-6	27	79.45	35.05	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-7	36	77.18	18.89	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-8	40	88.53	45.13	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-9	45	81.72	42.86	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-10	52	79.45	11.60	4	0.58	–	–	–	–	–	–	–	–
DA-RNA8-201-139-11	59	63.56	9.58	227	34.21	6	2.64	1.00	0.00	5	2.20	0.80	0.00
DA-RNA8-201-139-12	63	65.83	6.04	54	4.95	2	3.70	1.00	0.00	2	3.70	1.00	0.00
DA-RNA8-201-139-13	71	61.29	12.35	15	3.02	–	–	–	–	–	–	–	–
DA-RNA8-202-138-1	-2	97.61	10.08	7	0.72	–	–	–	–	2	28.57	0.50	0.00
DA-RNA8-202-138-2	4	81.72	58.25	398	283.69	16	4.02	0.94	0.00	19	4.77	0.79	0.11
DA-RNA8-202-138-3	18	86.26	45.13	344	179.98	15	4.36	0.87	0.00	18	5.23	0.22	0.00
DA-RNA8-202-138-4	28	90.80	43.13	5	2.38	–	–	–	–	–	–	–	–
DA-RNA8-202-138-5	36	81.72	30.51	29	10.83	–	–	–	–	4	13.79	1.00	0.00
DA-RNA8-219-141-1	-2	74.91	46.90	–	–	–	–	–	–	–	–	–	–
DA-RNA8-219-141-2	10	90.80	8.31	–	–	–	–	–	–	–	–	–	–
DA-RNA8-219-141-3	26	77.18	8.31	–	–	–	–	–	–	–	–	–	–
DA-RNA8-206-142-1	-2	61.29	4.79	13	1.02	–	–	–	–	1	7.69	1.00	0.00
DA-RNA8-206-142-2	6	81.72	9.38	28	3.21	–	–	–	–	1	3.57	1.00	0.00
DA-RNA8-206-142-3	12	99.88	13.72	70	9.62	1	1.43	1.00	0.00	2	2.86	1.00	0.00
DA-RNA8-206-142-4	21	93.07	15.99	92	15.81	–	–	–	–	3	3.26	0.33	0.00
DA-RNA8-206-142-5	50	88.53	16.04	39	7.07	–	–	–	–	–	–	–	–
DA-RNA8-206-142-6	64	52.21	9.18	9	1.58	–	–	–	–	1	11.11	1.00	0.00
DA-RNA8-215-139-1	-2	38.59	36.32	–	–	–	–	–	–	–	–	–	–
DA-RNA8-215-139-2	2	74.91	17.19	–	–	–	–	–	–	–	–	–	–

Table 16.5. Continued.

Locus/	*C. patzcuaro*				*C. caudata*				*I. bradyi*			
Sample ID Number	No.	%	A/J	C/V	No.	%	A/J	C/V	No.	%	A/J	C/V
Congress Street/Brickyard (contd.)												
DA-RNA8-201-139-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-6	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-7	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-8	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-9	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-10	–	–	–	–	–	–	–	–	4	100.00	1.00	0.00
DA-RNA8-201-139-11	–	–	–	–	–	–	–	–	206	90.75	0.74	0.08
DA-RNA8-201-139-12	–	–	–	–	–	–	–	–	50	92.59	0.44	0.00
DA-RNA8-201-139-13	–	–	–	–	–	–	–	–	15	100.00	0.87	0.00
DA-RNA8-202-138-1	1	14.29	0.00	0.00	–	–	–	–	4	57.14	0.75	0.00
DA-RNA8-202-138-2	–	–	–	–	–	–	–	–	334	83.92	0.61	0.00
DA-RNA8-202-138-3	–	–	–	–	–	–	–	–	289	84.01	0.56	0.00
DA-RNA8-202-138-4	–	–	–	–	–	–	–	–	5	100.00	1.00	0.00
DA-RNA8-202-138-5	–	–	–	–	–	–	–	–	24	82.76	0.71	0.00
DA-RNA8-219-141-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-219-141-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-219-141-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-206-142-1	–	–	–	–	–	–	–	–	12	92.31	0.92	0.00
DA-RNA8-206-142-2	2	7.14	0.00	1.00	–	–	–	–	25	89.29	0.84	0.00
DA-RNA8-206-142-3	–	–	–	–	5	7.14	0.00	0.40	60	85.71	0.75	0.00
DA-RNA8-206-142-4	–	–	–	–	–	–	–	–	89	96.74	0.78	0.00
DA-RNA8-206-142-5	–	–	–	–	–	–	–	–	39	100.00	0.79	0.00
DA-RNA8-206-142-6	–	–	–	–	–	–	–	–	8	88.89	0.88	0.00
DA-RNA8-215-139-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-215-139-2	–	–	–	–	–	–	–	–	–	–	–	–

Table 16.5. Continued.

Locus/	*H. brevicaudata*				*Ch. Arcuata*				*D. stevensoni*			
Sample ID Number	No.	%	A/J	C/V	No.	%	A/J	C/V	No.	%	A/J	C/V
Congress Street/Brickyard (contd.)												
DA-RNA8-201-139-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-6	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-7	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-8	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-9	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-10	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-11	–	–	–	–	5	2.20	0.00	0.00	5	2.20	1.00	0.00
DA-RNA8-201-139-12	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-13	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-202-138-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-202-138-2	6	1.51	0.83	0.00	–	–	–	–	20	5.03	0.65	0.10
DA-RNA8-202-138-3	14	4.07	0.64	0.00	–	–	–	–	4	1.16	0.50	0.00
DA-RNA8-202-138-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-202-138-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-219-141-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-219-141-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-219-141-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-206-142-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-206-142-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-206-142-3	–	–	–	–	1	1.43	0.00	0.00	–	–	–	–
DA-RNA8-206-142-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-206-142-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-206-142-6	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-215-139-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-215-139-2	–	–	–	–	–	–	–	–	–	–	–	–

Table 16.5. Continued.

Locus/ Sample ID Number	*P. unicaudata*				*P. pustulosa*				*Cypridopsis* sp.			
	No.	%	A/J	C/V	No.	%	A/J	C/V	No.	%	A/J	C/V
Congress Street/Brickyard (contd.)												
DA-RNA8-201-139-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-6	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-7	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-8	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-9	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-10	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-11	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-12	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-201-139-13	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-202-138-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-202-138-2	–	–	–	–	3	0.75	0.33	0.00	–	–	–	–
DA-RNA8-202-138-3	–	–	–	–	4	1.16	0.00	0.00	–	–	–	–
DA-RNA8-202-138-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-202-138-5	–	–	–	–	1	3.45	0.00	0.00	–	–	–	–
DA-RNA8-219-141-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-219-141-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-219-141-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-206-142-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-206-142-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-206-142-3	–	–	–	–	1	1.43	0.00	0.00	–	–	–	–
DA-RNA8-206-142-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-206-142-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-206-142-6	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-215-139-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-215-139-2	–	–	–	–	–	–	–	–	–	–	–	–

Table 16.5. Continued.

						L. cf. *L. paraornata*				*C. vidua*			
Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Bulk Weight (gm)	Residual Weight (gm)	Ostra-codes	Ostra-codes/ gm	No.	%	A/J	C/V	No.	%	A/J	C/V
Congress Street/Brickyard													
DA-RNA8-215-139-3	11	77.18	10.48	–	–	–	–	–	–	–	–	–	–
DA-RNA8-215-139-4	18	79.45	19.01	25	5.98	5	20.00	1.00	0.00	–	–	–	–
DA-RNA8-215-139-5	26	95.34	27.24	131	37.43	2	1.53	1.00	0.00	5	3.82	0.40	–
DA-RNA8-215-139-6	33	79.45	31.78	23	9.20	–	–	–	–	–	–	–	–
DA-RNA8-215-139-7	40	74.91	21.98	187	54.87	6	3.21	0.83	0.00	4	2.14	0.50	0.00
DA-RNA8-215-139-8	45	40.86	2.65	10	0.65	1	10.00	1.00	0.00	2	20.00	0.50	0.00
DA-RNA8-215-139-9	50	100.00	12.35	505	62.37	4	0.79	0.75	0.00	24	4.75	0.63	0.00
DA-RNA8-220-141-1	-2	68.10	26.47	–	–	–	–	–	–	–	–	–	–
DA-RNA8-220-141-2	10	83.99	8.11	130	12.55	–	–	–	–	2	1.54	1.00	1.00
DA-RNA8-220-141-3	26	88.53	9.01	–	–	–	–	–	–	–	–	–	–
DA-RNA8-265-151-1	-2	79.45	29.56	–	–	–	–	–	–	–	–	–	–
DA-RNA8-265-151-2	4	100.00	16.89	–	–	–	–	–	–	–	–	–	–
DA-RNA8-265-151-3	25	100.00	16.89	14	2.36	–	–	–	–	–	–	–	–
DA-RNA8-265-151-4	35	100.00	73.94	–	–	–	–	–	–	–	–	–	–
DA-RNA8-265-151-5	48	100.00	14.62	253	36.99	4	1.58	1.00	0.00	14	5.53	0.57	0.00
DA-RNA8-265-151-6	54	100.00	28.34	82	23.24	5	6.10	1.00	0.00	2	2.44	1.00	0.00
DA-RNA8-265-151-7	63	100.00	26.12	15	3.92	1	6.67	1.00	0.00	–	–	–	–
DA-RNA8-265-151-8	71	100.00	70.37	2	1.41	–	–	–	–	–	–	–	–
DA-RNA8-265-151-9	82	100.00	20.52	–	–	–	–	–	–	–	–	–	–
DA-RNA8-265-151-10	86	83.99	6.54	4	0.31	–	–	–	–	1	25.00	1.00	0.00
DA-RNA8-255-154-1	-2	100.00	68.90	–	–	–	–	–	–	–	–	–	–
DA-RNA8-255-154-2	5	100.00	57.45	–	–	–	–	–	–	–	–	–	–
DA-RNA8-255-154-3	13	100.00	29.51	159	46.92	7	4.40	1.00	0.00	21	13.21	0.48	0.00

Table 16.5. Continued.

Locus/	*C. patzcuaro*				*C. caudata*				*I. bradyi*			
Sample ID Number	No.	%	A/J	C/V	No.	%	A/J	C/V	No.	%	A/J	C/V
Congress Street/Brickyard (contd.)												
DA-RNA8-215-139-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-215-139-4	–	–	–	–	–	–	–	–	18	72.00	0.72	0.11
DA-RNA8-215-139-5	2	1.53	0.00	0.00	–	–	–	–	122	93.13	0.70	0.00
DA-RNA8-215-139-6	–	–	–	–	–	–	–	–	23	100.00	0.61	0.09
DA-RNA8-215-139-7	–	–	–	–	–	–	–	–	173	92.51	0.73	0.00
DA-RNA8-215-139-8	–	–	–	–	–	–	–	–	7	70.00	0.57	0.00
DA-RNA8-215-139-9	2	0.40	0.00	0.00	–	–	–	–	401	79.41	0.82	0.00
DA-RNA8-220-141-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-220-141-2	–	–	–	–	–	–	–	–	128	98.46	0.72	0.02
DA-RNA8-220-141-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-265-151-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-265-151-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-265-151-3	–	–	–	–	–	–	–	–	14	100.00	0.93	0.00
DA-RNA8-265-151-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-265-151-5	–	–	–	–	–	–	–	–	223	88.14	0.65	0.01
DA-RNA8-265-151-6	1	1.22	0.00	0.00	–	–	–	–	64	78.05	0.73	0.00
DA-RNA8-265-151-7	–	–	–	–	–	–	–	–	12	80.00	0.67	0.00
DA-RNA8-265-151-8	–	–	–	–	–	–	–	–	1	50.00	1.00	0.00
DA-RNA8-265-151-9	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-265-151-10	–	–	–	–	–	–	–	–	3	75.00	0.67	0.00
DA-RNA8-255-154-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-255-154-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-255-154-3	–	–	–	–	–	–	–	–	120	75.47	0.63	0.00

Table 16.5. Continued.

Locus/ Sample ID Number	*H. brevicaudata*				*Ch. Arcuata*				*D. stevensoni*			
	No.	%	A/J	C/V	No.	%	A/J	C/V	No.	%	A/J	C/V
Congress Street/Brickyard (contd.)												
DA-RNA8-215-139-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-215-139-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-215-139-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-215-139-6	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-215-139-7	–	–	–	–	–	–	–	–	2	1.07	1.00	0.00
DA-RNA8-215-139-8	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-215-139-9	–	–	–	–	33	6.53	0.00	0.00	35	6.93	0.74	0.06
DA-RNA8-220-141-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-220-141-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-220-141-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-265-151-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-265-151-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-265-151-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-265-151-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-265-151-5	–	–	–	–	–	–	–	–	2	0.79	1.00	0.00
DA-RNA8-265-151-6	–	–	–	–	–	–	–	–	1	1.22	0.00	0.00
DA-RNA8-265-151-7	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-265-151-8	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-265-151-9	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-265-151-10	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-255-154-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-255-154-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-255-154-3	–	–	–	–	–	–	–	–	–	–	–	–

Table 16.5. Continued.

Locus/ Sample ID Number	*P. unicaudata*				*P. pustulosa*				*Cypridopsis* sp.			
	No.	%	A/J	C/V	No.	%	A/J	C/V	No.	%	A/J	C/V
Congress Street/Brickyard (contd.)												
DA-RNA8-215-139-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-215-139-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-215-139-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-215-139-6	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-215-139-7	–	–	–	–	–	–	–	–	2	1.07	0.00	0.00
DA-RNA8-215-139-8	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-215-139-9	–	–	–	–	10	1.98	0.00	0.00	–	–	–	–
DA-RNA8-220-141-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-220-141-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-220-141-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-265-151-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-265-151-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-265-151-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-265-151-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-265-151-5	–	–	–	–	–	–	–	–	10	3.95	0.40	0.00
DA-RNA8-265-151-6	–	–	–	–	–	–	–	–	9	10.98	0.33	0.00
DA-RNA8-265-151-7	–	–	–	–	–	–	–	–	2	13.33	0.00	0.00
DA-RNA8-265-151-8	–	–	–	–	–	–	–	–	1	50.00	0.00	0.00
DA-RNA8-265-151-9	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-265-151-10	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-255-154-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-255-154-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA8-255-154-3	–	–	–	–	–	–	–	–	7	4.40	0.00	0.00

Table 16.5. Continued.

						L. cf. *L. paraornata*				*C. vidua*			
Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Bulk Weight (gm)	Residual Weight (gm)	Ostra-codes	Ostra-codes/ gm	No.	%	A/J	C/V	No.	%	A/J	C/V
San Agustín Mission													
DA-RNA2-3-1	1	72.64	24.97	0	–	–	–	–	–	–	–	–	–
DA-RNA2-3-2	8	83.99	31.78	0	–	–	–	–	–	–	–	–	–
DA-RNA2-3-3	-5	56.75	6.81	0	–	–	–	–	–	–	–	–	–
DA-RNA2-3-4	2	79.45	11.35	0	–	–	–	–	–	–	–	–	–
DA-RNA2-3-5	9	72.64	15.89	0	–	–	–	–	–	–	–	–	–
DA-RNA2-9-1	-2	59.02	2.27	2	0.08	–	–	–	–	–	–	–	–
DA-RNA2-9-2	5	68.10	15.89	1	0.23	–	–	–	–	–	–	–	–
DA-RNA2-9-3	16	61.29	11.35	99	18.33	5	5.05	–	–	17	17.17	–	–
DA-RNA2-9-4	22	43.13	6.81	74	11.68	2	2.70	–	–	25	33.78	–	–
DA-RNA2-53-1	0	95.34	4.54	2	0.10	–	–	–	–	–	–	–	–
DA-RNA2-53-2	2	72.64	9.08	2	0.25	–	–	–	–	–	–	–	–
DA-RNA2-53-3	12	72.64	6.81	2	0.19	–	–	–	–	–	–	–	–
DA-RNA2-53-4	2	70.37	18.16	0	–	–	–	–	–	–	–	–	–
DA-RNA2-53-5	12	63.56	4.54	1	0.07	–	–	–	–	–	–	–	–
DA-RNA2-53-6	0	93.07	9.08	1	0.10	–	–	–	–	–	–	–	–
DA-RNA2-53-7	2	68.10	22.10	0	–	–	–	–	–	–	–	–	–
DA-RNA2-53-8	17	72.64	9.08	6	0.75	–	–	–	–	2	33.33	–	–
DA-RNA2-53-9	27	70.37	6.81	1	0.10	–	–	–	–	–	–	–	–
DA-RNA2-53-10	2	70.37	27.24	0	–	–	–	–	–	–	–	–	–
DA-RNA2-53-11	9	59.02	18.16	19	5.85	–	–	–	–	7	36.84	–	–
DA-RNA2-53-12	0	68.10	6.81	0	–	–	–	–	–	–	–	–	–
DA-RNA2-53-13	2	52.21	11.35	2	0.43	–	–	–	–	–	–	–	–
DA-RNA2-53-14	11	65.83	11.35	5	0.86	–	–	–	–	1	20.00	–	–
DA-RNA2-127-1	-6	65.83	18.16	0	–	–	–	–	–	–	–	–	–
DA-RNA2-127-2	1	61.29	2.27	1	0.04	–	–	–	–	–	–	–	–
DA-RNA2-127-3	11	59.02	2.27	1	0.04	–	–	–	–	–	–	–	–
DA-RNA2-127-4	13	63.56	2.27	0	–	–	–	–	–	–	–	–	–

Table 16.5. Continued.

Locus/ Sample ID Number	*C. patzcuaro*				*C. caudata*				*I. bradyi*			
	No.	%	A/J	C/V	No.	%	A/J	C/V	No.	%	A/J	C/V
San Agustín Mission (contd.)												
DA-RNA2-3-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-3-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-3-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-3-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-3-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-9-1	–	–	–	–	–	–	–	–	1	50.00	–	–
DA-RNA2-9-2	–	–	–	–	–	–	–	–	1	100.00	–	–
DA-RNA2-9-3	–	–	–	–	–	–	–	–	46	46.46	–	–
DA-RNA2-9-4	–	–	–	–	–	–	–	–	24	32.43	–	–
DA-RNA2-53-1	–	–	–	–	–	–	–	–	2	100.00	–	–
DA-RNA2-53-2	–	–	–	–	–	–	–	–	2	100.00	–	–
DA-RNA2-53-3	–	–	–	–	–	–	–	–	2	100.00	–	–
DA-RNA2-53-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-6	–	–	–		–	–	–	–	–	–	–	–
DA-RNA2-53-7	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-8	–	–	–	–	–	–	–	–	3	50.00	–	–
DA-RNA2-53-9	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-10	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-11	–	–	–	–	–	–	–	–	9	47.37	–	–
DA-RNA2-53-12	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-13	–	–	–	–	–	–	–	–	2	100.00	–	–
DA-RNA2-53-14	–	–	–	–	–	–	–	–	4	80.00	–	–
DA-RNA2-127-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-127-2	–	–	–	–	–	–	–	–	1	100.00	–	–
DA-RNA2-127-3	–	–	–	–	–	–	–	–	1	100.00	–	–
DA-RNA2-127-4	–	–	–	–	–	–	–	–	–	–	–	–

Table 16.5. Continued.

	H. brevicaudata				*Ch. Arcuata*				*D. stevensoni*			
Locus/ Sample ID Number	No.	%	A/J	C/V	No.	%	A/J	C/V	No.	%	A/J	C/V
San Agustín Mission (contd.)												
DA-RNA2-3-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-3-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-3-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-3-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-3-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-9-1	–	–	–	–	–	–	–	–	1	50.00	–	–
DA-RNA2-9-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-9-3	10	10.10	–	–	–	–	–	–	18	18.18	–	–
DA-RNA2-9-4	5	6.76	–	–	–	–	–	–	20	27.03	–	–
DA-RNA2-53-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-5	–	–	–	–	–	–	–	–	1	100.00	–	–
DA-RNA2-53-6	1	100.00	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-7	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-8	1	16.67	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-9	1	100.00	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-10	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-11	–	–	–	–	2	10.53	–	–	1	5.26	–	–
DA-RNA2-53-12	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-13	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-14	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-127-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-127-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-127-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-127-4	–	–	–	–	–	–	–	–	–	–	–	–

Table 16.5. Continued.

Locus/	*P. unicaudata*				*P. pustulosa*				*Cypridopsis* sp.			
Sample ID Number	No.	%	A/J	C/V	No.	%	A/J	C/V	No.	%	A/J	C/V
San Agustín Mission (contd.)												
DA-RNA2-3-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-3-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-3-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-3-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-3-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-9-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-9-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-9-3	–	–	–	–	8	8.08	–	–	–	–	–	–
DA-RNA2-9-4	–	–	–	–	8	10.81	–	–	–	–	–	–
DA-RNA2-53-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-6	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-7	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-8	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-9	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-10	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-11	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-12	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-13	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-53-14	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-127-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-127-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-127-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-127-4	–	–	–	–	–	–	–	–	–	–	–	–

Table 16.5. Continued.

						L. cf. *L. paraornata*				*C. vidua*			
Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Bulk Weight (gm)	Residual Weight (gm)	Ostra- codes	Ostra- codes/ gm	No.	%	A/J	C/V	No.	%	A/J	C/V
San Agustín Mission													
DA-RNA2-127-5	18	68.10	6.81	0	–	–	–	–	–	–	–	–	–
DA-RNA2-137-1	-30	49.94	31.78	0	–	–	–	–	–	–	–	–	–
DA-RNA2-137-2	1	63.56	9.08	2	0.29	–	–	–	–	–	–	–	–
DA-RNA2-137-3	7	68.10	9.08	3	0.40	–	–	–	–	–	–	–	–
DA-RNA2-137-4	11	56.75	6.81	0	–	–	–	–	–	–	–	–	–
DA-RNA2-137-5	16	70.37	15.89	0	–	–	–	–	–	–	–	–	–
DA-RNA2-137-6	22	70.37	22.70	3	0.97	–	–	–	–	–	–	–	–
DA-RNA2-137-7	26	70.37	22.70	0	–	–	–	–	–	–	–	–	–
DA-RNA2-137-8	32	70.37	24.97	10	3.55	–	–	–	–	5	50.00	–	–
DA-RNA2-137-9	37	68.10	34.05	67	33.50	2	2.99	–	–	39	58.21	–	–
DA-RNA2-137-10	42	70.37	29.51	46	19.29	–	–	–	–	21	45.65	–	–
DA-RNA2-137-11	47	68.10	31.78	36	16.80	1	2.78	–	–	19	52.78	–	–
DA-RNA2-137-12	51	74.91	36.32	56	27.15	1	1.79	–	–	32	57.14	–	–
DA-RNA2-137-13	53	61.29	13.62	6	1.33	–	–	–	–	3	50.00	–	–
DA-RNA2-137-14	56	65.83	13.62	6	1.24	–	–	–	–	–	–	–	–
DA-RNA2-137-15	62	72.64	20.43	54	15.19	–	–	–	–	8	14.81	–	–
DA-RNA2-137-16	59	65.83	27.24	79	32.69	1	1.27	–	–	53	67.09	–	–
DA-RNA2-137-17	65	70.37	34.05	81	39.19	–	–	–	–	58	71.60	–	–
DA-RNA2-137-18	69	70.37	31.78	92	41.55	–	–	–	–	48	52.17	–	–
DA-RNA2-137-19	75	81.72	40.86	38	19.00	–	–	–	–	22	57.89	–	–
DA-RNA2-137-20	61	79.45	22.70	10	2.86	–	–	–	–	2	20.00	–	–
DA-RNA2-137-21	66	74.91	20.43	7	1.91	–	–	–	–	1	14.29	–	–
DA-RNA2-137-22	72	65.83	13.62	57	11.79	1	1.75	–	–	6	10.53	–	–
DA-RNA2-137-23	76	70.37	11.35	80	12.90	1	1.25	–	–	9	11.25	–	–
DA-RNA2-137-24	81	83.99	13.62	62	10.05	3	4.84	–	–	11	17.74	–	–
DA-RNA2-137-25	84	65.83	24.97	79	29.97	1	1.27	–	–	31	39.24	–	–
DA-RNA2-137-26	100	83.99	34.09	74	30.04	1	1.35	–	–	34	45.95	–	–

Table 16.5. Continued.

Locus/ Sample ID Number	*C. patzcuaro*				*C. caudata*				*I. bradyi*			
	No.	%	A/J	C/V	No.	%	A/J	C/V	No.	%	A/J	C/V
San Agustín Mission (contd.)												
DA-RNA2-127-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-2	–	–	–	–	–	–	–	–	2	100.00	–	–
DA-RNA2-137-3	–	–	–	–	–	–	–	–	3	100.00	–	–
DA-RNA2-137-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-6	–	–	–	–	–	–	–	–	2	66.67	–	–
DA-RNA2-137-7	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-8	–	–	–	–	–	–	–	–	3	30.00	–	–
DA-RNA2-137-9	–	–	–	–	–	–	–	–	20	29.85	–	–
DA-RNA2-137-10	–	–	–	–	–	–	–	–	22	47.83	–	–
DA-RNA2-137-11	–	–	–	–	–	–	–	–	14	38.89	–	–
DA-RNA2-137-12	–	–	–	–	–	–	–	–	17	30.36	–	–
DA-RNA2-137-13	–	–	–	–	–	–	–	–	1	16.67	–	–
DA-RNA2-137-14	–	–	–	–	–	–	–	–	6	100.00	–	–
DA-RNA2-137-15	–	–	–	–	–	–	–	–	44	81.48	–	–
DA-RNA2-137-16	–	–	–	–	–	–	–	–	15	18.99	–	–
DA-RNA2-137-17	–	–	–	–	1	1.23	–	–	19	23.46	–	–
DA-RNA2-137-18	–	–	–	–	–	–	–	–	30	32.61	–	–
DA-RNA2-137-19	–	–	–	–	–	–	–	–	13	34.21	–	–
DA-RNA2-137-20	–	–	–	–	–	–	–	–	8	80.00	–	–
DA-RNA2-137-21	–	–	–	–	–	–	–	–	6	85.71	–	–
DA-RNA2-137-22	–	–	–	–	–	–	–	–	51	89.47	–	–
DA-RNA2-137-23	–	–	–	–	–	–	–	–	69	86.25	–	–
DA-RNA2-137-24	–	–	–	–	–	–	–	–	47	75.81	–	–
DA-RNA2-137-25	–	–	–	–	–	–	–	–	31	39.24	–	–
DA-RNA2-137-26	–	–	–	–	2	2.70	–	–	32	43.24	–	–

Table 16.5. Continued.

Locus/ Sample ID Number	*H. brevicaudata*				*Ch. Arcuata*				*D. stevensoni*			
	No.	%	A/J	C/V	No.	%	A/J	C/V	No.	%	A/J	C/V
San Agustín Mission (contd.)												
DA-RNA2-127-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-6	1	33.33	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-7	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-8	2	20.00	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-9	–	–	–	–	–	–	–	–	4	5.97	–	–
DA-RNA2-137-10	2	4.35	–	–	–	–	–	–	5	10.87	–	–
DA-RNA2-137-11	–	–	–	–	–	–	–	–	1	2.78	–	–
DA-RNA2-137-12	–	–	–	–	–	–	–	–	6	10.71	–	–
DA-RNA2-137-13	–	–	–	–	–	–	–	–	2	33.33	–	–
DA-RNA2-137-14	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-15	–	–	–	–	–	–	–	–	2	3.70	–	–
DA-RNA2-137-16	–	–	–	–	–	–	–	–	8	10.13	–	–
DA-RNA2-137-17	–	–	–	–	–	–	–	–	2	2.47	–	–
DA-RNA2-137-18	1	1.09	–	–	–	–	–	–	9	9.78	–	–
DA-RNA2-137-19	1	2.63	–	–	–	–	–	–	2	5.26	–	–
DA-RNA2-137-20	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-21	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-22	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-23	–	–	–	–	–	–	–	–	1	1.25	–	–
DA-RNA2-137-24	–	–	–	–	–	–	–	–	1	1.61	–	–
DA-RNA2-137-25	–	–	–	–	–	–	–	–	8	10.13	–	–
DA-RNA2-137-26	–	–	–	–	–	–	–	–	4	5.41	–	–

Table 16.5. Continued.

Locus/ Sample ID Number	*P. unicaudata*				*P. pustulosa*				*Cypridopsis* sp.			
	No.	%	A/J	C/V	No.	%	A/J	C/V	No.	%	A/J	C/V
San Agustín Mission (contd.)												
DA-RNA2-127-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-6	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-7	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-8	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-9	–	–	–	–	2	2.99	–	–	–	–	–	–
DA-RNA2-137-10	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-11	–	–	–	–	1	2.78	–	–	–	–	–	–
DA-RNA2-137-12	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-13	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-14	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-15	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-16	–	–	–	–	2	2.53	–	–	–	–	–	–
DA-RNA2-137-17	–	–	–	–	1	1.23	–	–	–	–	–	–
DA-RNA2-137-18	–	–	–	–	4	4.35	–	–	–	–	–	–
DA-RNA2-137-19	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-20	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-21	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-22	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-23	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-24	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-25	–	–	–	–	8	10.13	–	–	–	–	–	–
DA-RNA2-137-26	–	–	–	–	1	1.35	–	–	–	–	–	–

Table 16.5. Continued.

						L. cf. *L. paraornata*				*C. vidua*			
Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Bulk Weight (gm)	Residual Weight (gm)	Ostra-codes	Ostra-codes/ gm	No.	%	A/J	C/V	No.	%	A/J	C/V
San Agustín Mission													
DA-RNA2-137-27	-59	74.91	22.70	0	–	–	–	–	–	–	–	–	–
DA-RNA2-137-28	-48	70.37	11.35	0	–	–	–	–	–	–	–	–	–
DA-RNA2-137-29	-38	70.37	6.81	0	–	–	–	–	–	–	–	–	–
DA-RNA2-137-30	-28	65.83	9.08	0	–	–	–	–	–	–	–	–	–
DA-RNA2-137-31	-18	79.45	13.62	27	4.63	2	7.41	–	–	1	3.70	–	–
DA-RNA2-Cienega		56.75	6.81	0	–	–	–	–	–	–	–	–	–
Mission Gardens													
DA-RNA11-310-200-1	-5	100.00	9.08	53	0.53	–	–	–	–	4	7.55	1.00	0.00
DA-RNA11-310-200-2	0	100.00	7.81	3	0.03	–	–	–	–	–	–	–	–
DA-RNA11-310-200-3	6	100.00	7.31	5	0.05	–	–	–	–	1	20.00	1.00	0.00
DA-RNA11-310-200-4	15	100.00	23.25	68	0.68	6	8.82	1.00	0.00	8	11.76	0.50	0.00
DA-RNA11-310-200-5	36	100.00	60.02	110	1.10	12	10.91	1.00	0.00	16	14.55	0.63	0.00
DA-RNA11-310-200-6	43	100.00	43.48	104	1.04	14	13.46	1.00	0.00	20	19.23	0.20	0.00
DA-RNA11-310-200-7	7	100.00	21.73	3	0.03	1	33.33	1.00	0.00	–	–	–	–
DA-RNA11-310-200-8	23	100.00	19.16	14	0.14	–	–	–	–	6	42.86	0.00	0.00
DA-RNA11-310-200-9	13	100.00	30.66	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-10	52	100.00	61.29	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-11	12	100.00	18.81	54	0.54	6	11.11	0.83	0.00	6	11.11	0.33	0.00
DA-RNA11-310-200-12	40	100.00	20.93	6	0.06	–	–	–	–	2	33.33	0.00	0.00
DA-RNA11-310-200-13	18	100.00	86.50	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-14	70	100.00	90.80	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-15	90	97.60	89.53	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-16	109	100.00	83.99	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-17	129	100.00	70.37	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-18	75	100.00	48.40	–	–	–	–	–	–	–	–	–	–

Table 16.5. Continued.

Locus/ Sample ID Number	*C. patzcuaro*				*C. caudata*				*I. bradyi*			
	No.	%	A/J	C/V	No.	%	A/J	C/V	No.	%	A/J	C/V
San Agustín Mission (contd.)												
DA-RNA2-137-27	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-28	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-29	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-30	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-31	–	–	–	–	–	–	–	–	24	88.89	–	–
DA-RNA2-Cienega	–	–	–	–	–	–	–	–	–	–	–	–
Mission Gardens (contd.)												
DA-RNA11-310-200-1	–	–	–	–	–	–	–	–	22	41.51	0.91	0.00
DA-RNA11-310-200-2	3	100.00	0.00	0.67	–	–	–	–	–	–	–	–
DA-RNA11-310-200-3	1	20.00	0.00	0.00	–	–	–	–	3	60.00	1.00	0.00
DA-RNA11-310-200-4	10	14.71	0.20	0.00	–	–	–	–	42	61.76	0.90	–
DA-RNA11-310-200-5	12	10.91	0.17	0.00	–	–	–	–	70	63.64	0.94	0.00
DA-RNA11-310-200-6	8	7.69	0.00	0.00	–	–	–	–	58	55.77	0.72	0.00
DA-RNA11-310-200-7	–	–	–	–	–	–	–	–	2	66.67	1.00	0.00
DA-RNA11-310-200-8	4	28.57	0.50	0.00	–	–	–	–	2	14.29	1.00	0.00
DA-RNA11-310-200-9	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-10	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-11	3	5.56	0.00	0.00	–	–	–	–	33	61.11	0.82	0.00
DA-RNA11-310-200-12	1	16.67	0.00	0.00	–	–	–	–	2	33.33	0.50	0.00
DA-RNA11-310-200-13	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-14	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-15	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-16	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-17	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-18	–	–	–	–	–	–	–	–	–	–	–	–

Table 16.5. Continued.

	H. brevicaudata				*Ch. Arcuata*				*D. stevensoni*			
Locus/ Sample ID Number	No.	%	A/J	C/V	No.	%	A/J	C/V	No.	%	A/J	C/V
San Agustín Mission (contd.)												
DA-RNA2-137-27	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-28	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-29	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-30	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-31	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-Cienega	–	–	–	–	–	–	–	–	–	–	–	–
Mission Gardens (contd.)												
DA-RNA11-310-200-1	5	9.43	0.00	0.00	–	–	–	–	–	–	–	–
DA-RNA11-310-200-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-4	–	–	–	–	–	–	–	–	2	2.94	1.00	0.00
DA-RNA11-310-200-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-6	4	3.85	0.00	0.00	–	–	–	–	–	–	–	–
DA-RNA11-310-200-7	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-8	–	–	–	–	–	–	–	–	2	14.29	1.00	0.00
DA-RNA11-310-200-9	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-10	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-11	1	1.85	0.00	0.00	–	–	–	–	4	7.41	1.00	0.00
DA-RNA11-310-200-12	1	16.67	0.00	0.00	–	–	–	–	–	–	–	–
DA-RNA11-310-200-13	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-14	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-15	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-16	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-17	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-18	–	–	–	–	–	–	–	–	–	–	–	–

Table 16.5. Continued.

Locus/ Sample ID Number	*P. unicaudata*				*P. pustulosa*				*Cypridopsis* sp.			
	No.	%	A/J	C/V	No.	%	A/J	C/V	No.	%	A/J	C/V
San Agustín Mission (contd.)												
DA-RNA2-137-27	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-28	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-29	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-30	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-137-31	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA2-Cienega	–	–	–	–	–	–	–	–	–	–	–	–
Mission Gardens (contd.)												
DA-RNA11-310-200-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-6	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-7	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-8	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-9	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-10	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-11	–	–	–	–	1	1.85	0.00	0.00	–	–	–	–
DA-RNA11-310-200-12	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-13	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-14	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-15	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-16	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-17	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-310-200-18	–	–	–	–	–	–	–	–	–	–	–	–

Table 16.5. Continued.

						L. cf. *L. paraornata*				*C. vidua*			
Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Bulk Weight (gm)	Residual Weight (gm)	Ostra-codes	Ostra-codes/ gm	No.	%	A/J	C/V	No.	%	A/J	C/V
Mission Gardens													
DA-RNA11-300-207-1	-5	100.00	6.69	2	0.02	–	–	–	–	–	–	–	–
DA-RNA11-300-207-2	0	100.00	47.67	272	2.72	3	1.10	1.00	0.00	51	18.75	0.25	0.00
DA-RNA11-300-207-3	15	100.00	42.36	272	2.72	6	2.21	1.00	0.00	51	18.75	0.43	0.00
DA-RNA11-300-207-4	25	100.00	37.32	135	1.35	–	–	–	–	25	18.52	0.20	0.00
DA-RNA11-307-205-1	-2	100.00	12.35	22	0.22	1	4.55	1.00	0.00	1	4.55	1.00	0.00
DA-RNA11-307-205-2	6	100.00	18.16	73	0.73	3	–	0.67	0.00	10	13.70	0.40	0.00
DA-RNA11-307-205-3	10	100.00	28.49	166	1.66	1	–	1.00	0.00	16	9.64	0.56	0.00
DA-RNA11-307-205-4	13	100.00	27.24	55	0.55	–	–	–	–	19	34.55	0.53	0.11
DA-RNA11-307-205-5	27	100.00	24.97	26	0.26	–	–	–	–	13	50.00	0.23	0.00
DA-RNA11-302-200-1	-2	100.00	12.65	14	0.14	1	7.14	0.00	0.00	3.00	21.43	0.67	0.00
DA-RNA11-302-200-2	2	100.00	61.29	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-200-3	25	100.00	70.37	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-200-4	29	100.00	56.75	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-200-5	15	100.00	14.12	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-200-6	8	100.00	7.15	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-200-7	21	100.00	3.37	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-200-8	33	100.00	39.94	14	0.14	1	7.14	0.00	0.00	2	14.29	0.50	0.00
DA-RNA11-302-200-9	42	100.00	17.14	8	0.08	1	12.50	0.00	0.00	1	12.50	0.00	0.00
DA-RNA11-302-200-10	57	100.00	43.48	4	0.04	3	75.00	0.00	0.00	–	–	–	–
DA-RNA11-302-201-1	-2	100.00	5.64	26	0.26	–	–	–	–	–	–	–	–
DA-RNA11-302-201-2	2	100.00	36.32	325	3.25	2	0.62	1.00	0.00	42	12.92	0.76	0.00
DA-RNA11-302-201-3	9	100.00	18.96	277	2.77	3	1.08	1.00	0.00	21	7.58	0.86	0.38
DA-RNA11-302-201-4	21	100.00	44.13	44	0.44	–	–	–	–	6	13.64	1.00	0.00
DA-RNA11-302-201-5	35	100.00	34.05	526	5.26	4	0.76	1.00	0.00	86	16.35	0.62	0.00

Table 16.5. Continued.

Locus/ Sample ID Number	*C. patzcuaro*				*C. caudata*				*I. bradyi*			
	No.	%	A/J	C/V	No.	%	A/J	C/V	No.	%	A/J	C/V
Mission Gardens												
DA-RNA11-300-207-1	–	–	–	–	–	–	–	–	2	100.00	1.00	0.00
DA-RNA11-300-207-2	–	–	–	–	–	–	–	–	173	63.60	0.58	0.00
DA-RNA11-300-207-3	–	–	–	–	–	–	–	–	173	63.60	0.58	0.00
DA-RNA11-300-207-4	–	–	–	–	–	–	–	–	107	79.26	0.75	0.00
DA-RNA11-307-205-1	–	–	–	–	–	–	–	–	20	90.91	0.85	0.00
DA-RNA11-307-205-2	–	–	–	–	–	–	–	–	47	64.38	0.85	0.00
DA-RNA11-307-205-3	–	–	–	–	–	–	–	–	136	81.93	0.85	0.00
DA-RNA11-307-205-4	–	–	–	–	–	–	–	–	31	56.36	0.94	0.00
DA-RNA11-307-205-5	–	–	–	–	–	–	–	–	13	50.00	1.00	0.00
DA-RNA11-302-200-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-200-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-200-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-200-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-200-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-200-6	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-200-7	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-200-8	–	–	–	–	–	–	–	–	7	50.00	1.00	0.00
DA-RNA11-302-200-9	–	–	–	–	–	–	–	–	6	75.00	1.00	0.00
DA-RNA11-302-200-10	–	–	–	–	–	–	–	–	1	25.00	1.00	0.00
DA-RNA11-302-201-1	–	–	–	–	–	–	–	–	5	19.23	1.00	0.00
DA-RNA11-302-201-2	–	–	–	–	–	–	–	–	43	13.23	0.63	0.00
DA-RNA11-302-201-3	–	–	–	–	–	–	–	–	250	90.25	0.87	0.05
DA-RNA11-302-201-4	–	–	–	–	–	–	–	–	32	72.73	0.81	0.00
DA-RNA11-302-201-5	–	–	–	–	–	–	–	–	370	70.34	0.78	0.00

Table 16.5. Continued.

Locus/ Sample ID Number	*H. brevicaudata*				*Ch. Arcuata*				*D. stevensoni*			
	No.	%	A/J	C/V	No.	%	A/J	C/V	No.	%	A/J	C/V
Mission Gardens												
DA-RNA11-300-207-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-300-207-2	3	1.10	0.00	0.00	3	1.10	0	0	37	13.60	0.59	0.00
DA-RNA11-300-207-3	1	0.37	0.00	0.00	3	1.10	0.00	0.00	38	13.97	0.58	0.11
DA-RNA11-300-207-4	1	0.74	0.00	0.00	1	0.74	0.00	0.00	11	8.15	0.82	0.00
DA-RNA11-307-205-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-307-205-2	–	–	–	–	–	–	–	–	5	6.85	1.00	0.00
DA-RNA11-307-205-3	–	–	–	–	–	–	–	–	3	1.81	0.33	0.00
DA-RNA11-307-205-4	–	–	–	–	–	–	–	–	3	5.45	0.33	0.00
DA-RNA11-307-205-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-200-1	1	7.14	0.00	0.00	–	–	–	–	–	–	–	–
DA-RNA11-302-200-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-200-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-200-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-200-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-200-6	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-200-7	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-200-8	1	7.14	0.00	0.00	–	–	–	–	–	–	–	–
DA-RNA11-302-200-9	1	12.50	0.00	0.00	–	–	–	–	–	–	–	–
DA-RNA11-302-200-10	3	75.00	0.00	0.00	–	–	–	–	–	–	–	–
DA-RNA11-302-201-1	1	3.85	0.00	0.00	–	–	–	–	–	–	–	–
DA-RNA11-302-201-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-201-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-201-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-201-5	–	–	–	–	–	–	–	–	3	0.57	1.00	0.00

Table 16.5. Continued.

Locus/ Sample ID Number	*P. unicaudata*				*P. pustulosa*				*Cypridopsis* sp.			
	No.	%	A/J	C/V	No.	%	A/J	C/V	No.	%	A/J	C/V
Mission Gardens												
DA-RNA11-300-207-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-300-207-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-300-207-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-300-207-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-307-205-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-307-205-2	–	–	–	–	–	–	–	–	8	10.96	0.00	0.00
DA-RNA11-307-205-3	–	–	–	–	–	–	–	–	10	6.02	0.60	0.00
DA-RNA11-307-205-4	–	–	–	–	–	–	–	–	2	3.64	0.00	0.00
DA-RNA11-307-205-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-200-1	–	–	–	–	–	–	–	–	9	64.29	0.56	0.00
DA-RNA11-302-200-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-200-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-200-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-200-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-200-6	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-200-7	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-200-8	–	–	–	–	–	–	–	–	2	14.29	1.00	0.00
DA-RNA11-302-200-9	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-200-10	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-302-201-1	–	–	–	–	–	–	–	–	20	76.92	0.35	0.00
DA-RNA11-302-201-2	–	–	–	–	–	–	–	–	238	73.23	0.10	0.00
DA-RNA11-302-201-3	–	–	–	–	–	–	–	–	13	4.69	0.31	0.00
DA-RNA11-302-201-4	–	–	–	–	–	–	–	–	6	13.64	0.00	0.00
DA-RNA11-302-201-5	–	–	–	–	–	–	–	–	63	11.98	0.24	0.00

Table 16.5. Continued.

						L. cf. *L. paraornata*				*C. vidua*			
Locus/ Sample ID Number	Stratigraphic Level (cm from base of canal)	Bulk Weight (gm)	Residual Weight (gm)	Ostra-codes	Ostra-codes/ gm	No.	%	A/J	C/V	No.	%	A/J	C/V
Mission Gardens													
DA-RNA11-302-201-6	62	100.00	29.51	73	0.73	1	1.37	1.00	0.00	9	12.33	0.33	0.00
DA-RNA11-302-201-7	65	100.00	27.24	337	3.37	4	1.19	1.00	0.00	40	11.87	0.30	0.05
DA-RNA11-302-201-8	71	100.00	17.39	371	3.71	3	0.81	1.00	0.00	50	13.48	0.84	0.04
DA-RNA11-302-201-9	80	97.61	15.89	342	3.50	–	–	–	–	21	6.14	0.62	0.00
DA-RNA11-309-206-1	-3	100.00	28.24	8	0.08	1	12.50	1.00	0.00	1	12.50	0.00	0.00
DA-RNA11-309-206-2	3	100.00	43.13	222	2.22	3	1.35	1.00	0.00	29	13.06	0.59	0.00
DA-RNA11-309-206-3	14	100.00	52.21	87	0.87	1	1.15	1.00	0.00	22	25.29	0.36	0.18
DA-RNA11-305-204-1	-25	100.00	7.31	6	0.06	–	–	–	–	–	–	–	–
DA-RNA11-305-204-2	-2	93.07	20.43	–	–	–	–	–	–	–	–	–	–
DA-RNA11-305-204-3	2	100.00	30.11	33	0.33	–	–	–	–	4	12.12	0.00	0.00
DA-RNA11-305-204-4	15	100.00	36.72	7	0.07	–	–	–	–	1	14.29	0.00	0.00
DA-RNA11-305-204-5	23	100.00	56.75	–	–	–	–	–	–	–	–	–	–
DA-RNA11-305-204-6	28	100.00	47.97	–	–	–	–	–	–	–	–	–	–
DA-RNA11-305-204-7	40	100.00	40.86	7	0.07	–	–	–	–	–	–	–	–
DA-RNA11-305-204-8	51	100.00	18.46	–	–	–	–	–	–	–	–	–	–

Table 16.5. Continued.

Locus/ Sample ID Number	*C. patzcuaro*				*C. caudata*				*I. bradyi*			
	No.	%	A/J	C/V	No.	%	A/J	C/V	No.	%	A/J	C/V
Mission Gardens (contd.)												
DA-RNA11-302-201-6	–	–	–	–	–	–	–	–	47	64.38	0.77	0.00
DA-RNA11-302-201-7	–	–	–	–	–	–	–	–	231	68.55	0.78	0.00
DA-RNA11-302-201-8	–	–	–	–	–	–	–	–	269	72.51	0.45	0.00
DA-RNA11-302-201-9	–	–	–	–	–	–	–	–	276	80.70	0.55	0.04
DA-RNA11-309-206-1	–	–	–	–	–	–	–	–	5	62.50	1.00	0.00
DA-RNA11-309-206-2	–	–	–	–	–	–	–	–	156	70.27	0.74	0.00
DA-RNA11-309-206-3	–	–	–	–	–	–	–	–	52	59.77	0.85	0.00
DA-RNA11-305-204-1	–	–	–	–	–	–	–	–	6	100.00	0.83	0.00
DA-RNA11-305-204-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-305-204-3	–	–	–	–	–	–	–	–	29	87.88	0.93	0.00
DA-RNA11-305-204-4	–	–	–	–	–	–	–	–	6	85.71	1.00	0.00
DA-RNA11-305-204-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-305-204-6	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-305-204-7	–	–	–	–	–	–	–	–	7	100.00	1.00	0.00
DA-RNA11-305-204-8	–	–	–	–	–	–	–	–	—	–	—	–

Table 16.5. Continued.

Locus/ Sample ID Number	*H. brevicaudata*				*Ch. Arcuata*				*D. stevensoni*			
	No.	%	A/J	C/V	No.	%	A/J	C/V	No.	%	A/J	C/V
Mission Gardens (contd.)												
DA-RNA11-302-201-6	2	2.74	1.00	0.00	–	–	–	–	2	2.74	1.00	0.00
DA-RNA11-302-201-7	4	1.19	0.00	0.00	–	–	–	–	2	0.59	1.00	0.00
DA-RNA11-302-201-8	1	0.27	0.00	0.00	–	–	–	–	6	1.62	1.00	0.00
DA-RNA11-302-201-9	2	0.58	0.00	0.00	–	–	–	–	1	0.29	1.00	0.00
DA-RNA11-309-206-1	–	–	–	–	–	–	–	–	1	12.50	1.00	0.00
DA-RNA11-309-206-2	–	–	–	–	–	–	–	–	15	6.76	0.87	0.00
DA-RNA11-309-206-3	1	1.15	0.00	0.00	1	1.15	1.00	0.00	6	6.90	1.00	0.00
DA-RNA11-305-204-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-305-204-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-305-204-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-305-204-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-305-204-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-305-204-6	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-305-204-7	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-305-204-8	–	–	–	–	–	–	–	–	–	–	–	–

Table 16.5. Continued.

	P. unicaudata				*P. pustulosa*				*Cypridopsis* sp.			
Locus/ Sample ID Number	No.	%	A/J	C/V	No.	%	A/J	C/V	No.	%	A/J	C/V
Mission Gardens (contd.)												
DA-RNA11-302-201-6	–	–	–	–	–	–	–	–	10	13.70	0.20	0.00
DA-RNA11-302-201-7	–	–	–	–	–	–	–	–	57	16.91	0.12	0.00
DA-RNA11-302-201-8	–	–	–	–	–	–	–	–	44	11.86	0.05	0.00
DA-RNA11-302-201-9	–	–	–	–	–	–	–	–	34	9.94	0.35	0.00
DA-RNA11-309-206-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-309-206-2	2	0.90	0.00	0.00	–	–	–	–	17	7.66	0.06	0.00
DA-RNA11-309-206-3	–	–	–	–	–	–	–	–	4	4.60	0.00	0.00
DA-RNA11-305-204-1	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-305-204-2	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-305-204-3	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-305-204-4	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-305-204-5	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-305-204-6	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-305-204-7	–	–	–	–	–	–	–	–	–	–	–	–
DA-RNA11-305-204-8	–	–	–	–	–	–	–	–	–	–	–	–

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CHAPTER 17

SOURCES OF OBSIDIAN ARTIFACTS

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A total of 32 flaked obsidian artifacts was recovered by the Desert Archaeology, Inc., investigations at the Clearwater site, AZ BB:13:6 (ASM), and the Tucson Presidio, AZ BB:13:13 (ASM). The elemental concentrations in 20 obsidian artifacts were analyzed by the energy dispersive X-ray fluorescence (EXRF) method to match them to the compositions of known obsidian sources in the Greater Southwest. The types of obsidian artifacts, their contexts, the ages of those contexts, and identified sources are summarized in Table 17.1. Elemental concentrations for the analyzed obsidian artifacts are shown in Table 17.2, and the periods and sample sizes of obsidian artifacts from archaeological sites in the Tucson Basin are listed in Table 17.3. Table 17.4 shows the sources of obsidian artifacts from archaeological sites in the Tucson Basin, by period. The locations of identified sources for obsidian artifacts from Clearwater and the Tucson Presidio, dating to the Cienega phase, the Hohokam periods, and the Spanish period, are illustrated in Figures 17.1-17.3, respectively.

ANALYSIS AND INSTRUMENTAL CONDITIONS

All the archaeological samples from Clearwater and the Tucson Presidio were analyzed whole. The results presented here are quantitative in that they are derived from "filtered" intensity values ratioed to the appropriate x-ray continuum regions through a least-squares fitting formula rather than plotting the proportions of the net intensities in a ternary system. More essentially, through the analysis of international rock standards, these data allow for inter-instrument comparisons with a predictable degree of certainty.

The trace element analyses were performed in the Archaeological XRF Laboratory, Department of Earth and Planetary Sciences, University of California, Berkeley, using a Spectrace/Thermo™ *QuanX* energy dispersive x-ray fluorescence spectrometer. The spectrometer is equipped with an air-cooled Cu x-ray target with a 125-micron Be window, an x-ray generator that operates from 4-50 kV/0.02-2.0 mA at 0.02 increments, using an IBM PC-based microprocessor and WinTrace™ reduction software. The x-ray tube is operated at 30 kV, 0.14 mA, using a 0.05 mm (medium) Pd primary beam filter in an air path at 200 seconds livetime to generate x-ray intensity Kα-line data for elements titanium (Ti), manganese (Mn), iron (as FeT), thorium (Th) using Lα line, rubidium (Rb), strontium (Sr), yttrium (Y), zirconium (Zr), and niobium (Nb). Weight percent iron ($Fe_2O_3^T$) can be derived by multiplying pp estimates by $1.4297(10^{-4})$.

Trace element intensities were converted to concentration estimates by utilizing a least-squares calibration line established for each element from the analysis of international rock standards certified by the National Institute of Standards and Technology (NIST), the U.S. Geological Survey (USGS), Canadian Centre for Mineral and Energy Technology, and the Centre de Recherches Pétrographiques et Géochimiques in France (Govindaraju 1994). Line fitting is linear (XML) for all elements except iron, where a derivative is used to improve the fit for the high concentrations of iron, and thus, for all the other elements. Further details concerning the petrological choice of these elements in southwest obsidian is available elsewhere (Hughes and Smith 1993; Mahood and Stimac 1990; Shackley 1990, 1995, 1998, 2005).

Specific standards used for the best-fit regression calibration for elements titanium through niobium include basalt (G-2), andesite (AGV-1), GSP-1, syenite (SY-2), hawaiite (BHVO-1), syenite (STM-1), quartz latite (QLO-1), obsidian (RGM-1), diabase (W-2), basalt (BIR-1), mica schist (SDC-1), tonalite (TLM-1), shale (SCO-1), all U.S. Geological Survey standards, basalt (BR-N) from the Centre de Recherches Pétrographiques et Géochimiques in France, and obsidian (JR-1 and JR-2) from the Geological Survey of Japan (Govindaraju 1994). In addition to the reported values here, nickel, copper, zinc, and gallium were measured, but these are rarely useful in discriminating glass sources and are not generally reported.

The data from the WinTrace™ software were translated directly into Excel for Windows software for manipulation, and on into SPSS for Windows for statistical analyses. To evaluate these quantitative determinations, machine data were compared with measurements of known standards during each run. RGM-1 is analyzed during each sample run for obsidian artifacts to check machine calibration (see

Table 17.1. Information about obsidian artifacts from the Rio Nuevo archaeological investigations, in temporal order.

AZ (ASM) Site No.	Feature No.	Field No.	Period/Phase	Context	Artifact Type	Source
BB:13:6	3364	9248	Unnamed phase of Early Agricultural period	Pit structure	Flake	Unknown
BB:13:13	409	4104	San Pedro or Cienega phase	American Territorial period pit	San Pedro point	Tank Mountains
BB:13:6	0	5596	Early Cienega phase	Sheet trash	Cienega Short point	Antelope Creek/ Mule Mountains
	20	6781	Late Cienega phase	Roasting pit	Biface tip	Tank Mountains
	9357	8471	Late Cienega phase	Big house	Flake	Government Mountain
		8355b	Late Cienega phase	Big house	Flake	Los Vidrios
		8355c	Late Cienega phase	Big house	Flake	Tank Mountains
		9026	Late Cienega phase	Big house	Flake	Government Mountain
BB:13:13	406	3525	Hohokam Colonial period?	Pit structure	Flake	Blue/San Francisco River
BB:13:6	0	5605	Hohokam Sedentary period	Sheet trash	Sedentary point	Superior
BB:13:13	0	3473	Hohokam Classic period	Sheet trash	Classic point tip	Sauceda Mountains
BB:13:6	0	5230	Protohistoric or Spanish period	Alluvium	Sobaipuri point	Sand Tanks
	178	6520a	Spanish period	Pit	Flake	Mule Creek
		6520b	Spanish period	Pit	Flake	Los Vidrios
	3000	7970	Spanish period	Mission wall	Flake	Burro Creek
BB:13:13	371	2439	Spanish period?	American Territorial period pit	Point tip	Tank Mountains
	0	2694	Spanish period?	Backhoe backdirt	Point tip	Los Vidrios
		2694	Spanish period	Disturbed area	Point tip	Los Vidrios
		3377	Mexican period	Sheet trash	Sobaipuri point	Sauceda Mountains

Table 17.2). Compilation and discussion of RGM-1 analyses are available at http://www.swxrflab.net/analysis.htm. Source assignments were made with reference to the source standard library at Berkeley (Shackley 1995, 1998, 2005), Baugh and Nelson (1987), Glascock et al. (1999), and Nelson (1984).

RESULTS AND DISCUSSION

The majority of the assemblage from the Clearwater and Tucson Presidio sites were made of materials procured from sources in the Sonoran Desert, including (in order of increasing distance) the Sand Tanks, Sauceda Mountains, Los Vidrios, and Tank Mountains sources (see Table 17.1). However, the earliest obsidian artifacts, dating to the Cienega phase (circa 800 B.C.-A.D. 50), did not come from the closest sources, but rather, from sources between 200 km and 400 km away (source distances are shown in Table 17.4). This fits with a previous observation that obsidian was procured from diverse sources, including some from great distances, during the Cienega phase in southern Arizona (Shackley 2005). It does not, however, fit with the previous model of a contracted obsidian procurement pattern during the Late Archaic/Early Agricultural period, compared with the extensive procurement pattern of the preceding Middle Archaic period (e.g., Roth 2000; Shackley 1990, 1996, 1999, 2002, 2005).

Table 17.2. Elemental concentrations for the obsidian samples from the Rio Nuevo Archaeology project, by state. (All measurements in parts per million [ppm]).

Sample	Titanium	Manganese	Iron	Rubidium	Strontium	Yttrium	Zirconium	Niobium	Source
BB-13-6-20-6781	1,135	502	7,923	142	138	21	127	9	Tank Mountains
BB-13-6-3000-7970	684	567	7,550	337	5	81	92	45	Burro Creek
BB-13-6-3364-9248	1,928	674	7,523	91	59	13	56	52	Unknown
BB-13-6-5012	1,742	620	25,956	148	40	85	712	52	Arizona unknown A
BB-13-6-5230	1,157	584	9,300	151	14	29	241	25	Sand Tanks
BB-13-6-5596	895	344	7,614	223	14	33	103	14	Antelope Creek/Mule Mountains
BB-13-6-5605	1,261	542	6,075	118	19	22	91	30	Superior
BB-13-6-8355-9357a	2,860	83	2,651	3	5	-3	8	24	Not obsidian
BB-13-6-8355-9357b	1,050	252	12,800	236	10	59	211	40	Los Vidrios
BB-13-6-8355-9357c	1,358	486	8,125	146	137	9	122	10	Tank Mountains
RNA-2-AZ-BB-13-6-178-6520-a	874	318	7,328	195	26	32	104	22	Antelope Creek/Mule Mountains
RNA-2-AZ-BB-13-6-178-6520-b	1,070	244	11,504	228	20	70	205	28	Los Vidrios
RNA-2-AZ-BB-13-6-5-9423	929	408	8,158	223	23	36	114	30	Antelope Creek/Mule Mountains
RNA-2-AZ-BB-13-6-9357-9026	726	526	7,116	109	73	17	66	48	Government Mountain
RNA-8-A&B-AZ-BB-13-6-9357-8471	946	736	8,973	117	95	18	80	51	Government Mountain
BB-13-13-2583	976	254	11,321	243	14	70	223	36	Los Vidrios
BB-13-13-2694	1,088	251	11,833	239	17	73	211	32	Los Vidrios
BB-13-13-3146	1,050	575	6,395	121	22	25	91	34	Superior
BB-13-13-3377	1,490	373	9,929	162	109	23	191	15	Sauceda Mountains
BB-13-13-3473	1,606	517	10,633	158	76	24	201	12	Sauceda Mountains
BB-13-13-371-2439	1,240	461	7,805	160	145	12	110	19	Tank Mountains
BB-13-13-376-2605	1,575	531	13,906	111	136	15	92	23	Cow Canyon?
BB-13-13-409-4101	1,388	273	10,098	140	136	22	156	8	Tank Mountains
RNA-12-AZ-BB-13-13-2849	973	214	10,233	238	17	63	202	39	Los Vidrios
RNA-12-AZ-BB-13-13-3349	1,310	552	17,248	139	85	56	351	26	Unknown
RNA-12-AZ-BB-13-13-3496	1,298	373	8,355	158	68	28	195	31	Sauceda Mountains
RNA-12-AZ-BB-13-13-376-2638	940	267	11,230	242	13	70	216	21	Los Vidrios
RNA-12-AZ-BB-13-13-376-3809	1,089	202	10,338	220	7	55	202	32	Los Vidrios
RNA-12-AZ-BB-13-13-376-3826	1,002	610	7,971	369	5	75	96	38	Burro Creek
RNA-12-AZ-BB-13-13-376-3897	1,661	962	35,410	263	25	116	1,495	111	Antelope Wells
RNA-12-AZ-BB-13-13-406-3525	747	530	6,916	200	21	31	71	21	Blue/San Francisco River
RNA-12-AZ-BB-13-13-4424	1,193	434	7,783	170	150	15	126	16	Tank Mountains
RGM1-H1	1,663	349	13,262	151	116	22	219	17	Standard
RGM1-H1	1,672	309	13,323	154	117	20	223	3	Standard
RGM1-S1	1,635	315	13,245	152	119	21	227	8	Standard

Table 17.3. Periods and sample sizes of obsidian artifacts from archaeological sites in the Tucson Basin.

- Middle Archaic Period
  - AZ AA:12:181 (ASM) (*n* = 2)
  - La Paloma, AZ BB:9:127 (ASM) (*n* = 3)
  - Owl Head Butte, AZ AA:8:194 (ASM) (*n* = 7)
  - Tates Hills, AZ AA:12:84 (ASM) (*n* = 5)
  - West Branch, AZ AA:16:3 (ASM) (*n* = 1)
- Upper Bajada, Late Archaic/Early Agricultural Period
  - AZ AA:12:84 (ASM) (*n* = 13)
  - Angus, AZ AA:8:133 (ASM) (*n* = 1)
  - Coffee Camp, AZ AA:6:19 (ASM) (*n* = 3)
  - HK, AZ AA:8:166 (ASM) (*n* = 7)
  - La Paloma, AZ BB:9:127 (ASM) (*n* = 3)
- Early Agricultural Period
  - Unnamed Phase
    - Clearwater, AZ BB:13:6 (ASM) (*n* = 1)
  - San Pedro or Cienega Phase
    - Tucson Presidio, AZ BB:13:13 (ASM) (*n* = 1)
  - San Pedro Phase
    - Las Capas, AZ AA:12:111 (ASM) (*n* = 8)
  - Cienega Phase
    - Clearwater, AZ BB:13:6 (ASM) (*n* = 6)
    - Cortaro Fan, AZ AA:12:486 (ASM) (*n* = 1)
    - Santa Cruz Bend, AZ AA:12:746 (ASM) (*n* = 6)
    - Stone Pipe, AZ BB:13:425 (ASM) (*n* = 2)
- Hohokam Colonial Period?
  - Tucson Presidio, AZ BB:13:13 (ASM) (*n* = 1)
- Hohokam Sedentary Period
  - Clearwater, AZ BB:13:6 (ASM) (*n* = 1)
  - Sunset Mesa, AZ AA:12:10 (ASM) (*n* = 8)
  - West Branch, AZ AA:16:3 (ASM) (*n* = 16)
- Hohokam Classic Period
  - Marana site complex (*n* = 178)
  - Tucson Presidio, AZ BB:13:13 (ASM) (*n* = 1)
- Protohistoric or Spanish Period
  - Clearwater, AZ BB:13:6 (ASM) (*n* = 1)
- Spanish Period
  - Clearwater, AZ BB:13:6 (ASM) (*n* = 3)
  - Tucson Presidio, AZ BB:13:13 (ASM) (*n* = 3)
- Mexican Period
  - Tucson Presidio, AZ BB:13:13 (ASM) (*n* = 1)

Recent data, however, suggest such a contraction may have occurred during the San Pedro phase (1200-800 B.C.), the phase preceding the Cienega phase. The small sample of obsidian artifacts from the San Pedro phase (*n* = 8) in the Tucson Basin, all from the Las Capas site, AZ AA:12:111 (ASM), is limited to sources within 150-200 km (Shackley et al. 2006). Among the recovered samples from Cerro Juanaqueña in northwestern Mexico, the only other San Pedro phase site that has yielded obsidian, the four identified sources are also within 150-200 km of the site (Shackley 1999). This pattern may indicate restricted access and/or reduced movements to obsidian sources during the San Pedro phase, probably related to reduced residential mobility and the use of fewer resource zones during that interval (Shackley 1996).

In contrast, the currently available data for the Cienega phase in the Tucson Basin shows an extensive pattern of obsidian procurement. With the new data from the Rio Nuevo project, the list of identified obsidian sources for Cienega phase artifacts in the Tucson Basin has been expanded to include the distant western sources of Los Vidrios and the Tank Mountains, as well as the Government Mountain source far to the north. Obsidian from Los Vidrios could have been procured during expeditions to gather marine shells from the Gulf of California for making shell jewelry found at Cienega phase sites. Table 17.4 shows that the spatial scale of obsidian sources for Cienega phase farming communities in the Tucson Basin was much greater than is currently known for San Pedro phase farmers, and it was almost as extensive as the procurement ranges of Middle Archaic foraging bands and later pre-Classic and Classic Hohokam communities in the region.

The varied and extensive pattern of Cienega phase sources may have developed with a shift in procurement strategies to include more obsidian exchange rather than direct procurement, a shift first proposed by Shackley (1990). This interpretation is supported by the presence of artifacts manufactured from other nonlocal materials (for example, marine shells, rare stones, and exotic minerals) at Cienega phase sites in the Tucson Basin, indicating the development of long-distance exchange networks during this phase (Huckell 1995; Mabry 1998). For the obsidian from this phase, there is no fall-off curve in the number of artifacts in relation to increasing distances to sources, as would be expected to result from down-the-line exchange (Renfrew 1975). Including projectile points and flakes, the assemblage reported here also contradicts the previously known pattern noted by Roth (2000) of obsidian from Late Archaic/

Table 17.4. Sources of obsidian artifacts from archaeological sites in the Tucson Basin.

			Early Agricultural Period					
	Middle Archaic Period	Upper Bajada Late Archaic/ Early Agricultural Period	San Pedro Phase	Cienega Phase	Sedentary Period	Classic Period	Spanish Period	Mexican Period
Obsidian Sources (In order of distance)	(5 sites) (*n* = 18)	(6 sites) (*n* = 27)	(1 site) (*n* = 8)	(4 sites) (*n* = 16)	(3 sites) (*n* = 14)	(3 sites) (*n* = 179)	(2 sites) (*n* = 6)	(1 site) (*n* = 1)
Within 100-200 km								
Superior	3	5	–	1	3	7	–	–
Sauceda Mountains	1	–	5	–	2	153	–	1
Sand Tanks	–	–	1	–	2	–	–	–
Cow Canyon	2	16	1?	2	3	2	–	–
Los Vidrios	2	–	–	1	–	–	3	–
Within 200-300 km								
Mule Creek	3	–	–	3	3	5	1	–
Antelope Wells	4	3	–	1	–	–	–	–
Vulture	–	–	–	–	–	10	–	–
Gwynn Canyon	1	1	–	–	–	–	–	–
Tank Mountains	–	–	–	2	–	–	1	–
Within 300-400 km								
Burro Creek	–	–	–	–	–	–	1	–
Government Mountain	–	1	–	2	1?	–	–	–
Within 400-600 km								
Obsidian Ridge	1	–	–	–	–	–	–	–
Cerro del Medio	1	–	–	–	–	–	–	–
Unknown A	–	–	–	1	–	–	–	–
Unknown X	–	–	–	2	–	–	–	–
Unknown	–	1	1	–	–	2	–	–

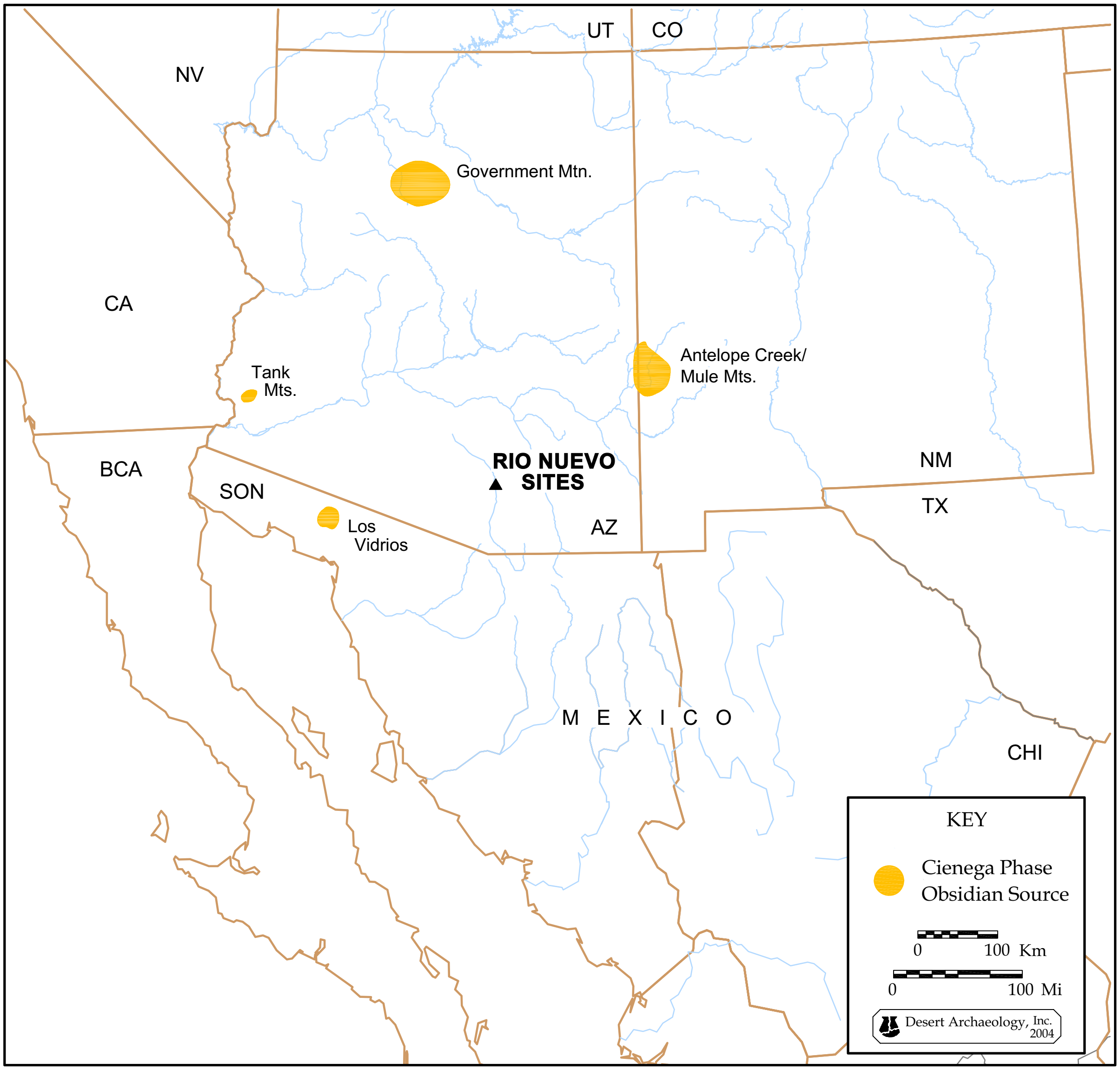

Figure 17.1. Identified material sources of Cienega phase obsidian artifacts from the Rio Nuevo sites.

Early Agricultural period contexts being limited to flakes and shatter. However, the total assemblage of Cienega phase obsidian artifacts in the Tucson Basin is still a very small sample, and these patterns will likely change with new data.

The assemblage of Hohokam obsidian artifacts from the Clearwater site and the Tucson Presidio is very small (*n* = 3), but it adds to the recently available data on pre-Classic Hohokam obsidian procurement by the inhabitants of the Tucson Basin. The data now available from the Clearwater and Tucson Presidio sites (this report); the Sunset Mesa site, AZ AA:12:10 (ASM) (Shackley 2000); and the West Branch site, AZ AA:16:3 (ASM) (Shackley 2004), provide the first glimpses of Sedentary period obsidian procurement patterns in the Tucson Basin.

The total Sedentary period assemblage from this region (*n* = 14) includes projectile points and flakes. The Superior and Mule Creek (Blue/San Francisco River) sources are represented by artifacts from the Clearwater and Tucson Presidio sites, while a variety of other sources are represented in the Sunset Mesa and West Branch assemblages. The majority of obsidian artifacts dating to this period are from sources within 200 km to the north and west, with one possibly coming from Government Mountain, 400 km away to the north. The overall pattern fits with previous observations that pre-Classic obsidian was procured from the nearest sources, probably directly by the inhabitants of each community, with obsidian tool manufacture conducted on-site rather than at the sources (Shackley 2005).

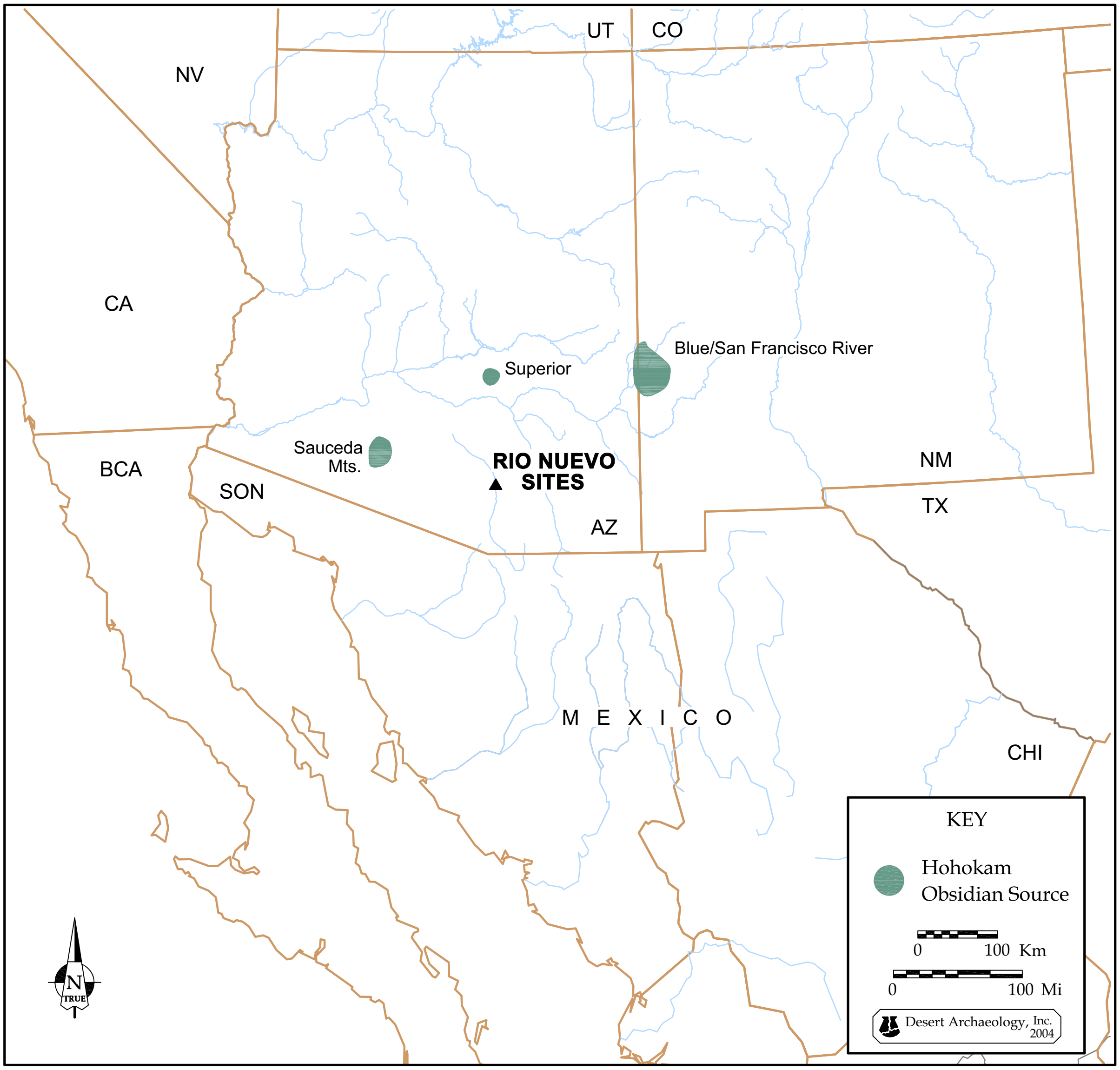

Figure 17.2. Identified material sources of Hohokam obsidian artifacts from the Rio Nuevo sites.

The single Classic period obsidian artifact recovered during this project, a projectile point tip from the Tucson Presidio, fits the previously known pattern of the relatively nearby Sauceda Mountains being the primary source for Classic period communities in the Tucson Basin (Bayman 1995). However, the second-most important source, the Vulture, near Wickenburg, Arizona, is some 250 km to the north. This contradicts the expectations of the down-the-line obsidian exchange proposed for most Classic period communities (cf. Bayman and Shackley 1999; Mitchell and Shackley 1995).

The analyses results for the Spanish period obsidian artifacts recovered from the Clearwater and Tucson Presidio sites (*n* = 6) provide the first information about the obsidian sources used during this early portion of the Historic era. A variety of sources are represented in the sample, all of them located at a distance between 200 km and 300 km away. This pattern contrasts with the prehistoric periods, when the closest sources to the Tucson Basin were well represented, if not predominant. Most of the Spanish period sources were located to the west, perhaps reflecting the difficulty that desert O'odham groups (Sobaipuri and Papago) faced in procuring obsidian from eastern sources after the intrusion of Apache groups into the highlands of the southern Southwest.

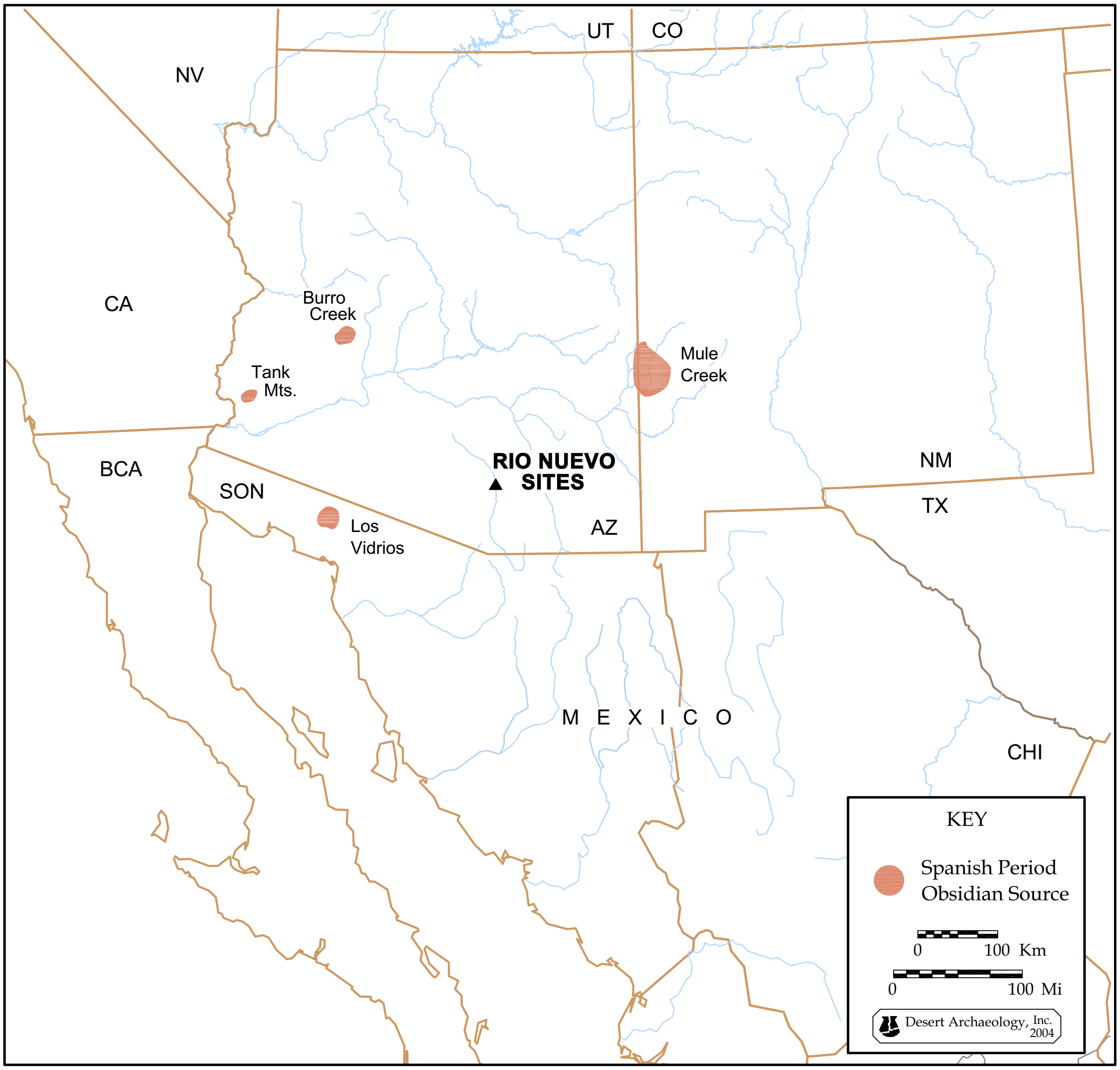

Figure 17.3. Identified material sources of Spanish period obsidian artifacts from the Rio Nuevo sites.

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CHAPTER 18

HUMAN BURIALS

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Human remains were discovered during testing and data recovery work conducted as part of the Rio Nuevo Archaeology project. An Agreement on Treatment and Disposition of Burial Discoveries had been prepared to facilitate compliance with A.R.S. §41-844. It was expected that remains dating from the Early Agricultural period to the Historic era might be found. Tribes claiming affinity with the Hohokam and Archaic cultural traditions in the project area included the Gila River Indian Community, the Ak-Chin Indian Community, the Salt River Pima-Maricopa Indian Community, the Hopi Tribe, and the Tohono O'odham. The Tohono O'odham Nation was the lead claimant, and as such, represented the other groups when remains were found. Los Descendientes del Presidio de Tucson represented the early Hispanic settlers in Tucson, the Pascua Yaqui Tribe represented Yaqui burials, and the San Carlos Apache Tribe represented the Apache. The discovery plan established the steps to be followed when remains were found.

A total of 25 inhumations, 6 cremations, and 7 partial skeletal remains were discovered during the Rio Nuevo project (Table 18.1). These ranged in date from the Early Agricultural period to the Protohistoric period. An additional 13 Spanish period burials previously discovered at the San Agustín Mission and Tucson Presidio were also examined.

Burials were generally excavated by bioarchaeologists from the Arizona State Museum (ASM) who performed in-field, nondestructive analysis. Similarly, burial-associated artifacts were analyzed in the field by experts. Following analysis, all human remains and associated burial goods were repatriated to the Tohono O'odham Nation. The Historic era burials at the San Agustín Mission were left in place, and the City of Tucson's plan is to recreate the old cemetery wall and re-consecrate the area as a cemetery.

Descriptions of each burial are presented in this chapter, in addition to an osteological analysis and identification of the likely time period of the burial. These descriptions were prepared by osteologist John McClelland and archaeologist Thomas Klimas. Table 18.2 summarizes the portions of skeletal elements within burial features.

Previous excavations in the late 1940s through the early 1970s, at both the Clearwater site, AZ BB:13:6 (ASM), and the Tucson Presidio, AZ BB:13:13 (ASM), resulted in the recovery of numerous burials, currently curated at ASM. Robert Dayhoff analyzed these remains and prepared brief summaries of his findings for this report.

SAN AGUSTÍN MISSION LOCUS, THE CLEARWATER SITE, AZ BB:13:6 (ASM)

Feature 24B

Feature 24B was a very fragmentary adult inhumation found in a backhoe trench beneath Mission Lane on the eastern side of the mission. Most of the skeleton had been removed by trenching, and the backdirt was screened to recover human remains.

The individual lay within a burned, bell-shaped pit. The pit was 1 m long, 50 cm wide, and 22 cm deep. It was filled with moderately compact, dark brown, sandy-silty clay. The edges of the pit were highly oxidized, and the pit was clearly reused as a grave after an earlier use as a roasting pit or some other type of pit where burning took place.

The head was toward the east and the feet to the west. Based on the position of the left leg, the body was semi-flexed, lying on its right side with the left hand near the left knee.

The sex of the individual could not be determined. The age at death was estimated to be 25+ years, based on the wear of one tooth and the fusion of the proximal epiphysis of a carpal phalanx.

No associated artifacts were present with this burial. The burial contained no diagnostic artifacts. The flexed position and stratigraphic context indicate that it dates to the Early Agricultural period.

Feature 35

Feature 35 was a very fragmentary inhumation that had been mostly removed by a City of Tucson waterline trench. The burial pit had survived in a 25-cm-long by 16-cm-wide area. It was filled with brown clayey silt with a small amount of charcoal.

The only in situ elements were of the left foot, which lay at the northern side of the burial pit. It was not possible to determine the sex of the individual, nor the age at death. No artifacts were found with the burial, but the poor preservation of the bone and the lack of Historic era artifacts suggests the burial dates to the Prehistoric era.

Table 18.1. List of human remains found during the Rio Nuevo project, the Clearwater site, AZ BB:13:6 (ASM).

Locus/Feature	Type of Burial	Era/Period
Mission		
24B	Inhumation	Early Agricultural
35	Inhumation	Prehistoric
36	Inhumation	Early Ceramic or Hohokam
38	Inhumation	Early Ceramic or Hohokam
39	Cremation	Hohokam
90	Cremation	Hohokam
159	Inhumation	Early Agricultural
160	Partial inhumation	Prehistoric?
190	Inhumation	Early Agricultural
Mission Gardens		
3002	Cremation	Hohokam
3019	Inhumation	Hohokam
3025	Inhumation	Prehistoric
3041	Cremation	Hohokam
3045	Inhumation	Prehistoric
3048	Inhumation	Early Agricultural
3057	Inhumation	Hohokam
3071	Cremation	Hohokam
3080	Inhumation	Hohokam
3097	Inhumation	Protohistoric
3101	Cremation	Hohokam
3343	Bone cluster	Unknown
3345	Inhumation	Early Agricultural
3346	Inhumation	Early Agricultural
3347	Inhumation	Hohokam
Congress Street		
144	Bone cluster	Unknown
573	Inhumation	Early Agricultural
574	Inhumation	Prehistoric
591	Bone cluster	Prehistoric
603	Inhumation	Early Agricultural
604	Bone cluster	Early Agricultural
605	Inhumation	Early Agricultural
618	Inhumation	Prehistoric
Brickyard		
3267	Inhumation	Early Agricultural
3268	Inhumation	Early Agricultural
9357	Isolated bones	Early Agricultural
9357	Isolated bones	Early Agricultural
3330	Inhumation	Hohokam
3357	Inhumation	Early Agricultural

Feature 36

Feature 36 was an adult female inhumation discovered in the wall of a City of Tucson waterline trench. The skeleton was complete from the pelvis upward. It lay within an oval pit; the pit was 84 cm long, 50 cm wide, and 35 cm deep. It was filled with light brown silt with chunks of clay.

The individual lay on her right side, with the head at the southeastern end of the pit. The right arm was extended along the side of the body. The left upper arm was extended along the chest, and this arm was bent at the elbow so that the forearm lay across the pelvis and the hand would have been above the right ilium.

A broad sciatic notch and gracile arm bones indicate this was a female. Heavy tooth wear and the presence of bony growths on the lumbar vertebrae indicate the woman was between 30 and 40 years old when she died. She had two molars with caries, including one molar with total crown destruction.

One large plain ware sherd was found under the ribs of the individual. The presence of a sherd in the pit fill indicates the burial dates to either the Early Ceramic period or a Hohokam period.

Feature 38

Feature 38 was a child inhumation placed along the northwestern side of a pit. The burial was found beneath the surface of Mission Lane, but it was complete and in excellent condition. The pit was roughly oval and was 65 cm long, 30 cm wide, and 15 cm deep. The fill was moderately compact brown clay.

The child lay on its right side, with the head at the northern end of the pit and its pelvis at the southern side. The right arm was drawn up so that the right hand lay beneath the skull. The left arm was bent at a 90° angle, crossing over the lower chest with the left hand next to the right elbow. The legs were flexed, with the left leg over the right leg and the knees pointing northwest. The feet were at the southern end of the pit adjacent to the pelvis.

Sex cannot be reliably determined for juveniles. Dental development indicates the child was between 6 and 10 years old at death. The degree of fusion of long bones and extremities is consistent with this age. The only visible pathology was a faint linear enamel hypoplasia on a mandibular canine. This indicates the child had experienced growth stoppage from either disease or nutritional stress. The head was not deformed from a cradleboard.

No associated grave goods were recovered; however, fire-cracked rocks, prehistoric ceramics, and flaked stone were found in the fill.

Table 18.2. Position of skeletal elements for Rio Nuevo inhumations, the Clearwater site, AZ BB:13:6 (ASM).

Feature	Side	Head	Face	Arms	Hands	Legs	Knees	Feet
24B	Right	E	?	?	L, l knee	Flexed	N	SW
35	?	?	?	?	?	?	?	N
36	Right	S	W	R, extended; l, bent	L, r pelvis	?	?	?
38	Right	N	SW	R, tightly bent; l, bent at 90° angle	R, below head; l, r elbow	Flexed	NW	S
159	Back	S	?	R, bent	?	Tightly flexed	SE	NW
190	Back or left	N	NE	R, bent; l, ?	R, hand over chest	Flexed	SE	NW
573	Back	SW	?	Sides	?	Flexed, r side	SW	NE
603	Back	SE	W	Flexed	Near skull	Flexed	SE	NW
604	?	?	?	?	?	?	?	?
605	Back	SE	W	Bent at elbow	Over lower chest	Flexed, r side	SE	NW
3019	Left	N?	?	?	?	Semi-flexed	R = E, l = SW	W
3025	?	S	NW	?	?	Tightly flexed?	?	?
3045	?	N?	?	?	?	Flexed	N	S
3048	Back	NW	?	?	?	Tightly flexed	NW	SE
3057	Left	NW	N	Likely bent at elbow	Near skull	?	?	?
3080	Left	S	N-NW	R, flexed; l, extended	R, face; l, legs	Flexed	S	N
3097	Back	S	N-NW	Extended	Over pelvis	Flexed	E	W
3267	?	?	?	?	?	?	?	?
3268	?	?	?	?	?	?	?	?
3330	Left	N	E	R, flexed; l, extended	R, under skull; l, legs	Flexed, l side	E	S
3343	?	?	?	?	?	?	?	?
3345	Left	S	W	Bent at elbow	Near ankles	Tightly flexed	SW	?
3346	Left	E	S	?	?	Flexed?	?	?
3347	?	?	?	?	?	?	?	?
3357	Right	S	E	R, bent at elbow; l, extended	R, on abdomen; l, feet?	Flexed, r side	E	N

Note: ? = Unknown.

The burial dates to the Prehistoric era, based on the presence of fire-cracked rocks, prehistoric plain ware ceramics, and the position of the body. It dates to either the Early Ceramic or Hohokam periods.

Feature 39

Feature 39 was a secondary cremation found in the area beneath Mission Lane. The upper portions of the pit had been destroyed by use of the road. The surviving portion of the cremation consisted of a 25-cm-diameter cluster of sherds and cremated bone in a pit area measuring 47 cm long, 42 cm wide, and 6 cm deep. The fill consisted of light brown fine silt.

A very small amount of human bone, consisting of 10 fragments, were found. None could be identified.

Fragments of at least four highly fragmented ceramic vessels were present. The cremation dates to a Hohokam period.

Feature 90

Feature 90 was a secondary cremation located beneath the surface of Mission Lane. The cremation was contained within a circular pit with straight sides and a flat base. The pit was approximately 64 cm in diameter and 32 cm deep. The pit was filled with tan sand at the top and an ashy gray sand at its base. Small pieces of cremated human bone were scattered throughout the fill. None of the bone was identifiable to specific skeletal elements.

Ceramics and flaked stone were found in the pit fill, but none appear to be directly associated with the remains. The cremation dates to a Hohokam period.

Feature 159

Feature 159 was an adult male inhumation found in a pit inside a pithouse, Feature 97. The burial was in an oval-shaped pit measuring 1.1 m long, 82 cm wide, and 24 cm deep. The pit was filled with compacted, granular, brown clayey silt. Flecks of daub and clay were present in the fill.

The individual lay on his back with the head toward the south and the pelvis to the west. The upper right arm was probably extended along the chest, and the forearm was bent and underneath the right femur. The left upper arm was extended along the left side. The legs were tightly flexed, with the knees brought up to the chest. The right femur was disarticulated and lay out of position north of the other leg bones. Many bones were either missing or decomposed, including the cranium, suggesting the burial had been disturbed by rodents and perhaps by human activity.

The individual was determined to be male, based on the general robusticity of the bone and the diameter of the femoral head. The moderate amount of tooth wear and the presence of degenerative joint disease on a navicular suggest that the individual was between 30 years old and 40 years old when he died. This individual had lost his left third mandibular molar before death. There was also extensive alveolar bone loss that can be attributed to periodontal disease.

No associated grave goods were found with the burial, although flaked stone was present in the fill. This burial probably dates to the Cienega phase of the Early Agricultural period.

Feature 160

Feature 160 was a disarticulated left leg found in the fill of a Hohokam canal. No burial pit could be delineated. The area in which bone was documented was 1.04 m long, 64 cm wide, and 32 cm deep. The matrix surrounding the bones was a loosely compact, brown, silty sand.

The femur, tibia, and fibula were in poor condition and were not in anatomical position, although they all sloped downward at the same angle. A fragment from a distal ulna was also found. The sex of this individual could not be determined; age at death was estimated to be older than 15 years, based on the size of the bone.

A large mano was found adjacent to the bones and may represent a grave good. A fragment of Mexican majolica was also found near the bones, as were prehistoric sherds and animal bones. The majolica may have been introduced by rodent burrowing.

The date of the burial could not be determined, given the presence of Prehistoric and Historic era artifacts, although it is likely prehistoric.

Feature 190

Feature 190 was an inhumation of a young adult found in an area with Early Agricultural period and Historic era features. The burial lay at the base of a large circular pit that was 96 cm long, 92 cm wide, and 35 cm deep. The pit was filled with brown silty sand that contrasted sharply with the surrounding soil.

Although poorly preserved, most of the surviving skeleton was in correct anatomical position. The individual lay on his back or left side, semi-flexed, with the skull at the northern end of the pit and the pelvic area at the southwestern side. The right humerus was probably extended along the chest and was bent so that the hand would have originally been over the chest. The left forearm was disarticulated. The legs were flexed with the right leg over the left leg. The knees pointed to the southeast, and the feet were originally positioned toward the northwest.

The sex of the individual could not be positively determined. Although the gonial angle of the mandible and the width of the ascending ramus appeared to be male, the cranium and long bones were gracile. The teeth were lightly worn and the third molars erupted, suggesting an age at death between 18 and 22 years.

A large, broken ground stone mortar lay over the foot area and lower left leg. Animal bone was also found in the fill of the pit.

The burial dates to the Cienega phase of the Early Agricultural period.

Isolated Human Bone

A small quantity of cremated human bone was discovered in four excavation units adjacent to a historic-era well. Most of the pieces were unidentifiable, and age and sex could not be determined.

MISSION GARDENS LOCUS, THE CLEARWATER SITE, AZ BB:13:6 (ASM)

Feature 3002

Feature 3002 was a primary cremation located when a backhoe trench cut through the edge of the pit. The circular, bell-shaped pit was approximately 160 cm in diameter at the top and roughly the same size at the base, although the base was offset about 16 cm to the west; it was 96 cm deep. The walls of the pit were heavily burned, and the upper 20 cm of the pit contained a brown clayey-silt. The next 45 cm consisted of a very compact, grayish-tan sandy silt that contained a larger amount of charcoal. The next 10 cm was a white ash layer with abundant pieces of large charcoal and human bone. Four large rocks were present in this layer. The base of the pit contained brown, sandy silt with little bone and less charcoal.

Most of the skeleton had been distributed across the base of the pit by stirring during the cremation process. One arm lay in situ, indicating the head of the cremated individual was once in the southeastern corner of the pit. The arm was bent at the elbow, with the hand area close to the shoulder.

Approximately 1,405 gm of bone were recovered from the cremation, with most portions of the skeleton represented. The largest piece was 5 cm long, with most about 3 cm in diameter. About 75 percent of the bone was a smoky gray color, with the remaining 25 percent calcined white. Cranial fragments were more calcined than the postcranial skeleton.

The robust nature of the bone and the rugose nuchal crest suggest the individual was a male. Age at death was estimated to be 35+, based on the degree of dental wear. Slight marginal lipping of the articular surface of the proximal tibia was present, further supporting an assessment of the age as an older adult.

A large number of artifacts was present in the pit fill. A shell bracelet fragment and a partial female figurine may have been associated with the cremation. Three worked sherds, a core, a cobble with a flake struck from it, a scraper, flaked stone, and ceramics were collected, although probably not all were directly associated with the burial.

The feature dates to a Hohokam period.

Feature 3019

Feature 3019 was an adult inhumation found during backhoe trenching in the southeastern corner of the garden area. Most of the burial was removed by historic-era plowing. No burial pit could be delineated, but the bones were present in an area measuring 43 cm long by 40 cm wide. The bone lay within a 16-cm-deep zone of consolidated light grayish-brown silt.

Although missing, the head would have been located to the north. The legs and right forearm were the only in situ elements. The elements reveal that the individual was lying on the left side with the legs semi-flexed. The right knee pointed to the east and the left knee to the southeast. The feet would have been at the western side of the grave.

Sex could not be determined. The bones were from an individual aged between 18 and 45 years old at death. No pathologies were visible.

No associated grave goods were present, although ceramics, flaked stone, and ground stone fragments were present in the fill surrounding the bone. The burial is probably prehistoric. The presence of prehistoric ceramics in the fill around the burial suggests it dates to a Hohokam period.

Feature 3025

Feature 3025 was an adult inhumation located in a backhoe trench adjacent to the eastern garden wall. Most of the burial was inadvertently removed by the backhoe bucket, with only the upper portion of the skull and an isolated long bone fragment in place.

The individual had been placed in a pit that was 20 cm wide (the length of the pit could not be determined), with the bone found in a 7-cm-deep area. The in situ bone indicated the individual was probably buried in the flexed position with the head on the left side, facing northwest. Screening of the trench backdirt resulted in the recovery of long bone, cranial, and dental remains. The burial was relatively close to the modern ground surface. No pit outline could be discerned, and the proximity of the garden wall may indicate the burial had been disturbed during its construction. No associated grave goods were found with this individual.

The sex of this individual could not be determined. The teeth indicated the person was aged between 35 to 50 years at the time of death. Visible pathologies consisted of a small antemortem chip on one of the lateral maxillary incisors and small pits on the labial (outer) surface of the mandibular canines. The pits are a developmental defect of the enamel and are probably a result of an episode of nutritional stress or disease when the person was a child, with growth interrupted as a result.

The burial is thought to be prehistoric.

Feature 3041

Feature 3041 was a secondary cremation discovered in the side wall of a backhoe trench located between the Mission Gardens and the mission on the southern side of Mission Lane. The pit was circular, with vertical walls and a flat base. It was 1 m long, at least 89 cm wide, and 35 cm deep. The pit was filled with grayish-tan clayey silt with a moderate amount of charcoal flecking. The base of the pit was burned red; however, this appears to have been a result of the first use of the pit, perhaps as a cooking pit, rather than use as a primary cremation. Two concentrations of human bone were found. On the northern side of the pit was a cluster of cranial fragments, and on the southern side was a concentration of pelvic fragments. The rest of the bone was distributed throughout the fill.

Approximately 139 gm of cremated bone was present in the pit. The largest piece was 7 cm long, with most pieces about 2 cm in diameter. All were calcined white and were heavily warped, some with curved cracks, indicative of prolonged exposure to high heat.

Identifiable fragments included cranial fragments, pieces of mandible, several teeth, a radius or ulna shaft, and femur and humerus shaft fragments. Some of the cranial fragments appear to belong to a child aged between 1 and 4 years at death, while the remaining bone appears to come from an adult. The thin margin of a fragment of an eye orbit may indicate the adult was a female.

Prehistoric ceramics and flaked stone were scattered throughout the fill of the pit but were probably not associated with the burial. The presence of Hohokam ceramics indicates this was a Hohokam cremation.

Feature 3045

Feature 3045 was an adult inhumation located in the backhoe trench cut between the Mission Gardens and the mission, along the southern side of Mission Lane. The backhoe removed the upper half of the skeleton, with the pelvis and legs left in place. The backdirt was screened to recover elements removed by the backhoe.

The burial had been placed along the western wall of a large bell-shaped pit that was 70 cm long and 40 cm wide, with the burial lying in a 32-cm-deep portion of the pit. The individual had been positioned in the pit on the right side, with the legs flexed, so that the knees faced north and the feet were positioned at the southern side of the pit. The head would have been on the northern side of the pit.

The sex of the individual could not be determined. Age at death was estimated to be between 25 and 45 years, based on the thickness of the cortical bone of the femur shaft and on the visible tooth wear. No grave goods were associated with the burial, although flaked stone and animal bone were present in the general fill.

The burial is prehistoric in age. The top of the pit originated in the clayey silt immediately below the plowzone, perhaps indicating it dates to a Hohokam period.

Feature 3048

Feature 3048 was an adult female inhumation discovered in the backhoe trench cut between the Mission Gardens and the mission, along the southern side of Mission Lane. The backhoe removed the skeleton from the mid-chest upward. Screening of the backdirt resulted in the recovery of numerous cranial fragments, teeth, and pieces of the arm bones.

The burial had been placed in the bottom of a circular-to-oval pit with slightly sloping side walls and a flat base. The pit was at least 85 cm long, 35 cm wide, and 32 cm deep. It was filled with a compact, grayish-brown silty clay.

The individual had been positioned on her back, with the legs tightly flexed. The head would have been on the northwestern side of the pit. The right upper arm was extended along the chest. The left arm and the right forearm were not in place. The knees pointed to the northwest, and the feet were at the southeastern side of the pit.

The individual was determined to be female, based on a broad sciatic notch, gracile cranial traits, and a small femoral head. Age at death was determined to be between 25 and 40 years. A faint linear enamel hypoplasia was present on one of the mandibular canines. This line developed as a result of a mild growth stoppage while the tooth was forming. This interruption could be a result of disease or a nutritional deficiency. Several teeth had small chips or fractures that indicate either a diet that included hard items or the use of teeth in manufacturing activities.

A dozen pieces of fire-cracked rocks were present in the fill of the pit. No other artifacts were recovered. Based upon the depth of the burial, it probably dates to the Early Agricultural period.

Feature 3057

Feature 3057 was an inhumation discovered in a backhoe trench. Much of the skeleton was removed during mechanical excavation. Bone removed from the backdirt was consistent with the age of the remains of the individual found in situ in the trench wall. The skull and bones of the hand were excavated from the northern face of the trench by hand.

Due to disturbance by the backhoe, pit shape and size could not be determined. Fill around the remains was a uniform, fine clayey silt, grayish-brown in color. Most of the skull was in situ and found on its side facing north. Fragments of the hands were also recovered from the trench face and suggested that the arms had been flexed at the elbows. The individual was estimated to have been between the ages of 16 and 20 years old at time of death. Age assessment was based on the fusion status of long bone epiphyses and eruption status of the third molars. The fragmentary nature of the postcranial skeleton did not allow for a determination of sex.

Sherds of prehistoric pottery were recovered from the in situ fill. Several dozen pieces of flaked stone and a shell were recovered from loose fill in the bottom of the trench, but it was uncertain if they had originated from the fill of the inhumation. The presence of Hohokam ceramics in the fill indicated that this inhumation dates to a Hohokam period.

Feature 3071

Feature 3071 was a secondary cremation found 70 cm north of Feature 3002. The feature was excavated from the trench face, revealing that the cremation had been deposited in a circular pit with vertical walls and a flat base. The pit was 74 cm in diameter and was 58 cm deep. The upper 45 cm of fill contained very compact, brown silty clay with many charcoal pieces. The lower fill was a less compact, lighter brown silty clay loam that contained a large amount of charcoal.

Approximately 153 gm of bone were recovered, distributed randomly throughout the pit fill. The largest piece was about 5 cm long, with the majority of the bone approximately 1.3 cm in diameter. The bone ranged in color from white to gray. Little bone could be identified to element. Several cranial fragments, several teeth, and two distal phalanges were present. The bone appears to come from a juvenile and may represent two different children, one aged 2 to 5 years at death and one aged 10 to 15 years.

Fire-cracked rocks, Hohokam ceramics, a worked sherd, and flaked stone were present in the fill of the pit. The cremation dates to a Hohokam period.

Feature 3080

Feature 3080 was a child inhumation located during the excavation of a possible pithouse. The child had been buried in an oval pit, and the skeleton was relatively well preserved. The pit was 60 cm long, 38 cm wide, and 15 cm deep. It was filled with a compact, grayish-brown clayey silt.

The child's head was at the southern side of the pit with the face toward the northwest. The child lay on the left side. The right arm lay across the chest, bent at a 60° angle so that the right forearm was along the front of the face. The left arm was extended along the side of the chest with the hand in the leg area. The pelvis was originally at the southern end of the pit with the legs flexed so that the knees pointed north and the right leg lay over the left leg. The feet were positioned at the northern side of the pit.

Sex could not be determined. Examination of the teeth suggests the child was between 5.0 and 6.5 years old at death. The long bones indicated that the individual was between 2.5 to 4.5 years old at death. This discrepancy is not uncommon and may suggest that either the aging formulas are inappropriate for this population or the child was small for its age. A small amount of dental calculus was present on a mandibular incisor, indicating the diet of the child included at least a moderate amount of carbohydrates. The back of the child's skull was noticeably flattened, revealing that the child had spent some time on a cradleboard.

No associated artifacts were present, although pieces of prehistoric pottery were discovered in the pit fill. The recovery of Hohokam ceramics from the pit fill indicates the child was probably buried during a Hohokam period.

Feature 3097

Feature 3097 was an adult female inhumation located during excavation of a pithouse, Feature 3038. The pit containing the burial intruded into the house, which dates to the Agua Caliente phase of the Early Ceramic period. The oval pit had relatively straight walls and a flat base. It was 80 cm long, 50 cm wide, and 40 cm deep.

The skeleton lay with the head to the south, resting partly on the base and partly on the right side. The upper body was extended to the north and appeared to lie on the back. The right arm was fully extended, with the radius crossing over the ulna with its posterior surface up. This indicates the right hand would have rested palm side down. The left lower arm was semi-flexed, with the hand placed between the ilia.

Both legs were flexed to the right side with the left leg lying on top of the right. Unlike the rest of the skeleton, the legs did not lie horizontal. The knees were about 20 cm higher than the hips. The legs were probably pressed up against the northern wall of the pit and were retained in this position during decomposition.

The individual was determined to be a female based on a broad sciatic notch on the right ilium and gracile cranial traits. Extreme tooth wear and antemortem loss of most of the mandibular molars suggested the individual was over 40 years old at death.

Estimated long bone lengths suggest the woman was only about 150 cm tall.

A number of pathologies were discovered. Most of the front teeth had been worn so heavily that no enamel remained. These teeth were essentially root stubs that had been rounded smooth on their occlusal surfaces and sloped downward into the mouth. The alveolar bone of the maxilla and mandible had receded, exposing the roots of the teeth. The left third molar had enlarged roots, which is a common consequence of reduced contact between the tooth root and the alveolar bone.

Two of the mandibular premolars had caries located between the teeth at the junction between the enamel and root. A small chip was also present on one of the lower premolars. A groove was noted on the distal root surface of the right second premolar, probably produced when the tooth was used during the manufacture of an item or when the woman probed her tooth to alleviate discomfort. Examination of the skull revealed two healed depressed cranial fractures on the superior surface of the right parietal. One of these injuries caused the inner surface of the bone to bend inward a few millimeters. The fractures would have occurred when something struck the woman's head. Based on their position, it is unlikely the fractures would have occurred as a result of a fall. Slight thinning of the cortical bone of a radius shaft may indicate the beginning stages of osteoporosis.

One large piece of flaked stone was found in the lower chest area of the skeleton and may represent an associated artifact, although this is uncertain. Other pieces of flaked stone, ceramics, daub, and several chunks of red ochre were found in the pit fill. This inhumation probably dates to the Agua Caliente phase of the Early Ceramic period.

Feature 3101

Feature 3101 was a secondary cremation discovered in Trench 317. The cremation had originally been placed inside a jar, which was completely removed by the backhoe. The impression of the jar was visible in the wall of the trench between 33 cm and 43 cm below the original ground surface. Screening of backdirt resulted in the recovery of jar fragments, a shell pendant, and about four pieces of calcined human bone. The cremation dates to a Hohokam period.

Feature 3343

Feature 3343 was an extremely fragmentary, disturbed inhumation of unknown age found in the wall of a backhoe trench.

Feature 3345

Feature 3345 was an adult inhumation discovered in the southern face of a backhoe trench. The individual had been interred in an oval-shaped pit that measured 1.00 m in length, 0.50 m in width, and 0.29 m in depth. Fill of the pit was grayish-brown, fine clayey silt.

The individual had been laid on the left side, in a tightly flexed position. The skull was pointed toward the south, with the face on its left side, looking to the west. The knees were pulled up tightly to the torso, and the arms were at the individual's side with the forearms pointed toward the ankles. The hands and feet had been disturbed by mechanical trenching. Cranial suture closure and tooth wear suggested the individual was between the ages of 30 and 40 years at the time of death. The skeleton displayed no good sex indicators, so the sex of the individual was undetermined.

Some slight disarticulation of the remains was attributed to rodent disturbance. One piece of flaked stone was discovered in the fill. The lack of ceramics in the fill suggest this burial dates to the Early Agricultural period.

Feature 3346

Feature 3346 was an adult male inhumation discovered in the northern wall of a backhoe trench. The individual was interred in an oval pit with steep sides that measured 0.70 m in length, 0.45 m in width, and 0.60 m in depth. The pit had been capped with a large rectangular stone and a few other smaller stones. Fill of the pit was silty sand mixed with some clay and caliche. The clay and caliche were mostly confined to the upper centimeters of fill. The fill was compacted and grayish-brown in color.

Preservation of the skeleton was poor, and the legs and pelvis of the individual appeared to have been removed by the backhoe. The skull was located at the eastern end of the pit and appeared to lie on the left anterior aspect. Some rodent disturbance was visible in the fill and in the pit margins around the skull, and this disturbance may have changed the position of the skull. Fragmentary remains of the vertebral column and a few of the ribs were in situ and indicated that the body had been placed on its left side. The shafts of both humeri, radii, and ulnae—all also found in situ—seemed to support this conclusion. The size of the burial pit and the location of a tibia shaft fragment suggested that the legs had been tightly flexed, although this could not be confirmed.

The status of cranial sutures and the level of tooth wear suggested that the individual was between the ages of 35 and 50 years at time of death. Cranial traits and mandible morphology suggested that the individual was a male. The robustness of the humerus shafts further support this determination.

The upper portion of the burial pit, with higher clay content, also contained a few pieces of fire-cracked rock. Some six small ceramic sherds were also present in this fill. Due to the rodent disturbance noted in the burial pit, the sherds were thought to be intrusive to the inhumation. The lower fill of the pit containing the remains of the individual also contained some charcoal flecking. Two pieces of flaked stone were found in this lower portion of fill.

The ceramics discovered in this fill were probably brought in through rodent turbation. Their confinement to the small area of upper pit fill that had been disturbed seemed to support this conclusion. The burial probably dates to the Early Agricultural period.

Feature 3347

Feature 3347 was an inhumation exposed during backhoe trenching. The remains were extremely fragmentary, and the presence of several metal pipes suggested the burial had been previously disturbed by modern activity at the site. Due to this disturbance, a burial pit could not be located. It could not be determined if this was a primary or a secondary inhumation. A few skeletal fragments were recovered from the backdirt and were thought to have originated from this feature.

The remains recovered from the trench consisted of a few cranial fragments and one carpal phalanx. A long bone fragment was also collected from the backfill. The age of the individual could only be determined as between 15 and 50 years. Sex could not be determined.

Half of a ceramic bowl was found in close association with the remains and was thought to have been associated with this inhumation. This inhumation likely dates to a Hohokam period.

Isolated Human Bone

Several fragments of cremated bone not associated with features were found during the project. One fragment came from the plowzone of Trench 300 and is either a tibia or a femur shaft fragment from an adult. Two small long bone shaft fragments were also found in Feature 3001.

CONGRESS STREET LOCUS, THE CLEARWATER SITE, AZ BB:13:6 (ASM)

Feature 144

Feature 144 was a cluster of probable human bone found inside a prehistoric canal, AZ BB:13:481 (ASM). No pit was identified for the remains. One human tooth fragment and 18 probable human bone fragments were recovered. The largest piece was 4.4 cm long, with most between 1-2 cm in length. Four of the pieces appear to have come from an ilium, a possible temporal bone, two probable radius shafts, three fragments of radius or ulna shaft, and several pieces of cortical bone from either a humerus or a femur. A tooth crown fragment, probably from a mandibular premolar, was only slightly worn, indicating an age of less than 35 years at death. The sex of the individual could not be determined, and there were no visible pathologies in the poorly preserved remains. These remains probably date to the Prehistoric era or the Protohistoric period.

Feature 573

Feature 573 was a subadult-to-young adult inhumation discovered in an area where soil was being mechanically stripped. The burial was placed in a pit 95 cm long, 60 cm wide, and 12 cm deep. The fill was a dark gray-brown silty clay. Several pieces of charcoal were present.

The body had been placed in the pit in a flexed position with the head to the southwest and the pelvis to the north. The arms were probably extended along the side, and the leg bones were flexed and lay on the right sides. The knees pointed southwest, and the feet would have been at the northeastern side of the pit.

Sex could not be determined. There was little to no wear on the third molars and moderate wear on the first molars. Age at death is estimated to be between 15 and 25 years.

Three pieces of fire-cracked rock and a piece of flaked stone were found in the pit. The burial dates to the Early Agricultural period.

Feature 574

Feature 574 was an infant inhumation found in a mechanically stripped area. The skeletal elements were poorly preserved, with primarily cranial fragments recovered. No body positioning could be determined, and no pit outline was found. Based on dental development, the infant was determined to be six months old at death, plus or minus three months.

Six small shell beads were found in close proximity to the skull. The burial is prehistoric and dates to either the Early Agricultural or Hohokam occupation of the site.

Feature 591

Feature 591 was a cluster of adult human bones found within a prehistoric canal. The bones lay within a 30-cm by 5-cm area in a hard brown clayey loam. A set of long bones lay stacked together, with at least four present, as well as one cranial fragment. The remains were likely redeposited in the canal. The sex of this individual could not be determined. One distal tibia was fused, and a recovered premolar was heavily worn, indicating the individual was at least 30 years old at death. The bones were determined to be prehistoric, based on their position inside an irrigation canal from that timeframe.

Feature 603

Feature 603 was a young adult female inhumation discovered during stripping of a portion of the site. The burial was positioned on its back with the head to the southeast and the feet to the northwest. The skull lay on its base with the chin pointing to the west. The upper arms were extended along the chest, and the lower arms were sharply bent so that the hands were near the skull. The legs were tightly flexed and drawn up so that the knees were over the chest and pointing to the southeast, a short distance away from the hands.

The individual was determined to be female, based on characteristics of the pelvis, including the pubic symphysis and the subpubic angle. Cranial traits were a mixture of typically female and male traits. Those suggesting a female identity included a smooth glabella and gracile nuchal crest. More masculine traits were robust mastoid processes and intermediate supraorbital ridges. The overall impression of the remains was of a female.

Age at death was determined to be between 22 and 25 years old. The third molars were erupted, indicating an age of at least 15. Dental wear was light to moderate, suggesting the individual was a young adult, younger than 35 years old. The iliac crest was fully fused, which occurs about 18 years of age. All of the annular epiphyses of the vertebrae were fused, but a remnant line was visible in some cases. Full fusion of the annular epiphyses does not typically happen until age 25. The medial epiphysis of the right clavicle was present but unfused. In females, this fuses at age 23 or younger.

A few dental pathologies were noted. A diffuse hypoplastic pitted area was noted on the outer surface of the right mandibular canine. A matching defect was not present on the left mandibular canine. This hypoplasia was likely the result of a brief episode of interrupted growth during tooth formation when the individual was a child. Calculus was present on two mandibular incisors, indicative of a diet rich in carbohydrates. No dental caries or abscesses were present. The left third mandibular molar was impacted against the back of the second molar. The cusp patterns of all third molars were irregular. Also noted was a region on the back of the parietal bones near the lambdoidal suture that exhibited remodeled fine porosity. The healed lesions probably indicate some type of scalp inflammation, perhaps from an infection of the area.

A large trough-shaped metate lay upside down above the skeleton. A small stone bowl was placed immediately next to the right heel. Two shell discs were next to the bowl. A fragment of vesicular basalt was next to the left side of the skull. Nineteen small shell beads were found around the left wrist and hand. Much of the skeleton was stained with hematite or red ochre, especially around the feet, thoracic region, and the portions of the legs over the thoracic region. More red ochre was present under the stone bowl, in the chest region, and around the right hand. A piece of red ochre was found over the right hand next to the right ear.

The burial dates to the Early Agricultural period.

Feature 604

Feature 604 was a very fragmentary, disturbed inhumation found in the wall of a backhoe trench. Based on its stratigraphic context, it probably dates to the Early Agricultural period.

Feature 605

Feature 605 was a juvenile inhumation found in the base of a backhoe trench. The pit was filled with a compact, dark brown clay with occasional pieces of charcoal.

The child had been placed in the pit tightly flexed, on its back, with its head to the southeast. The face was pointing west, although the skull appears to have slumped down, and this may not be the original orientation. The upper arms were extended along the chest, with the right forearm bent so that the hand lay in the lower chest area and the left arm bent so that the left hand was close to the top of the right pelvis. The legs were tightly flexed and drawn up over the forearms with the knees pointing to the southeast and the feet to the northwest. The legs were lying on their right sides.

Sex cannot be reliably determined for juveniles. The dentition of the individual indicated it was probably between 11 to 12 years old at death. This is supported by the degree of fusion for most of the skeleton, except the greater trochanter of the left femur, which appeared to be fused. This would indicate a slightly older age at death. However, examination of the acetabulum indicated it was unfused. Fusion of the acetabulum typically occurs between the ages of 13 and 14 years. Long bone lengths suggested an age range of between 7.5 and 10.5 years at death. The smaller long bone lengths may indicate this child underwent nutritional stress or disease and was smaller as a result.

No dental pathologies were present. The only postcranial defect was the cortical bone of the tibiae, which was abnormally porous. This may be a result of nutritional deficiency or a metabolic disorder.

Thirty-five shell beads from a necklace were found around the skull and neck vertebrae. Each bead was shaped to look like an animal claw and had a perforation near the base. Most of the beads were found in clusters near the right neck and shoulder area. A few beads were scattered about, including three inside the mouth. Ochre staining was visible on the leg bones and near the metatarsals. The depth of the burial, the lack of ceramic artifacts, and the flexed position of the burial indicate it dates to the Early Agricultural period.

Feature 618

Feature 618 was a juvenile inhumation discovered during mechanical stripping. The burial was discovered in a pit that was at least 55 cm long, 40 cm wide, and 10 cm deep. The remains were poorly preserved, and only three ribs and several unidentifiable long bone fragments were present in situ. No artifacts were found with the remains, which are thought to date to the Prehistoric era.

Isolated Bone

Fragments from a left femur and a possible humerus were found in the area near Features 603, 605, and 618. The fragments are from an adult of undetermined sex. A vertebral centrum fragment and a probable tarsal fragment were also found in the same area. These later two elements may have originated in Feature 603.

BRICKYARD LOCUS, THE CLEARWATER SITE, AZ BB:13:6 (ASM)

Feature 3267

Feature 3267 was a child inhumation discovered during excavation of a Cienega phase pit structure (Feature 9357). The burial pit was intrusive to the pit structure. Its edges were indistinct, but it measured at least 50 cm long, 10 cm wide, and 8 cm deep. The remains were poorly preserved and consisted of the skull and the lower portions of both arms. Dental and long bone development suggested the individual was a child, 3 to 4 years of age. Sex could not be determined. The burial dates to the Cienega phase of the Early Agricultural period.

The partial remains of another individual, Feature 3268, were also found intrusive to this pit structure, about 1 m south of this inhumation.

Feature 3268

Feature 3268 was an adult inhumation intrusive to the fill of pit structure Feature 9357. Pit edges for this burial could not be determined, as it was excavated into the fill of the house. Based on the position of the remains, the pit measured at least 50 cm long, 30 cm wide, and 14 mm deep. The skeletal elements recovered included the skull, a single vertebra, and an unidentifiable long bone fragment. Dental and long bone development suggested the individual was 20-50 years at the time of death. The remains were too fragmentary to determine the sex of the individual. The remains date to the Cienega phase of the Early Agricultural period.

This individual was interred just south of the remains of a child, Feature 3267, which were also intrusive to the pit structure, Feature 9357.

Isolated Bone from Feature 9357

Some additional fragmentary remains were discovered in this pit structure (Features 3267 and 3268), including fragments of the long bone of an adult individual and the premolar of a juvenile. The long bone was too fragmentary to determine if it came from the same individual as the one interred in Feature 3268. The juvenile premolar came from a child of 5 to 6 years of age, suggesting it represented a different individual than the one interred in Feature 3267.

Feature 3330

Feature 3330 was an adult male inhumation discovered during mechanical stripping. The individual had been interred in a pit that was originally used as a roasting pit. The pit was oval in shape and measured 87 cm long, 54 cm wide, and 11 cm deep.

The original pit had been excavated into the fill of a Hohokam canal, Feature 149, BB:13:481. Fill of the pit was clayey silt that contained charcoal, ash, and fire-cracked rock both above and below the burial. This suggested the roasting pit was excavated after use, the individual was interred, and the fill was redeposited to cover the individual.

The individual was placed in the pit in a flexed, semi-supine position. The legs were lying slightly off to the left side of the torso. The right arm was extended along the side of the body, while the left arm was bent at the elbow with the left hand under the head. The skull was in the northern end of the pit, with the face turned to the left, resting on the left hand.

Dental development and wear, as well as the stage of cranial suture closure, suggested the individual was between 35 and 45 years of age at the time of death. The sex of the individual was determined to be male, based on cranial characteristics and a large femoral head diameter.

Two perforated shell disks that measured approximately 2.6 cm in diameter were found around the mouth area of the individual. Fill of the pit also contained some fire-cracked rock and lithic debitage. The presence of the pit in the fill of a Hohokam period canal suggests the burial dates to a Hohokam period or the Protohistoric period.

Feature 3357

Feature 3357 was an adult inhumation discovered while excavating a backhoe trench below the floor of a pit structure, Feature 3327. The skeleton was recognized immediately, and very little disturbance was caused by the backhoe. The individual appeared to have been interred in a pit below the floor of the pit structure. The clayey silt fill of the pit was very similar to the surrounding soil matrix, and margins of the pit could not be determined. The pit measured at least 1 m in length, 75 cm in width, and 21 cm in depth.

The individual was interred in a tightly flexed position, turned slightly to the right. The head was oriented to the south, with the face looking toward the east. The left arm was extended parallel to the body, while the right arm was bent at the elbow. The right hand was resting over the abdomen, with the palm facing down. Preservation of the skeleton was poor, and most of the bones of the torso had decomposed.

Dental development and wear, joint wear, osteophytosis of a lumbar vertebra, and the fusion status of the cranial sutures all suggested the individual was between 35 and 50 years of age at the time of death. Characteristics of the cranium were consistent with those of a male individual. A narrow sciatic notch and a large femoral head also seemed to indicate the interred individual was male.

Fill of the burial pit contained many small pieces of burned daub and abundant charcoal flecking. Some small fragments of fire-cracked rock were also present. Artifacts recovered from the pit consisted of a Cienega-style projectile point and a few small burned clay objects. The location of the burial below a Cienega pit structure, as well as a lack of ceramics in the fill, suggested the burial dates to the Cienega phase of the Early Agricultural period.

THE PEOPLE FROM THE SAN AGUSTÍN MISSION CEMETERIES

Researchers sometimes use skeletal and dental remains as tools for understanding the past. Each set of skeletal remains possesses a single unique history reflecting the individual's life and many of the events that occurred during that person's lifetime. Often, indicators of disease, traumatic injury, and most dental problems suffered by a specific individual can be found in the skeletal and dental remains of the deceased.

Excavations conducted by ASM in the 1950s resulted in the recovery of many burials from the mission cemeteries just before portions of the site were destroyed by clay mining and the creation of a landfill. Remains of 53 individuals from the Mission locus were recently studied to better understand the lives of the people who once lived and died at the mission between 1771 and 1821.

Examination of the skeletal and dental remains from the Mission locus revealed the people buried there were burdened by poor dental health. Dental caries (cavities) and abscess rates among the native population were nearly double that seen among their presidio neighbors. Females sometimes exhibit caries frequency patterns as much as three times that observed among their male counterparts. Ethnohistoric sources suggest such patterns of carious lesion occurrence may have been attributable to diet and resource procurement patterns practiced by the mission people. Among the Pima, women gathered wild food, ground corn, collected wood, and made baskets and pottery. Among men's specialties, deer hunting was the most common, and they also made tools and dressed hides, and the older men wove cotton cloth. After the introduction of cattle, men hunted deer less and took over care of the livestock. Men also planted, tended the fields, and gathered the cultivated crops.

The risk of dental cavities increases if sugar is consumed between meals and it increases further if the sugar is eaten in a sticky form. Pimas consumed mesquite pods, the sugary mesquite sap, and produced a kind of syrup from fruits of the saguaro, prickly pear, and organ pipe cactus. These traditional foods would be highly cariogenic, and the female easy access to them provides a possible explanation for the difference in caries rates between mission males and females. Pregnancy and lactation following birth can also place females at increased risk for dental caries. The dietary insufficiency tied with pregnancy and lactation, working in concert with cultural traditions such as food gathering and preparation practices, probably caused mission females to have the highest rates of dental cavities and abscess among the groups studied.

At age 25, there appears to be little discernable difference in tooth loss patterns between mission males and females. However, by age 40, the mission females appear to have lost an average of 10 teeth per individual. In contrast, the average mission male's tooth loss was only 4 per individual by age 40. Among both sexes, the most common teeth to lose were the molars, followed by the premolars. Front or anterior dentition was often retained well into old age, and one person, an elderly female, was the only mission individual examined who had lost all her teeth (edentulous).

Mission females were also noted, more often than not, to exhibit equal evidence of arthritis in the arms and shoulders of both sides of the body. In males, arthritis was more commonly found to be heaviest on only one side. As with the frequency of dental problems, this can likely be explained by cultural practices. In the 1850s, international boundary surveyor John Bartlett commented on the intense amount of labor extended by Pima women while preparing flour with the two-handed metate and mano. He further observed no such exertion among Pima males. The bilateral occurrence of arthritis observed primarily among females probably reflects a behavior peculiar to Pima women, and the use of the metate and mano appears to be the most likely explanation.

The frequency of healed traumatic injuries such as cranial depression fractures and long bone fractures suggests interpersonal violence and or occupational injuries were common among the mission people. For example, of the 53 individuals examined during this study, three (all males) were found to have had healed cranial depression fractures. Further, an earlier study mentions one individual (sex not given) with a stone projectile point within the body cavity, suggesting death by arrow wound (Dobyns 1954).

European mission authorities disliked native people's urge to move about following and gathering wild food resources. They failed to realize that the native people's mobile customs were a functional adjustment to the harsh environment in which they lived. These long-established lifestyles caused fluctuating village populations during the year and undoubtedly served as a control on the rate that garbage and excrement accumulated in and around village areas. Forced sedentism could increase the chances of contacting communicable diseases and parasites and would certainly affect illness and mortality rates. European-introduced epidemic diseases killed more indigenous victims than Europeans and significantly contributed to the loss of Native American populations throughout the Americas. There is little doubt that eighteenth century Tucson provided a difficult environment in which to live. Native Americans were forced to adjust to a new lifestyle imposed by mission authorities and challenged with surviving new diseases to which they had developed no inborn immunity.

THE PEOPLE OF THE TUCSON PRESIDIO CEMETERY, AZ BB:13:13 (ASM) (1775-1856)

Examination of the skeletal and dental remains of 88 individuals from the Tucson Presidio cemetery (1775-1856) excavated between 1968 and 1970 reveals a people whose dental health was probably similar to that of other Euro-American communities on the North American continent from that time period. Cavities, dental abscess, and tooth loss were not uncommon. Unfortunately, a preservation bias in the dental arcades of presidio individuals makes it difficult to obtain an accurate cross-cultural comparison of antemortem tooth loss events between the cemetery populations of the presidio and mission. However, presidio inhabitants appeared to suffer fewer dental-related problems than did the mission people across the river. As discussed in the "Mission Cemeteries" section, this was probably the result of native cultural traditions not tied to the physical environment or due to an innate biological weakness among the native people.

Evidence from the presidio cemetery indicates a community whose children were racked with disease and who appeared to have suffered marked nutritional difficulties during their lifetime. The large number of children's skeletons from the presidio cemetery attests to a high mortality rate among the children of presidial-era Tucson.

It would appear from the burials examined that presidio newborns had about a 50/50 chance of surviving the first 18 months of life. If they survived the first 5-6 years of life, it seems that presidio children had a good chance of living to adulthood. In fact, 81 percent of all presidio juvenile deaths occurred between birth and 5-6 years of age.

Although of a lesser degree, the patterns of disease and nutritional deficiencies observed in the children are also present in presidio adults. In most instances, the condition observed in the adults is generally not active, suggesting these adults were exposed to, but survived, the same disease or nutritional episodes as those that appeared to have taken the lives of so many of the community's children.

Higher rates of disease or nutritionally driven stress are seen in the remains of Tucson's Presidio community than was present among the native people living in the San Agustín Mission community located on the opposite bank of the Santa Cruz River. There is a simple answer to this apparent paradox. It takes relatively long-term survival with potentially life-threatening episodes of disease or nutritional stress to leave a skeletal or dental signature on the remains. The native people more often succumbed early to the process, especially to such European-introduced diseases as smallpox and measles. Native people had no inborn immunity to the diseases that had plagued Europeans for generations.

Daily activities must have included maintenance of existing structures and new construction projects, as well as tending of fields and care of large and small domestic animals. Such activities would result in the occasional broken bone or skull fracture. It is unlikely however, that such activities alone would provide an environment in which over 20 percent of the population would exhibit evidence of traumatic injury, as was the case not only at the presidio community, but at the mission community as well.

There has been adequate documentation confirming warfare between the Apache, the Mission Native Americans, and the Spanish. The presence of male individuals from both cemeteries with stone-tipped arrow wounds in the chest, as well as a rather high incidence of cranial depression fractures, is indicative of interpersonal violence. Additionally, a presidio male exhibiting a healed parry fracture to his lower left arm (a probable defensive wound) provides additional evidence suggesting interpersonal violence was not unusual in Spanish period Tucson.

There is ample evidence to indicate that residents of both the mission and presidio communities faced high likelihoods of trauma and disease. The evidence provided by each community's cemetery suggests that, whether the individual was a native or of European descent, at best, life was difficult in Spanish and Mexican period Tucson.

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CHAPTER 19

RADIOCARBON DATING OF THE EARLY OCCUPATIONS

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The chronology of prehistoric occupations at the Clearwater site, AZ BB:13:6 (ASM), and associated canals, AZ BB:13:481 (ASM), earlier than about A.D. 550, the beginning of the Hohokam ceramic chronology, is based on 34 radiocarbon dates presented in Table 19.1 (this total does not include four dates rejected as unreliable, shown in parentheses). This set of radiocarbon dates includes 18 obtained during previous investigations of this site by Elson and Doelle (1987; dates reported in Mabry 1998) and Diehl (1996, 1997), and 16 new dates obtained during the Rio Nuevo Archaeology project. This combined set of radiocarbon dates also provides a chronological framework for the early portion of the alluvial sequence at the base of A-Mountain (Chapter 20, this report). In this chapter, the age ranges of pre-A.D. 550 occupations in various strata of the floodplain are estimated using the pooled probability method.

THE POOLED PROBABILITY METHOD

The pooled probability method of calculating the age range of an archaeological phase or interval of occupation involves calibrating, pooling, and averaging a set of dates (Eighmy and LaBelle 1996). The first step is to use a calibration algorithm to generate a calibrated age probability distribution for each acceptable radiocarbon date associated with the target time interval. This distribution, whether expressed in terms of a set of paired numerical values or a histogram curve, shows the relative probabilities that the age of the sample falls on each calendar year within the total span of the distribution. Next, the calibrated age probabilities for all the dates for that interval are pooled and averaged. The resulting distribution summarizes the pooled probabilities for the interval. This distribution can divided into 1-sigma and 2-sigma ranges, representing the age ranges containing 68 percent (PR68) and 95 percent (PR95) of the pooled probability distribution, respectively.

THE AGE RANGES OF EARLY OCCUPATIONS

Remains of the earliest occupation at the Clearwater site are contained in the upper portion of Stratum 504 at the Congress Street locus (see Chapter 20). The next oldest occupation is on top of Stratum 503 at the same locus. Stratum 502 at both the Congress Street and Mission loci contains the next oldest remains. Occupations on top of Stratum 502 are dated by associated Hohokam and Protohistoric pottery types instead of by radiocarbon dates (Chapter 7, this report).

There are five radiocarbon dates for Stratum 504 at the Congress Street locus, and two dates for Stratum 503 in the same locus. The dates from Stratum 502 occupations are divided according to the Brickyard and Mission loci (*n* = 19 and *n* = 5, respectively). The probability distribution curves and PR95 ranges for the radiocarbon dated features in each stratum are shown in Figure 19.1.

The dates from cultural features in Stratum 504 range between 3800 b.p. and 3620 b.p., uncalibrated, including dates on maize of 3690±40 b.p. and 3650±40 b.p. The PR95 pooled probability range for the calibrations of these dates is approximately 2300-1900 B.C., with a midpoint near 2100 B.C. If only the calibrated dates on maize are included (that is, excluding the dates on wood charcoal), the range is tightly clustered near 2100 B.C. This range indicates the initial occupation occurred during the earliest portion of the unnamed phase of the Early Agricultural period (circa 2100-1200 B.C.). This occupation represents the beginning of a 4,100-year-long sequence of almost continuous occupation at the base of A-Mountain, establishing Tucson’s status as one of the longest inhabited places in the United States.

The two dates available from cultural features in Stratum 503 at the Congress Street locus are 3280±40 b.p. and 3220±40 b.p., uncalibrated. The PR95 pooled probability range for the calibrations of these dates is roughly 1650-1425 B.C., with a midpoint near 1540 B.C. If only the date on annual plant tissue is used (that is, excluding the date on wood charcoal), the midpoint is near 1480 B.C. This range indicates the Stratum 503 occupation occurred during the middle part of the unnamed phase of the Early Agricultural period (circa 2100-1200 B.C.).

The dates from cultural features in Stratum 502 range between 2620±40 b.p. and 2140±40 b.p., uncalibrated, at the Congress Street locus, and between 2450±75 b.p. and 2350±60 b.p., uncalibrated, at the Mission locus. The PR95 pooled probability ranges

Table 19.1. Radiocarbon dates from the Clearwater site, AZ BB:13:6 (ASM), by stratum.

Stratum/Context	Material	Uncalibrated Radiocarbon Age b.p.	$^{13}C/^{12}C$ Ratio	Calibrated Age Range (1 sigma)	Sample Number	Reference
Top of Stratum 504, Congress Street Locus						
Pit structure, F. 516	Juniper charcoal	3800±40	-25.0	2290-2150 B.C.	Beta-157018	This report
Intramural pit, F. 580.01	Maize	3690±40	-10.9	2140-2020 B.C.	Beta-175842	This report
Pit structure, F. 581	Charcoal	3680±40	-25.3	2130-2010 B.C.	Beta-175843	This report
Intramural pit, F. 580.01	Maize	3650±40	-10.4	2120-1950 B.C.	Beta-160381	This report
Pit structure, F. 3359	Charcoal	3620±40	-24.8	2030-1920 B.C.	Beta-175844	This report
Top of Stratum 503, Congress Street Locus						
Pit, F. 572	Mesquite charcoal	3280±40	-24.5	1610-1510 B.C.	Beta-190713	This report
Pit, F. 630	Annual plant	3220±40	-8.3	1520-1440 B.C.	Beta-193150	This report
Stratum 502, Brickyard Locus						
"Big house," F. 9357.01	Maize	2620±40	-10.5	820-790 B.C.	Beta-193151	This report
Intramural pit, F. 1040.04	Charcoal	2600±50	-23.2	810-780 B.C.	Beta-90227	Diehl 1997
Intramural pit, F. 1006.02	Maize	2580±60	-8.7	805-770 B.C.	Beta-90225	Diehl 1997
Pit structure, F. 3323	Maize	2530±50	-9.9	790-550 B.C.	Beta-193148	This report
Intramural pit, F. 175.01	Maize	2520±40	-10.5	790-540 B.C.	Beta-85405	Diehl 1996
Pit, F. 1014	Mesquite	2510±50	-26.5	785-525 B.C.	Beta-92620	Diehl 1997
Intramural pit, F. 1006.03	Maize	2500±60	-10.0	785-505 B.C.	Beta-90226	Diehl 1997
Intramural pit, F. 3325.01	Maize	2500±50	-10.6	780-520 B.C.	Beta-193149	This report
Intramural pit, F. 1040.02	Mesquite	2500±50	-23.8	780-515 B.C.	Beta-90231	Diehl 1997
Pit structure, F. 371/370	Mesquite	2480±50	-24.0	775-425 B.C.	Beta-92622	Diehl 1997
Canal, F. 141	Maize	2470±40	-9.2	770-430 B.C.	Beta-160379	This report
Pit, F. 1023	Mesquite	2440±60	-24.9	760-405 B.C.	Beta-92618	Diehl 1997
Pit, F. 1020	Mesquite	2440±60	-23.5	760-405 B.C.	Beta-92621	Diehl 1997
Pit structure, F. 370/371	Maize	2430±60	-9.5	760-400 B.C.	Beta-92619	Diehl 1997
Pit, F. 1029	Maize	2420±50	-10.8	745-400 B.C.	Beta-90229	Diehl 1997
Pit, F. 1016	Maize	2390±50	-11.3	505-395 B.C.	Beta-90228	Diehl 1997
Pit, F. 1009	Mesquite	2390±70	-23.9	525-390 B.C.	Beta-92617	Diehl 1997
Pit, F. 1032	Mesquite	2250±50	-23.3	380-205 B.C.	Beta-90231	Diehl 1997
Canal, F. 139	Charcoal	2140±40	-21.4	200-110 B.C.	Beta-160378	This report
"Big house," F. 9357	Maize	(2010±40)	-11.4	50 B.C.-A.D. 40	Beta-190717	This report
Pit structure, F. 3293	Mesquite	(770±140)	-25.0	A.D. 1160-1310	Beta-193147	This report

for the calibrations of these dates are about 800-175 B.C. and 750-350 B.C., respectively. If the two youngest outlying dates from this stratum at the Congress Street locus are excluded, the PR95 pooled probability range of the remaining dates is approximately 800-400 B.C. These ranges indicate Stratum 502 occupations at both loci correspond with the Early Cienega phase (circa 800-400 B.C.), with at least some continued occupation at the Congress Street locus during the Late Cienega phase (circa 400 B.C.-A.D. 50).

EARLY DATES FOR MAIZE, CERAMICS, AND CANALS

The two direct dates on maize from Stratum 504 at the Congress Street locus, 3690±40 and 3650±40 b.p., uncalibrated (circa 2100 B.C., calibrated), are currently among the oldest radiocarbon dates on maize in the Southwest. They fall within a cluster of unambiguous maize radiocarbon dates between about 3800 b.p. and 3600 b.p., uncalibrated (circa 2200-2000 B.C., calibrated) from multiple sites in several regions of

Table 19.1. Continued.

Stratum/Context	Material	Uncalibrated Radiocarbon Age b.p.	$^{13}C/^{12}C$ Ratio	Calibrated Age Range (1 sigma)	Sample Number	Reference
Stratum 502, San Agustín Mission Locus						
Pit structure	Maize	2450±75	-16.9	765-405 B.C.	AA-6638	Mabry 1998
Intramural pit, F. 65.01	Maize	2430±50	-10.9	760-410 B.C.	Beta-193152	This report
Pit structure	Maize	2395±60	-9.9	755-395 B.C.	AA-6637	Mabry 1998
Pit structure	Maize	2390±65	-10.6	755-395 B.C.	AA-6636	Mabry 1998
Pit structure	Maize (?)	2360±60	-22.5	480-390 B.C.	AA-6639	Mabry 1998
Top of Stratum 502, San Agustín Mission Locus						
Pit structure, F. 15	Maize	1650±40	-10.5	A.D. 380-430	Beta-190710	This report
Pit structure, F. 28	Mesquite	(450±40)	-21.0	A.D. 1430-1460	Beta-190712	This report
Pit, F. 178	Capsicum	(100±40)	-25.7	A.D. 1680-1950	Beta-190711	This report
Top of Stratum 502, Mission Gardens Locus						
Pit structure, F. 3014	Maize	1760±40	-11.7	A.D. 230-450	Beta-193146	This report
Pit structure, F. 3038.02	Columnar-celled seed coat	1600±40	-25.3	A.D. 410-530	Beta-190715	This report

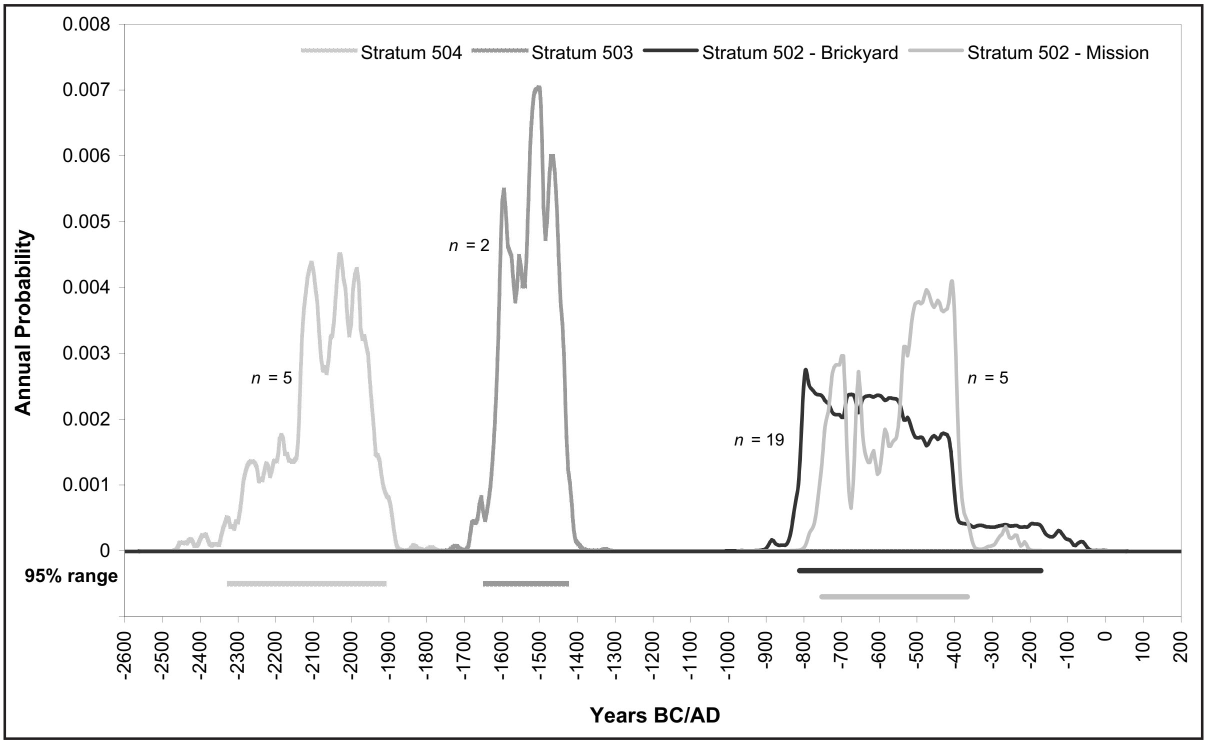

Figure 19.1. Calibrated pooled probability age ranges of major strata of occupation at the Clearwater site, AZ BB:13:6 (ASM).

the Southwest (see a current inventory in Mabry 2005), including a maize date of 3670±40 b.p., uncalibrated (circa 2100 B.C., calibrated) from the Las Capas site, AZ AA:12:111 (ASM), a few miles downstream in the middle Santa Cruz Valley (Hesse and Foster 2005).

The radiocarbon dates from Stratum 504 at the Congress Street locus are also associated with fired ceramic sherds and possible figurine fragments (Chapters 7 and 8, this report). Pit structure Feature 581 contained a sherd and provided a radiocarbon date of 3680±40 b.p., uncalibrated (circa 2100 B.C., calibrated) on wood charcoal. The other ceramics are indirectly associated with the radiocarbon dates from cultural features in this stratum. Currently, these are the oldest known fired ceramics in the Southwest (see Chapter 7). The next oldest known fired ceramics in the region are pottery sherds and figurine fragments in contexts dated circa 1200 B.C., at the nearby Las Capas site (see Heidke 2005, which includes a current inventory of earliest Southwestern ceramics).

Canal Feature 152, BB:13:481, originating in Stratum 503 at the Congress Street locus, is the oldest canal identified during the Rio Nuevo Archaeology project (see also Chapter 20). The canal is indirectly associated with radiocarbon dates near 1500 B.C., calibrated, obtained on samples from two nearby cultural features also originating in this stratum (see above). Canal Feature 141, originating in Stratum 502 and crossing both the Congress Street and Brickyard loci, provided a radiocarbon date on maize of 2470±40 b.p., uncalibrated (circa 600 B.C., calibrated), from a sediment sample collected from canal sediments. Wood charcoal from the fill of Canal Feature 139 in Stratum 502, and also crossing these loci, provided a date of 2140±40 b.p., uncalibrated (circa 150 B.C., calibrated); this canal immediately overlies Canal Feature 140 in the same stratum, providing a minimum age for that canal as well. Canal Feature 152, indirectly dated near 1500 B.C., is currently the oldest known canal north of central Mexico. The next oldest known canal in the Southwest is a canal bracketed prior to roughly 1250 B.C., at the Las Capas site a few miles downstream in the middle Santa Cruz Valley (Mabry 2006).

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CHAPTER 21

PUBLIC OUTREACH

Douglas Gann, Center for Desert Archaeology,
Beth DeWitt and Annamarie Schaecher, Arizona State Museum,
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Historical Society, Southern Arizona Division

An important component of the Rio Nuevo Archaeology project was the participation of members of the Tucson community. Desert Archaeology, Inc., used volunteers on several excavations, had guides to provide tours of the digs, and large open houses at the end of each project. Over 5,000 people viewed the work in person and thousands more saw or heard media reports on the television, radio, or newspapers. Several programs were focused on reaching a wider audience through the use of computer animation, outreach to students and teachers, and through exhibits at local museums. Each of these programs is briefly described here.

RECONSTRUCTING THE SAN AGUSTÍN MISSION ON THE COMPUTER: CREATING A VISUAL HYPOTHESIS

What did the San Agustín Mission look like? That basic question was difficult to answer. Although photographs and floorplans for some of the buildings survive, they fail to provide a sense of the early years of the mission.

Fortunately, the rapidly evolving field of computer graphics is generating new tools for the manipulation of information. Image enhancement and computer modeling are providing archaeologists and historians new toolkits to apply to their studies.

Digital image enhancement and modeling was used by the Center for Desert Archaeology to create a "visual hypothesis." By converting what is known about the San Agustín Mission into a digital model, a type of virtual theory of the appearance of the mission was created. This model could be examined critically and quickly modified when new data or better information was found.

Digital modeling of the San Agustín Mission incorporated many different lines of evidence to create the structure of the digital model. Photography, site plans and survey data, geographic data, and archaeological evidence were all used during the process of virtual reconstruction. A series of models were created, each one refined and made more accurate as new information became available. Meetings with historians and architects provided additional data. In all, 12 versions of the digital model were created.

Incorporating Photographic Data: Photometric Modeling

The process of photometric modeling with computer software uses multiple photographs of an object to make simple three-dimensional geometric models. The San Agustín Convento was modeled using this process.

Photometric modeling works by assuming that the objects in a photograph obey the laws of geometry, and that by marking identical points within a set of photographs of the same object, a geometric solution (or model) can be generated. This solution is very similar to what architects call a vanishing line study.

For the San Agustín Mission, photometric modeling began by locating photographs of the complex at the Arizona Historical Society, Southern Arizona Division; the University of Arizona Library Special Collections; the archives of the Arizona State Museum; and from private collections. Data from over 90 photographs were incorporated into the model.

Information from these photographs was digitized (Figure 21.1). In the second step, known points from the first photograph were marked on another photograph, and then extra points, not visible in the first photograph, were added (Figure 21.2). By continuing this process with several photographs, a composite model was ultimately generated (Figure 21.3).

The photometric modeling process is useful for creating rough models. It is important to note, however, that the model created can only make relative measurements of objects. For example, the model was used to show that the building height was 39 percent of its length, and that an individual archway opening was roughly 1.5 percent as wide as the building was long. To make the model accurate, the real survey and mapping data needed to be used to solve the problem of recreating exact measurements of the size of the building.

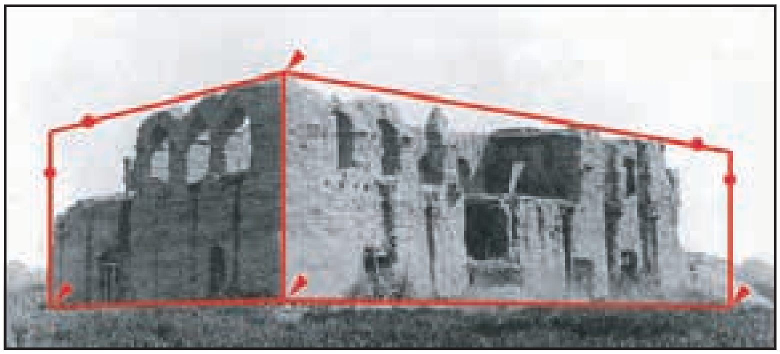

Figure 21.1. The first step in the modeling of the convento buildings at the San Agustín Mission. (Red lines indicate the edges of the convento, triangles mark known points, and circles mark boundaries when known points cannot be seen [all computer modeling figures created by Douglas Gann].)

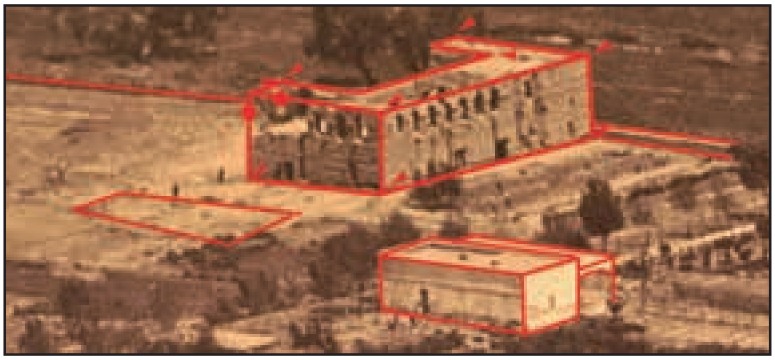

Figure 21.2. The second step in the modeling was to mark the same points in the first photograph onto a second photograph and to add extra points.

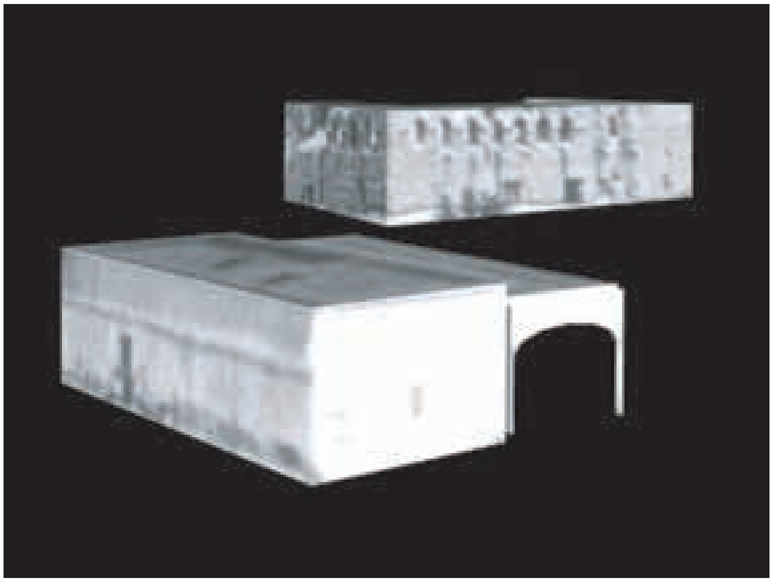

Figure 21.3. Composite photometric model of the Carrillo House (foreground) and the convento (background), generated from photographic data.

Digital Modeling with Plan Views and Archaeological Data

To begin the process of modeling the structures of the San Agustín Mission, the relative dimensions of the buildings needed to first be calculated in relation to each other. Photographs and maps of the site were used to create a plan view of the mission (Figure 21.4). The next step in the modeling process was to create wireframe models of the structural aspects of the mission site.

The subsequent step in the modeling process was to take the plan view and "extrude" the structures up into a three-dimensional space (Figure 21.5). Details, such as the height of walls and the placement of arches and doorways, were resolved from careful analysis of the surviving photographs. The resulting model contained all of the structural information known about the convento, but needed surfaces to look realistic.

To increase the realism of the wireframe model, the model was covered in surfaces by a process called texture mapping (Figures 21.6-21.7). In this process, textures were applied to the model to give it a solid appearance. The surfaces created for the mission model came from a variety of sources. The color values for the adobe bricks and wall plaster came from bits of brick and plaster found during excavation of the mission site. The colors for the wood and fired clay bricks were taken from photographs of similar materials from contemporary buildings at the Mission of San Xavier del Bac and Tumacácori National Historical Park.

Placing the Model on the Landscape

To place the model on the landscape, geographic data from sources such as the United States Geological Survey (USGS) topographic maps must be used.

This data can be enhanced with information from historic maps and other details to create a more realistic setting.

The USGS map provides details about the location of geological features, such as A-Mountain (Sentinel Peak), as well as information about changes in elevation (Figure 21.8). Based on survey data obtained during the excavation, the mission compound could be placed on the topographic map with a high degree of accuracy (Figure 21.9).

The next step in the modeling process was to convert the elevation data from the topographic lines into three-dimensional modeling data. This was accomplished by tracing the topographic lines in a computer-aided drafting program. The topographic lines were corrected to remove the downcutting of the Santa Cruz River, which happened after 1888. The terrain could then be created by stretching a mathematical surface over the framework of the topographic lines.

The resulting terrain model was then covered with a map of the farmers' fields of Tucson, originally drawn by John J. Mills in 1862. Each of the fields was bounded by small irrigation ditches, with three larger *acequias* running south to north through the fields.

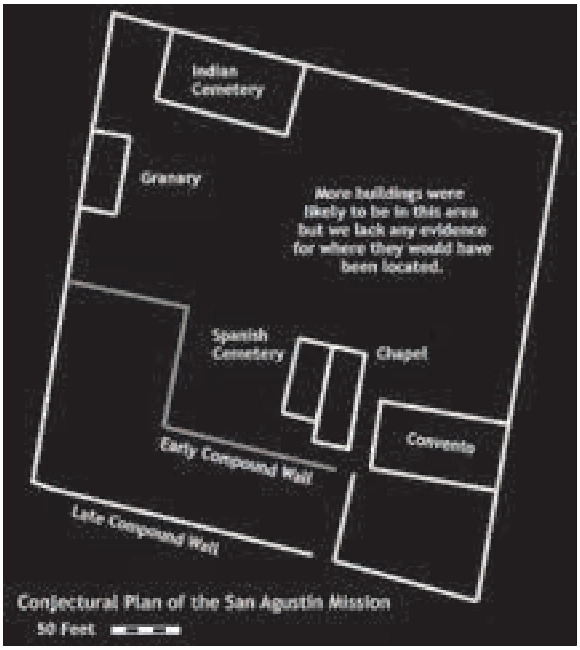

Figure 21.4. Plan view of the San Agustín Mission.

The resulting model is not complete—it is a virtual hypothesis meant for study and critique (Figure 21.10). The model represents an educated guess of what the mission may have looked like, although this is still a conjectural reconstruction. Additional evidence, yet to be found, may change current ideas about the appearance of the mission.

The computer models proved to be of great interest to members of the public. Versions of the San Agustín Mission and Tucson Presidio models were shown at open houses at the conclusion of archaeological work at each of these sites. The model was also shown at many meetings and for various groups throughout Tucson. Finally, it was incorporated into an exhibit at the Arizona Historical Society. Several hundred thousand people have had the opportunity to learn about these sites through the computer models.

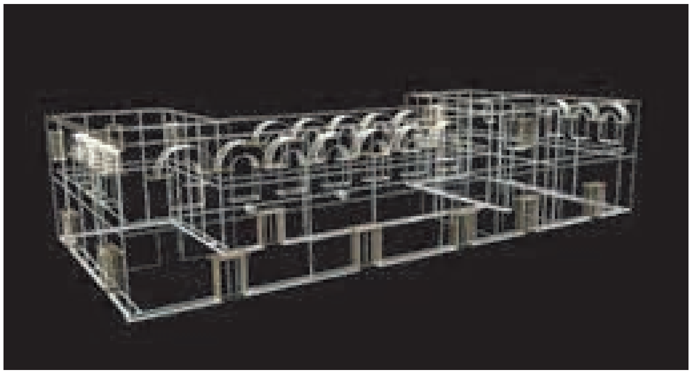

Figure 21.5. Plan view extruded into three dimensions by including wall height information.

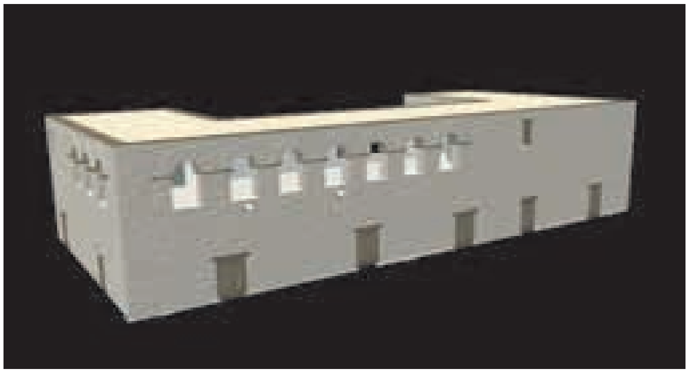

Figure 21.6. The convento model with surface textures applied.

THE ARIZONA STATE MUSEUM RIO NUEVO SCHOOL PARTNERSHIP

The Arizona State Museum School Partnership was an educational outreach component of the Rio Nuevo archaeological excavations conducted by Desert Archaeology, Inc., in downtown Tucson. Designed to engage the school community in the research and development phase of the Rio Nuevo project, the partnership promoted and supported student exploration of local cultural heritage and history. The primary goal of the partnership was to increase public awareness about the rich cultural resources of the Rio Nuevo District, with a focus on archaeology, multigenerational learning, community-based projects, and multicultural studies.

Figure 21.7. The convento model placed in three-dimensional space.

Figure 21.8. The terrain model, utilizing USGS topographic map data.

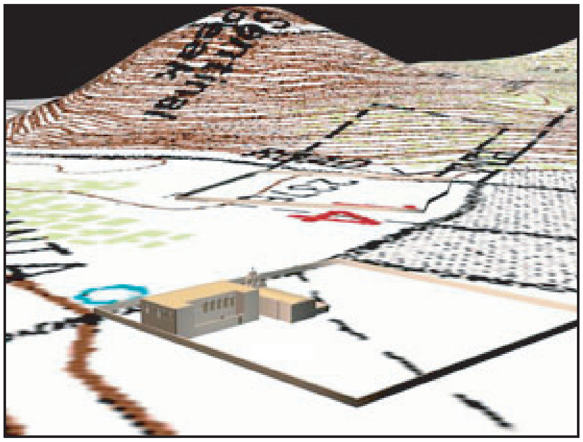

Figure 21.9. The placement of an early version of the convento and chapel model upon the landscape.

Over the past three years, students participating in the partnership gathered oral histories, visited Rio Nuevo archaeological excavations, produced video documentaries of their historic neighborhoods, and curated an exhibit on Tucson cultural heritage. The community *was* the classroom for these students, and they discovered that their hometown is rich with resources, long on history, and populated with adults beyond the classroom walls who care about them.

A Sense of Place, a Sense of Identity, a Sense of Pride

By learning about the diverse cultural groups contributing to the unique identity of Tucson, students grew to understand that the community has a cultural heritage and human stories worth learning, worth sharing, and worth preserving. In learning about other cultures, youth can better appreciate and respect people from many walks of life, they have the opportunity to reflect on and to refine their own sense of cultural identity, and they can develop pride in who they are and where they live.

Its mission, "to promote understanding of and respect for the peoples and cultures of Arizona and surrounding regions," made the Arizona State Museum (ASM) the ideal sponsor for the Rio Nuevo School Partnership. Museum/school partnerships have been popular since the early 1980s, and are a creative way for institutions to work cooperatively to enrich classroom curriculum, to support student success, and to help teachers better utilize their community museum resources.

Built on a previous successful partnership between ASM and Tucson Unified School District's (TUSD) Lawrence Intermediate School, the Rio Nuevo School Partnership was established in the spring of 2001, and expanded to include two schools adjacent to the Rio Nuevo redevelopment area. The partnership initially included Davis Bilingual Magnet School, Menlo Park Elementary, and Lawrence Intermediate, with Menlo Park replaced by Carrillo Magnet School during the final year of the program.

Partnership Resources and Programs: Special Projects

Each school year, select partnership classrooms participate in intensive community-based special projects that culminate in public presentations or educational products that can be shared with a

Figure 21.10. A conjectural reconstruction of the San Agustín Mission, Tucson, Arizona, as the mission might have appeared sometime around A.D. 1820.

wider audience. These special projects can take from 6-8 months, and follow a learning pattern. The first half of the program engages students in research and review of resources (human and cultural); the second half consists of writing, design, and production of a final product.

All three partnership schools participated in the 2001-2002 "Tiempos Pasados" community oral history project. Supported by a generous grant from the Arizona Humanities Council, the project consisted of a series of oral history teacher workshops, family nights with oral history interviews, and culminating oral history publications at each school.

Students in Ellen Murphy's fourth grade at Davis Bilingual Magnet School participated in an intensive "museum immersion" project during the 2002-2003 school year (Figure 21.11). After a series of educational fieldtrips, visiting experts in the classroom, behind-the-scenes museum visits, and extensive research, these youngsters developed a full-blown bilingual museum exhibition on Tucson's cultural heritage entitled "Cultural Currents/Corrientes Culturales." The exhibit opened with Davis School's own "Los Aguilitas" mariachi band.

An ongoing special project sponsored by the partnership is the Lawrence Multicultural Weaving Workshop. The brainchild of the Gloria F. Ross Tapestry Center, the Weaving Workshop brings master weavers into predominantly Yaqui classrooms to teach weaving arts, traditions, and fiber science. Students learn about unique community resources when they visit ASM to examine prehistoric and historic weavings from the Southwest and when they visit the University of Arizona Fiber Arts Studio to experiment on a wide variety of looms. The Weaving Workshop was underwritten by a generous grant from the Tucson-Pima Arts Council during the 2002-2003 school year and the Arizona Commission on the Arts in 2003-2004.

Several special projects were conducted during the 2003-2004 school year. Fourth grade students at Davis engaged in an in-depth study of the Santa Cruz River, and examined the environmental and social history of this local waterway. Several classes at Lawrence Intermediate studied ethnobotany and included this information in a discovery kit about Yaqui

Figure 21.11. Metaja Blackwater participated in the Davis Bilingual Magnet School oral history project and discovered two of her great aunt's baskets in the Arizona State Museum collections in the process (photograph by Annamarie Schaecher).

culture they created themselves. Several Carrillo School students stayed busy learning documentary techniques in the process of preparing a video about a corner of their historic Barrio Viejo neighborhood.

Learning Materials

The first materials to be developed and offered to partnership schools were artifact discovery kits and text sets (Figure 21.12). Artifact discovery kits include artifacts, children's literature, teacher background information, posters, lesson plans, and student supplies, while text sets consist primarily of children's literature grouped by themes. Partnership teachers check out the discovery kits for use in the classroom and can select from topics such as *Layers of Tucson History* (a five-kit set), *Navajo Weaving, American Indian Arts and Crafts, Dia de los Muertos,* and *Tucson Oral History* (with recording equipment). Text set topics include *Ethnobotany* and *Archaeology/Arizona Prehistory*, with a *Sense of Place* set currently in development.

One of the greatest challenges for the partnership has been to provide high-interest reading materials on Tucson heritage at a fourth grade reading level. To meet that need, the partnership has developed a "Student Primer" on Rio Nuevo area history, with short readings, historic photographs, vocabulary, and questions ready to use in the classroom. These writings were based on Rio Nuevo archaeology reports published in the Center for Desert Archaeology's *Archaeology Southwest* quarterly newsletter.

Field Trips

As adults, many of our fondest school memories involve fieldtrips, which serve to connect students to their wider community. Partnership students visited archaeological excavations, museums, historic sites, and other cultural institutions.

Excavations at the Rio Nuevo Mission Gardens were underway during the first year of the partnership, and students were able to observe archaeologists in the field as they uncovered 4,100 years of Tucson history. On guided tours, youngsters viewed the exposed foundations of the Mission Gardens wall, Hohokam pithouses, and a historic well; they even handled artifacts uncovered in the process.

In the second year of the partnership, students again witnessed Rio Nuevo archaeology in progress as a corner of the Tucson Presidio wall was excavated in the fall of 2002.

Guest Speakers

Information is more relevant to students when it comes directly from the source. Through the partnership, guest speakers came into classrooms to share their knowledge with students. Native American presenters told stories about their lives and culture that would be hard to capture in a book. Mexican-American culture and history came alive in the classroom when Irma Moreno, dressed in period costume, spoke to students about her family's many generations in Tucson. At special events, Ted Ramirez was a favorite performer of traditional Mexican ballads and *corridos*. Partnership classes were also exposed to careers as various museum professionals shared their expertise about exhibit design and docent training.

Figure 21.12. Chinese celadon bowl from the "Layers of Tucson History" kit.

After-school Programs and Wider Audiences

Partnership activities occurred not only during the school day, but also after school and on weekends. In the spring of 2003, Menlo Park students participated in an archaeology club held after school. The club exposed students to new careers and gave them insight into the investigations being conducted in their neighborhood in preparation for Rio Nuevo redevelopment. Davis School students have also enjoyed after-school archaeology, oral history, photojournalism, and Santa Cruz River activities sponsored or cosponsored by the partnership.

Partnership events often included students' families and members of the community (Figure 21.13). Parents and students enjoyed a day on the lawn of ASM when they attended a family program based on the aerial photography of Adriel Heisey. During an evening program, the Menlo Park community learned together of the latest Rio Nuevo plans when a model of the San Agustín Convento reconstruction was unveiled. The school communities were further informed about Rio Nuevo developments during Desert Archaeology presentations at Davis and Menlo Park family history nights.

Figure 21.13. A collage of the Davis Bilingual Magnet School Oral History Family Night held 7 February 2002. (After musical entertainment and a presentation on Rio Nuevo archaeological findings, some audience members participated in oral history interviews.)

Sense of Place

Reflecting on the past three years of projects and collaborations, the Arizona State Museum School Partnership has clearly been engaged in a larger educational movement referred to as "place-based education." Place-based education makes learning meaningful because the community itself is the context for students to explore history, culture, the environment, and real issues facing their neighborhoods. Through the partnership, students developed a Tucson sense of place by learning in the community, and by welcoming the community into the classroom. Students engaged in place-based education produced materials that enrich the entire community.

As the Rio Nuevo archaeological excavations and associated public outreach activities conclude, the partnership will continue to offer learning resources developed over the past three years to Tucson's teaching community. Place-based education makes classroom curriculum relevant and encourages students to get involved with their communities; therefore, future goals of the partnership will be to promote, encourage, and model this form of teaching.

Arizona Historical Society

In the fall of 2000, Desert Archaeology, Inc., contracted with the Arizona Historical Society (AHS) to provide educational programming to educate and inform the public about the archaeological work connected with the Rio Nuevo project. This was a natural partnership for several reasons. The AHS Education Department staff had the background, expertise, and contacts which Desert Archaeology lacked to produce educational programs, and the AHS has a strong interest in the project, both from historical research and practical perspectives as plans continue to relocate the facility to the downtown museum complex. The result has been a happy collaboration, resulting in numerous projects and presentations both for the general public and for Tucson area teachers. Outcomes include a major exhibit, a teacher's manual and accompanying CD, over 38 workshops, 50 presentations, and a public forum.

The collaboration was mutually beneficial to Desert Archaeology, the AHS, and the City of Tucson. The AHS contributed much administrative and facilities support and staff expertise at little or no direct cost. The result was extremely cost-effective, allowing production of exhibits, products, and events that would have cost thousands more if privately contracted. The average cost for a quality museum exhibit is between \$150 and \$200 per ft^2. The AHS produced the Rio Viejo/Rio Nuevo exhibit at a cost to the city of \$41.40 per ft^2. In turn, the AHS gained a full-time staff member for the duration of the contract who was able to work with schools and teachers, creating future contacts and good will, as well as tangible and lasting products.

In addition, staff at the AHS had the pleasure of working with Desert Archaeology, Inc. We have continually been impressed with the professionalism, dedication, and skill of the archaeologists and personnel at Desert Archaeology, most notably Dr. William Doelle, Dr. Jonathan Mabry, Dr. Douglas Gann, and Mr. Homer Thiel. In the midst of busy schedules working on the archaeological mitigation, they were always available when needed, whether it was to make public presentations, review materials, or work on getting artifacts for the exhibit. It was also a pleasure to work with Ms. Marty McCune from the City of Tucson's Historic Preservation Office, who also gave presentations, met with us monthly, and helped steer the projects.

We would also like to express appreciation for the help of AHS Exhibits Director Leslie Rowe and designer, Kevin Mills, as well as numerous other AHS staff members. Particularly, Kyle McKoy, AHS Education Rio Nuevo Project Director, should be commended. She put heart and soul into this project for the last 3.5 years. She wrote the teacher's manual and text for the Rio Viejo/Rio Nuevo exhibit, helped direct exhibit production, facilitated workshops, and gave numerous presentations in the community. The success of this project is, in large part, due to her skill and enthusiasm.

Through this partnership, Desert Archaeology was able to use AHS expertise and resources to help educate the public about the ongoing archaeological work at Rio Nuevo, resulting in increased public support and enthusiasm for the project. The AHS will continue to build on these productive partnerships.

Rio Nuevo is a brilliant vision for Tucson's future, allowing us to capitalize on our fascinating cultural history and resources to build pride in our community among our residents and to make Tucson a destination for numerous cultural heritage tourists. It has been our pleasure to help build public support for this project through oversight of the development of related educational programs.

Educational Outreach

The AHS is a member of the educational outreach team formed by Desert Archaeology, Inc., for the City of Tucson's downtown revitalization project, Rio Nuevo. The primary goals of the Society's Rio Nuevo educational programs include educating the community about Tucson's history and increasing community support for, and the visibility of, the Rio Nuevo project. One way to accomplish these goals is by using Rio Nuevo archaeology to recapture and celebrate Tucson's multicultural heritage. These programs provide a unique opportunity for the community and schools to transcend the walls that previously separated them. By discovering the diversity of people who contributed to the writing of Tucson's historical narrative, students understand that the Tucson community has a uniquely inclusive multicultural heritage and identity. Learning about other cultures that helped shape Tucson's present allows youth to appreciate and respect others, as well as to develop their own cultural identity.

Place-based education uses local particulars to teach universal concepts. Students think locally and link globally. Place-based education is the notion that schools should ground classroom instruction on the culture, history, ecology, and economy of the communities they serve, and extend classroom walls to engage communities in the work of the school. By placing learning within the context of the daily lives of students and community members, place-based education improves conditions within the community. Students assume ownership for their learning experience, relate their discoveries to pride in their surroundings, and become contributing citizens of their community.

Programs

Educational programs should build upon themselves. The Rio Nuevo excavations provided abundant information about Tucson's multicultural history on which to build. Native American groups, Spaniards, Mexicans, Chinese, and European immigrants all left their cultural footprints in the earth at the base of A-Mountain. The AHS embarked on several projects that used this information to bring their stories into Tucson-area classrooms. The AHS published a teacher's guide and an interactive CD-ROM, hosted teacher workshops and provided classroom resources, created a museum exhibit based on the archaeological excavations, made numerous public presentations to various audiences, organized an eight-part lecture series, and hosted a professional symposium.

The first stage of the project was the 2002 publication of *Downtown Under Ground: Archaeological Clues to Tucson's Past*, a teacher's guide and classroom activities book. The book traces Tucson's diverse history as revealed by the archaeological excavations performed prior to construction of the Rio Nuevo project improvements. It contains 12 lesson plans for classroom instruction, blackline maps and reproducible handouts, a timeline, a vocabulary list, and background information about the history of Tucson. It also provides a pre-visit introduction to the exhibit housed in the AHS Tucson main museum. At the time of this printing, 1,500 copies of *Downtown Under Ground* had been distributed to Tucson-area teachers. The book was also available as a free download online, creating the opportunity to reach thousands more teachers.

An intermediate magnet school has adapted the teacher's guide into its curriculum, providing ongoing community learning to 140 fourth- and fifth-grade students annually. In 2004, this school opened its doors to another grade school located on the eastern side of Tucson, spreading the imbedded place-based curriculum to more students and teachers. That the schools have taken it upon themselves to introduce place-based education into their curricula speaks to the importance of bringing community components into the classroom.

The AHS hosted 20 in-house and 18 in-service teacher workshops demonstrating how to use *Downtown Under Ground.* Following cross-curriculum state standards for an object-based, hands-on learning experience, the workshops reached more than 600 University of Arizona student teachers and professional K-12 teachers between 2001 and 2004. Ongoing in-service workshops reach many more teachers.

In May of 2003, more than 300 people attended the opening of a 1,500-ft^2 AHS exhibit capitalizing on the Rio Nuevo excavations (Figure 21.14). *Rio Viejo/Rio Nuevo: Uncovering Tucson's Past* displays

Figure 21.14. The entrance to the Arizona Historical Society exhibit entitled, *Rio Viejo/Rio Nuevo: Uncovering Tucson's Past.* (The exhibit showed how Desert Archaeology's excavations revealed evidence of Tucson's past [photograph courtesy Arizona Historical Society, Southern Arizona Division].)

Tucson's history in a timeline, beginning with the present and traveling back to prehistoric times. Features of the exhibit include: (1) the Tucson Pressed Brick Company, which operated at the foot of A-Mountain from 1896 to the 1960s; (2) American Territorial period Chinese truck farmers, who marketed produce to residents and business owners; (3) Spaniards who occupied the San Agustín Mission complex and Tucson Presidio; and (4) the Hohokam and earlier farming cultures along the banks of the Santa Cruz River. Artifacts uncovered at the various excavation sites are on display. Based on previous museum visitor counts, an estimated 47,000 adults and 10,000 students will visit the exhibit annually.

Staff of the AHS Education Department made public presentations about the Rio Nuevo project at various locations around the Tucson area. These included University of Arizona graduate classes, TUSD seminars, Tucson Newcomer's Club, museum and education conferences, AHS annual meeting, American Association of Environmental Educators, radio and television appearances, various gallery talks for fundraisers, and a public symposium. The AHS also hosted an eight-part summer lecture series that discussed the major points of the project. Together, these presentations reached more than 900 people and helped raise awareness of, and support for, the Rio Nuevo project.

The final AHS project was creation of an interactive CD-ROM for teachers that contains the *Downtown Under Ground* teacher's guide, a historic photograph archive, lesson plans and classroom activities, and computer simulations from the museum exhibit (Figures 21.15-21.16). The CD-ROM will reach an additional 500 Tucson-area teachers and librarians, and by extension, thousands of students and their families.

The AHS component of the Rio Nuevo project is a multifaceted approach to place-based education. The importance of such projects is reflected in its nomination for a 2004 Meritorious Award for Special Projects from the American Association of State and Local History.

CONCLUSION

Place-based education is a way to engage students in their own education, as well as a means of instilling community pride by allowing students to explore their surroundings. Because Rio Nuevo is a long-term city planning project for economic growth, it is important to educate and inform future citizens about preserving and protecting Tucson's diverse heritage as the community looks toward the future. Tucson's future is rooted in its past. Place-based education and the Rio Nuevo project educate students about their rich cultural heritage and community history, while instilling a sense of pride that will enrich and celebrate the community at large.

Figure 21.15. Teachers participate in a session demonstrating how to use the CD "Downtown Under Ground: Archaeological Clues to Tucson's Past." (This was part of a series of teacher workshops conducted by staff at the Arizona Historical Society [photograph courtesy Arizona Historical Society, Southern Arizona Division].)

Figure 21.16. A teacher workshop on the Rio Nuevo project at the Arizona Historical Society (photograph courtesy Arizona Historical Society, Southern Arizona Division).

CHAPTER 22

SUMMARY: THE ARCHAEOLOGY OF A CHANGING COMMUNITY

J. Homer Thiel and Jonathan B. Mabry
Desert Archaeology, Inc.

Between the twenty-first century B.C. and the arrival of the railroad in 1880, the series of communities that developed in Tucson's birthplace at the base of A-Mountain (Figure 22.1) and in the downtown area shared characteristics that define communities everywhere. They were groups of people living together, facing the same challenges, interacting face-to-face, having a general familiarity with the everyday life of each other, sharing certain beliefs and customs, and maintaining the necessary demographic balance and group memory to reproduce themselves and pass their cultures on to subsequent generations. Because each type of community shared these characteristics and developed from the previous one, the history of Tucson communities has a trajectory that can be traced through time.

Here, we use the lens of archaeology and the discoveries of the Rio Nuevo Archaeology project (Figure 22.2) to examine (1) how Tucson initially developed as one of the earliest oasis communities in the Southwest; (2) survived for millennia as an irrigation community operating extensive systems of canals; (3) transformed into both a mission and military community during the Spanish and Mexican periods; (4) and then, after becoming part of the United States in the mid-nineteenth century, rapidly evolved into an ethnically diverse frontier community providing supplies, services, and transportation links for miners and ranchers in southern Arizona. These identities sometimes overlapped for decades or for centuries, giving Tucson a diverse character through much of its history.

THE EVOLVING RIVERINE OASIS

During the 13,000 years of human occupation in the semiarid Tucson Basin, the Santa Cruz River has been the most important resource and attraction—the environmental "constant" that has been the focus of subsistence and settlement in both prehistoric and historic times. However, historical records and geology show that the river flow and the floodplain character have changed dramatically over that timespan.

It is difficult to imagine that the deep, normally dry channel of the Santa Cruz River of today was ever a permanently flowing river through Tucson. But historical photographs, newspaper accounts, and oral histories show that, as recently as the 1890s, some reaches of the river flowed year-round in a shallow channel meandering across a wide floodplain that held irrigated fields of wheat, alfalfa, cotton, and vegetables. These same sources show, however, that at the turn of the nineteenth century, a combination of drought, overgrazing, falling water table, ill-designed diversion ditches, and a series of large floods resulted in the entrenched, rarely flowing river of today.

Studies of the layers of alluvium exposed in deep trenches and the walls of the now 20-ft-deep, dry channel have shown that the turn-of-the-century event was only the most recent of six to eight major cycles of channel downcutting over the last 11,000 years (Chapter 20, this volume). Also present are layers of sediment representing long periods of floodplain building and the presence of freshwater marshes, as well as soil horizons representing intervals of floodplain stability.

The emerging picture is of a dynamic river valley with shifting opportunities and constraints for human groups. The buried contexts of prehistoric archaeological sites in the floodplain suggest that periods of settlement occupation correlate with intervals of relatively moist climate, year-round soil moisture, and floodplain stability. In contrast, canals appear to correlate with marshy, cienega soils, suggesting the necessary conditions for irrigation included a stable or rising floodplain and a high water table.

Like some other reaches of the Santa Cruz River in the Tucson Basin, the A-Mountain reach has some unique geological and hydrological characteristics that created oasis conditions. Immediately upstream (south) of A-Mountain is a subsurface barrier of volcanic bedrock that, during much of last several millennia, forced the subsurface flow of the river to the surface. This makes it likely that the area at the base of A-Mountain was one of the last remaining oases in the Tucson Basin during periods of drought and widespread downcutting of the river channel. For this reason, the layers of the floodplain preserve one of the longest records of continuous human occupation in the United States.

TUCSON AS AN OASIS COMMUNITY, CIRCA 2100 B.C.-A.D. 1890s

The earliest documented community in the floodplain at the base of A-Mountain was a settlement of seven pithouses surrounded by numerous pits for storage and other purposes, occupied about 4,100 years ago (2100 B.C.) (Figure 22.3). Named the Clearwater site, AZ AA:13:6 (ASM), the archaeological remains suggest it was a seasonal settlement occupied during the summer months by a band of hunter-gatherers who moved around the Tucson Basin throughout the year. Sediments, pollen, and charred plant remains preserved in the cultural features of this settlement show that the high water table created by a combination of geology and hydrology allowed these first Tucsonans to cultivate maize (corn), a then-recently introduced tropical cultigen, in this location. This method of water-table farming was probably the earliest type of agriculture in the Southwest (Mabry 2005).

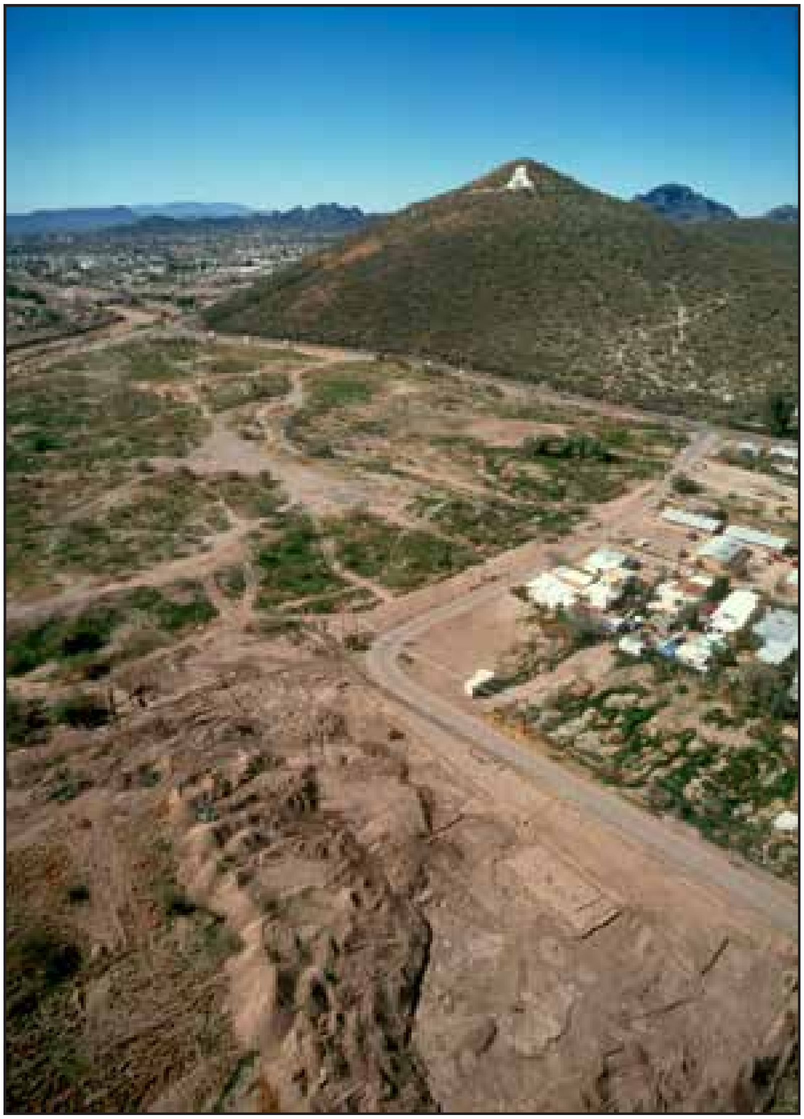

Figure 22.1. The Rio Nuevo Archaeological project uncovered the last surviving remnants of the Spanish period San Agustín Mission in Tucson's birthplace below A-Mountain. (In this photograph, the foundations of the mission granary are in the lower right; nearby white circles mark pithouses and pits of an early farming village occupied about 2,500 years ago. Photograph by Adriel Heisey.)

This earliest settlement was established on a high sandbar deposited by a flood on the edge of a curve in the river channel. The agricultural fields were probably located in the silty floodplain below this better-drained higher ground. This alluvial setting is also typical for Middle Archaic (circa 3500-2000 B.C.) sites in the desert lowlands of the Southwest, suggesting that high water tables, overbank floods, natural concentrations of runoff, and moisture-retaining soils were all utilized by indigenous proto-agriculturalists who protected, encouraged, and possibly cultivated weedy native plants with oily or starchy seeds prior to the introduction of maize from Mexico (Doolittle and Mabry 2006). Therefore, summer-growing, moisture-loving maize was incorporated easily into the existing subsistence pattern that was focused on damp floodplains during the hot months. Jackrabbits and cottontails were the most frequently obtained game that supplemented plant foods (Chapter 13, this volume).

The early settlement of farmer-foragers below A-Mountain represents the first known occupation of Tucson's riverine oasis, and the initial stage of an early farming village culture that developed and thrived in the river valleys of southern Arizona and northern Mexico for the next 2,000 years. What do the artifacts tell about the culture of these first farmers? Fragments of pottery (Figure 22.4) and possible ceramic figurines found in the 4,100-year-old pithouses at the Clearwater site (Chapters 7 and 8, this volume) are the earliest fired ceramics that have been found in the Southwest. Rim sherds indicate the pots were very small bowls or cups, sometimes decorated with designs incised with reeds or fingernails, and

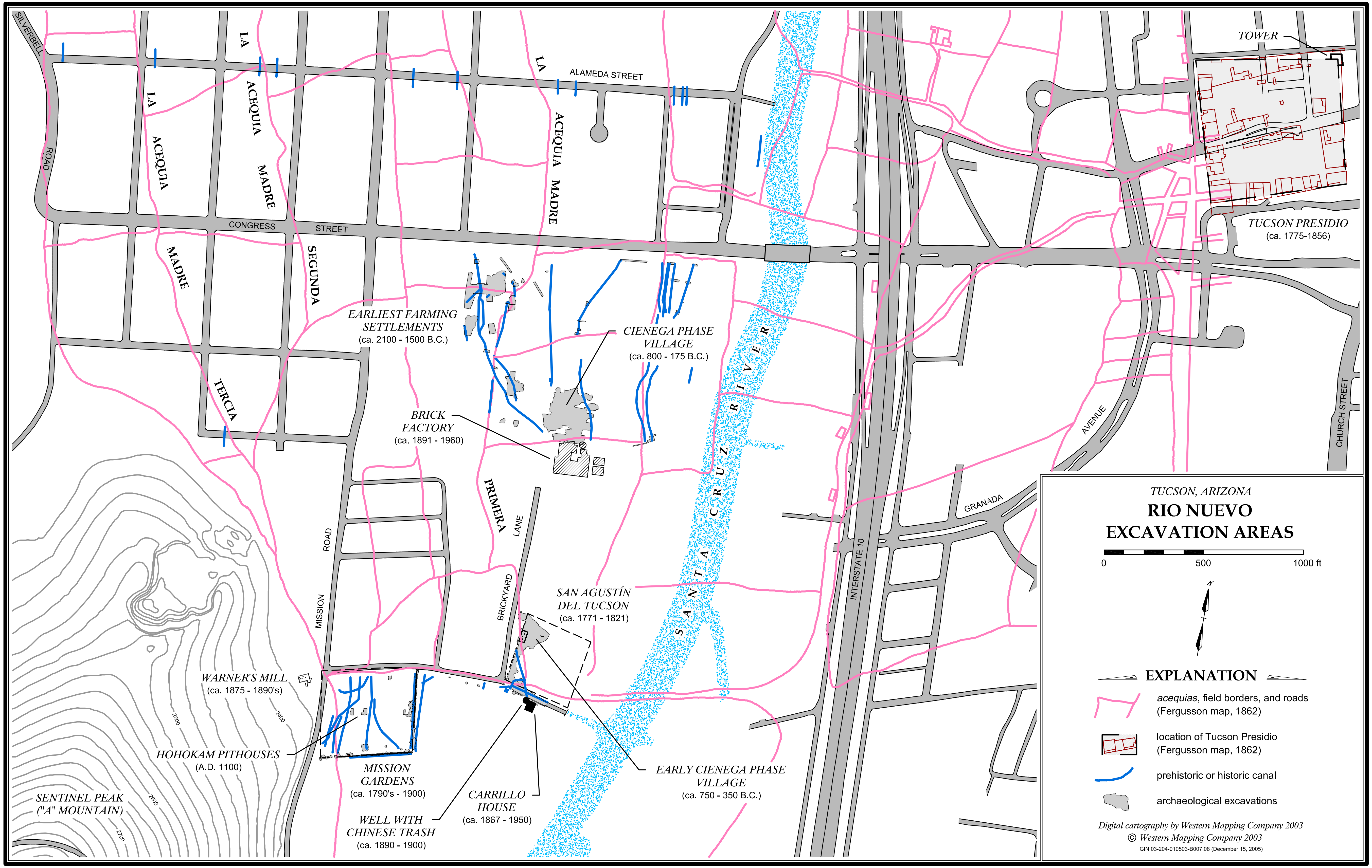

Figure 22.2. Excavations were conducted in several areas of downtown Tucson during the Rio Nuevo Archaeological project.

Figure 22.3. White circles mark pithouses and pits of a 4,100-year-old early farming settlement south of West Congress Street. (Photograph by Adriel Heisey.)

that served some function other than cooking or storage. This earliest Southwestern pottery may have been used to serve saguaro wine or an herb tea during ritual ceremonies (see Chapter 7). River cobbles and flat stones were used for grinding wild plant seeds (the early type of maize was a popcorn that probably was not ground into flour) and for making a red pigment possibly used for body decoration (Chapter 9, this report). Dart points (not arrow points, because bow-and-arrow technology had not yet been introduced to this region) and other flaked stone tools were produced from fine-grained river cobbles and other locally available, easily flaked types of rocks (Chapter 10, this report). Awls—pointed tools probably used in basketweaving—were made from the bones of large mammals, probably deer (see Chapter 13).

Over the next four millennia, the necessity of adapting to a riverine oasis greatly influenced Tucson's social and economic history. Each type of community that developed on the riverbanks here prior to modern times had some of the characteristics of oasis communities found around the world: These characteristics include: (1) isolation on the edges of larger social and economic systems; (2) concentration of residential and agricultural areas; (3) intensive control of water resources for irrigation and drinking; (4) territoriality, in the sense of residents defending from outsiders the resources of the oasis: water, arable land, crops, and livestock (after Spanish contact); and (5) near self-sufficiency, until the 1880 arrival of the railroad linked Tucson to national and international markets and ushered in the modern period.

Figure 22.4. Pieces of pottery discovered in the 4,100-year-old pithouses are the oldest known pottery in the southwestern United States.

TUCSON AS AN IRRIGATION COMMUNITY, CIRCA 1500 B.C.-A.D. 1890s

The long antiquity of irrigation along the Santa Cruz River has been demonstrated by the discovery of a canal dating to about 1500 B.C. (Chapter 19, this report). This is the oldest known canal north of central Mexico, and, along with canals dating to roughly 1200 B.C. a few miles downstream (Ezzo and Deaver 1998; Mabry 2006), are evidence for an extended history of irrigation in the Sonoran Desert. In the floodplain at the base of A-Mountain, the development of irrigation technology and techniques over the subsequent millennia are represented by a series of 35 other canals constructed between that time and the late nineteenth century, and documented during this research program (see Figure 22.2).

In addition to higher agricultural yields, reduced subsistence risks, and higher population carrying capacities, the practice of irrigation implies several things about the social organization of the groups of early farmers living in this location. The logistics of irrigation, even at a small scale, require an alliance of resource users that functions as an irrigation community (Mabry 1996, 2002). This is the most long-lived type of oasis community in the Tucson area. Irrigation communities are territorial by nature, because their success depends on the ability of the residents to limit growth such that membership provides a secure share of water resources and protects them from free-riding outsiders. Without limitation of resource access to a bounded group, there is open access, resulting in the well-known "tragedy of the commons" (Hardin 1968).

Cross-culturally, the practice of irrigation is associated with residential stability, or sedentism, and well-developed concepts of property (Mabry 1996; Netting 1982). This is because significant investments of labor that improve long-term agricultural productivity can be protected by maintaining permanent settlements in their vicinity, and by having rules of property ownership and inheritance. In locally controlled irrigation systems, the water resources and delivery systems are usually common properties, while the fields that are watered are invariably private properties (Netting 1982).

The scale of these early Southwestern irrigation systems does not imply hierarchical social organization; 100 hectares (or 250 acres) of irrigated area appears to be a cross-cultural threshold between consensus-based management and centralized management (Hunt 1988; Tang 1992). However, even the smallest, consensus-based irrigation organizations must successfully perform tasks related to water use (for example, acquisition, allocation, distribution, drainage), tasks related to water control structures (e.g., design, construction, operation, maintenance), and tasks related to organization (e.g., decision making, resource mobilization, communication, conflict management) (Uphoff 1986).

Clearly, even the small groups who practiced early irrigated farming in the Santa Cruz floodplain had to function as cooperative social formations to build, maintain, and operate the irrigation systems. However, the incentive for investments in long-term agricultural infrastructures like canals and field borders was household ownership and lineage-based tenure of specific fields, as well as restricted sharing of crop yields at the household level. Due to this tension between communal ownership of water and canals and private ownership of fields and yields, these early irrigation-based social formations had both community and household levels of organization. Each of these levels had temporal dimensions, with communities maintaining long-term territorial rights through stable residence and membership, and households maintaining long-term property rights through lineage-based rules of land tenure. This became the basic structure of later Southwestern villages, and of a series of prehistoric and historic communities at the base of A-Mountain.

Only a few Hohokam pithouses have been found in this area of the Santa Cruz floodplain. These appear to be isolated fieldhouses, and the locations of the primary settlements of the Hohokam irrigation communities that built and operated a series of canals in this area between about A.D. 950 and 1300 are unknown. It is also likely that other, as-yet-unidentified canals were constructed by the farmers of earlier Hohokam periods, whose traces have been found in the area. These canals and fieldhouses may have been built by residents of the large Hohokam village located on the eastern side of the river, in what is now downtown Tucson, or by farmers living in a large village whose traces were found beneath St. Mary's Hospital to the northwest. Regardless of where the villages were, the canals are testament to the developing engineering skills of Hohokam farmers in this valley. One buried Hohokam canal found in the Mission Gardens locus, estimated to have been built sometime between A.D. 900 and 1000, may have been large enough to divert the entire flow of the Santa Cruz River.

Several buried canals found in the Mission Gardens locus appear to date to the Protohistoric period (circa A.D. 1450-1690s), between the end of the Hohokam Classic period and the time of Spanish contact. Early Spanish colonial documents record that much of the middle Santa Cruz Valley was irrigated during the late 1600s. During his first visit in 1692, the missionary Father Eusebio Francisco Kino found communities of Piman-speaking irrigators along the river at the villages of Bac, Tucson, and Oiaur. In 1701, Kino established the San Xavier Mission at Bac, next to an existing major canal. When the mission of San Agustín was built at Tucson in 1771-1772, the mission community irrigated gardens and orchards within the mission grounds, and groups of Sobaipuris and Papagos (now called Tohono O'odham) also irrigated fields on the western side of the river. The eastern floodplain was also irrigated after the garrison of the presidio at Tubac was moved north to Tucson in 1776. Increasing competition for the water of the river led to a 1776 agreement that guaranteed three-fourths for the Indian villages and one-fourth for the presidio (Meyer 1984).

In 1780, Gerónimo de la Rocha visited the Tucson Presidio and described the *acequia* (canal) system (Rocha n.d.:82):

> We left the Presidio of Tucson and went one-quarter of a league to the south, and on our return I went off with Captain Don Pedro Allande to examine the dam and the place where the water is divided into three abundant acequias that serve for drinking and for cultivation of the fields of the Pueblo and Presidio.

De la Rocha's 1780 and 1784 maps of the Pimería Alta show, south of the mission *visita* and new presidio at "Tucson," a dam diverting water from the river into an *acequia* passing west of the *visita*. This area was referred to as *la isla* (the island) (Sonnichsen 1982).

After Mexico gained independence from Spain in 1821, new settlers began arriving from the south. The Mexican government secularized the missions by federal decree in 1827, and the settlers pressed officials for the water rights held by the mission Indians. The Indians' allocation of the Santa Cruz River was reduced from three-fourths to one-half by the Governor of Sonora in 1828 (Meyer 1984), allowing Mexican settlers to establish the traditional Sonoran system of irrigated agriculture in Tucson. The Rio Nuevo archaeological investigations identified two late prehistoric canals that were partially cleaned out and revived during the mid- or late nineteenth century, probably by the arriving Mexican farmers (see Chapter 20). Documents and oral histories indicate that three *acequias madres* (mother canals) were maintained as common property by a *común de agua* (irrigation community), and that an elected *zanjero* (overseer) supervised water distribution. The canal alignments of this irrigation system were recorded on the 1862 Fergusson map (see Figure 1.2). During the Rio Nuevo excavations, canal segments were found that match some of alignments shown on that map, including the "*Acequia Madre Primera*."

The traditional Mexican irrigation community, which supplied most of the food and livestock fodder for the growing settlement at Tucson, functioned until the late nineteenth century. During the early 1880s, a group of mostly Euro-American entrepreneurs purchased floodplain land upstream. They cleared this land for new fields and excavated deep ditches to increase the water supply to the vegetable gardens of their Chinese tenants, which diminished the supply to the downstream Mexican-American farmers. In 1885, the entrepreneurs defeated a challenge in court by citing U.S. water laws as superseding traditional local customs, and this ruling marked the beginning of the end for the traditional irrigation community (Sheridan 1986). In its place, Euro-American corporations began competing for the river's water (Kupel 1986).

TUCSON AS A MISSION COMMUNITY, 1690s-1820s

When Father Kino visited the middle Santa Cruz Valley in the 1690s, he found a Piman village called *Schook-schon* in the native language (this is the origin of the name Tucson). Situated at the base of a small, black mountain, the village was surrounded by a system of irrigation canals providing water for agricultural fields where maize, beans, and squash were being grown. Kino would later introduce European crops and livestock, including wheat, peaches, cattle, horses, and sheep. Census records in the 1750s and 1760s suggest a few hundred people lived in the settlement, including Sobaipuri Pimans who arrived in 1762 from the San Pedro River area. A detailed census prepared in 1801 by Father Llorens listed almost 250 people at San Agustín, including Pimans, Papagos, and Gileños. By the 1820s, the mission was largely abandoned, as people moved away to San Xavier and the Gila River, or perished from European diseases (Dobyns 1976). Late nineteenth century photographs document the disintegration of the mission ruins (Figure 22.5).

Much of the San Agustín Mission remnants were destroyed in the 1940s and 1950s, by clay mining and the use of the area as a municipal landfill. Recent excavations revealed that approximately 20 percent of the site within the mission compound walls had survived, including seven features, pits, and trash middens that have provided artifacts and food remains discarded by people who lived at the mission between about 1770 and 1820.

These items reveal that residents relied on beef and mutton as their main source of meat during this period, although hunting of rabbits and deer continued (see Chapter 13). A roasting pit feature, with charred mesquite logs covered by fire-cracked rocks and containing a number of cattle bones, reveal that the Native Americans living at the mission cooked meat outdoors. Charred plant remains indicate residents grew wheat, corn, and squash and gathered wild plant foods, including saguaro fruit, mesquite pods, and false purslane (Chapter 14, this volume).

Much of the pottery found at the mission was manufactured nearby (Chapters 6 and 7, this volume). Residents used these vessels to store foodstuffs and beverages, to cook in, and to serve in. Unlike residents of the nearby presidio, they did not use a large number of imported vessels. The residents still used bows and arrows for hunting, as shown by the small, stone arrow points found (see Chapter 10). No musket balls or gunflints were found—it is uncertain if the people at the mission owned muskets or pistols. Given the cost of these items and the expense of ammunition and gunpowder, they probably relied on their bow and arrows for hunting and personal protection.

Pieces of obsidian, a volcanic glass often used for arrow points, were analyzed and were found to have come from outcroppings to the west. During the Prehistoric era, obsidian came from the north and east. The change in sources may indicate the closer outcroppings to the east had been cut off by the presence

Figure 22.5. When this photograph was taken in 1880 from A-Mountain (then known as Sentinel Peak), the ruin of the two-story convento was the last standing structure of the San Agustín Mission (Photograph no. 18233, AHS/SAD).

of Apaches (Chapter 17, this report). A very small number of Mexican artifacts, a couple of pieces of majolica pottery and glass, were recovered (Chapter 12, this report). This suggests the mission residents had few imported possessions.

Much of the material culture of the mission residents was probably made from materials that have not survived—leather, basketry, matting, and cloth. While much has been lost, the remaining artifacts and food remains allow for a better understanding of life at the mission, revealing aspects not discussed in the documents about the San Agustín Mission.

TUCSON AS A MILITARY COMMUNITY, 1775-1856

Life was harsh for the 400 or so residents of the Tucson Presidio for much of the time the village was a military fort, from the move north from Tubac in 1776, until the withdrawal of Mexican forces in 1856. Tucson was on the northern frontier of New Spain, sometimes isolated from other communities. People often made do with what could be made locally; the nearest town with a store was several days travel to the south at Arizpe. Apaches attacked frequently, although the period between 1793 and the early 1820s was relatively peaceful due to a policy of appeasement.

Surviving documents provide information about the broad events of the presidio (Officer 1989), but details about everyday life are lacking. A few earlier excavations provided small samples of material culture and the remains of meals (Thiel 2004; Thiel et al. 1995). During the recent archaeological work, artifacts and food materials were collected from seven pit features at the northeastern corner of the fortress (Figure 22.6). These items and the architectural remains found there and at the Tucson Museum of Art have provided new information about the daily routines of the presidio families.

Animal bones reveal that residents of the fort relied on beef as their main source of meat (see Chapter 13). Chicken, sheep or goats, and pigs provided smaller amounts of meat. The cattle were butchered within the confines of the fort, and every scrap of meat was likely used, with long bones broken to extract marrow. Carcasses were chopped apart with axes and cleavers, and they were processed into pieces small enough to be boiled or roasted. Sediment samples provided a variety of charred plant remains (see Chapter 14). Wheat, maize, peppers, and apples or quinces were grown by fort residents. However, wild foods, such as saguaro cactus fruit and mesquite pods, were also collected. These latter foods might have been gathered because not enough crops could be grown on the nearby floodplain, especially during times of drought (Officer 1989).

Residents likely used iron or brass vessels to cook and store foods and beverages when the fort was first established. Soon, however, ceramic stewing pots, tortilla griddles, *chocolateros*, and water ollas were obtained from local Native Americans (see Chapter 7). A resident of the fort may have asked a local O'odham potter to manufacture these items, or perhaps a resourceful potter examined Spanish vessels and then replicated them for sale or barter to the soldiers and their families.

Meals were eaten from majolica dishes brought north from central Mexico on pack trains. A few pieces of Chinese porcelain also arrived at the fort after a long journey from China, to the Philippines, and then to the western coast of Mexico. These brightly colored vessels were important to the women of the presidio; they were symbols of lives left behind in Mexico by the initial residents of the fort, and were the vessels remembered by second and third generation residents who grew to adulthood in Tucson. By the mid-1820s, a small number of English vessels also made their way to Tucson, some with decorative scenes of faraway Europe.

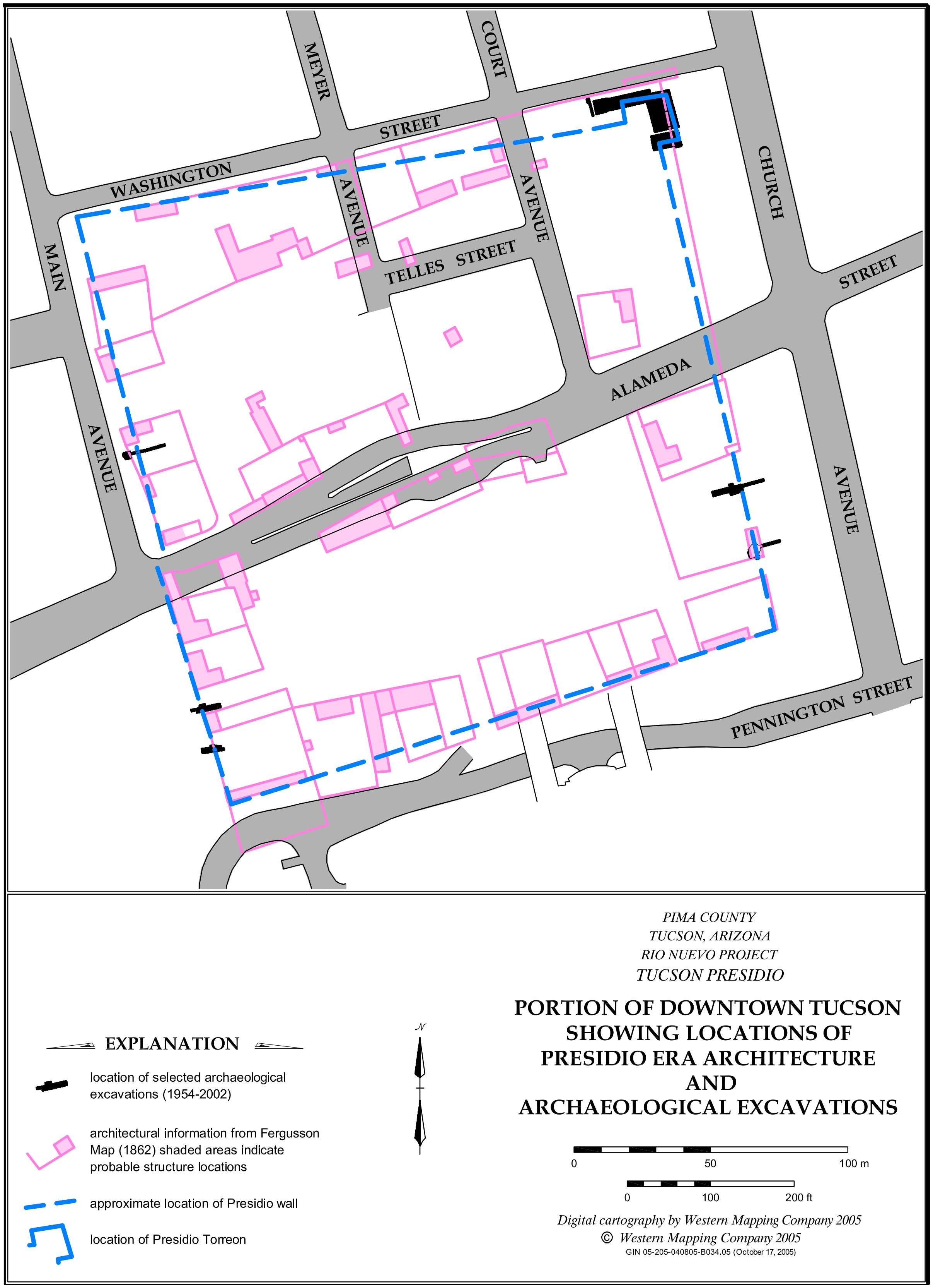

Figure 22.6. Archaeological excavations in several parts of downtown Tucson have uncovered portions of the walls of the Tucson Presidio, occupied between 1775 and 1856.

A few copper buttons, a bone comb, gun parts and ammunition, gaming pieces, and a crucifix are among the other items used by fort residents, uncovered during the recent work (Chapter 12, this report). The relative paucity of metal items suggests iron and copper were carefully conserved, perhaps carried to the presidio blacksmith shop, with its meteorite anvil, where unwanted or broken items could be recycled (Willey 1997). A few exotic artifacts reveal that trade was taking place between the residents of Tucson and distant pueblos in northern Arizona. Sherds of Zuni pottery, from at least four different vessels, were found (Figure 22.7). Captain José de Zúñiga led a group of soldiers from Tucson on an expedition north to the Zuni villages in 1795 (Officer 1989:68). It seems likely some of the soldiers bartered for small, decorated black-on-white pots, which would have been a novelty back in Tucson.

Architectural remains reveal that a large square tower stood at the northeastern corner of the fort (Figure 22.8), projecting 20 ft out from the walls of the presidio to provide a line of fire along the northern and eastern walls. Soldiers stood guard inside the 20-ft-tall tower, standing on a wooden walkway, watching out for the Apaches.

The eastern wall of the fort was found to line up with a wall segment found in 1992, proving that the wall running beneath the courtyard of the 1929 Pima County Courthouse was, in fact, a part of the presidio (Thiel et al. 1995). A ramada was found just inside the fort, built in an area where the earth had been tamped down to form a hard surface. Beneath this surface, a series of small pits were found, likely places where dirt was mined to provide material to patch adobe walls or for mud plaster.

Nearby, in the small excavation conducted between the Fish and Stevens homes in the Tucson Museum of Art complex, archaeologists located a corner fireplace inside a dwelling, also proving that the western wall of the presidio could not have been part of the Fish house, as has been claimed in the past (Thiel 2004).

Life was difficult in the Tucson Presidio, but many families stayed in the community through good times and bad times. Many people living in Tucson and southern Arizona today can trace their ancestry to the soldiers who served at the fort during the Spanish and Mexican periods.

TUCSON AS A DIVERSE FRONTIER COMMUNITY, 1856-1900s

The Mexican residents of Tucson watched with trepidation as the trickle of Americans into the community became a flood in the 1860s (Sheridan 1986). Men arrived from the eastern United States in search of opportunities—prospecting for mineral wealth, operating ranches, and opening stores throughout southern Arizona (Figure 22.9). Most of these men were single, and many sought wives among the Mexican girls and women living in Tucson and Tubac. The desire for manufactured goods, medicines, foodstuffs, and alcoholic beverages resulted in the importation of these goods in freight wagon trains, traveling overland from San Diego, Guaymas, and Santa Fe. These goods allowed the eastern men to recreate a semblance of their former lives, although this was tempered by Sonoran Desert adaptations.

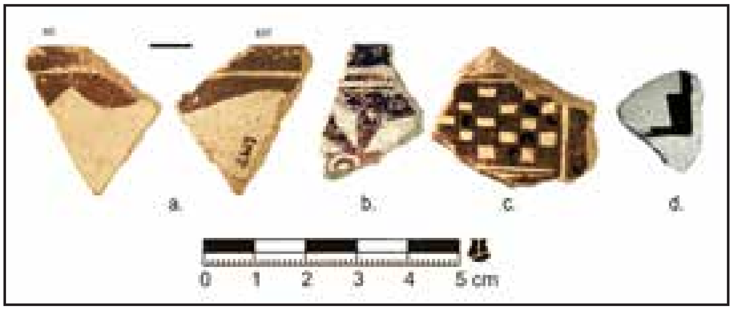

Figure 22.7. Zuni sherds found in the Tucson Presidio excavations: (a) Feature 376, FN 2639; (b) Feature 0, FN 3442; (c) Feature 1, FN 3892; (d) Feature 376, FN 2944.

Figure 22.8. The wall foundations of a corner tower of the Tucson Presidio were found beneath a parking lot on the corner of Washington Street and Church Avenue; a prehistoric Hohokam pithouse is visible beneath the wall.

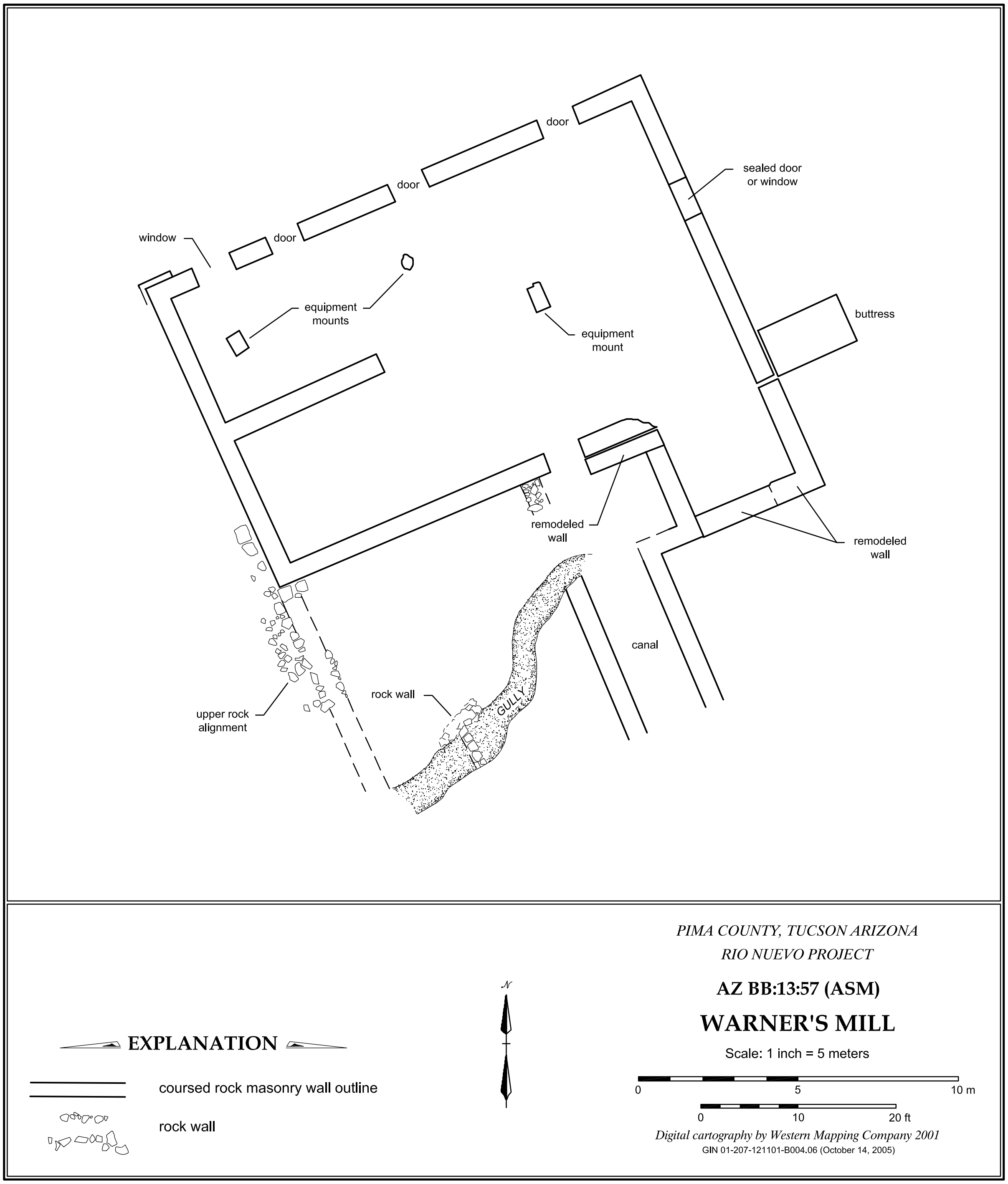

Figure 22.9. The foundations of a water-powered mill completed in 1875 by Solomon Warner are still visible on the lower slope of A-Mountain above the Mission Gardens. (Warner was one of the first Americans to arrive in Tucson after it became part of the United States in 1854.)

Most residents lived in traditional adobe Sonoran rowhouses, built close to the street, and with typical amenities such as corner fireplaces, high ceilings, and interior patios. Mexican wives likely used imported foodstuffs to please the tastes of their husbands, but also continued to prepare traditional items such as tortillas and spicy sauces incorporating chilies grown in kitchen gardens. The use of local Native American pottery continued, with most households having water jars made in the vicinity of the Papago [today Tohono O'odham] Reservation at Bac (see Chapter 7).

The arrival of the railroad in 1880 changed the community dramatically (Sonnichsen 1982). An influx of Euro-Americans resulted in changing dynamics with the resident population. After the railroad arrived, the number of Euro-Americans swelled rapidly, and inter-ethnic relations began to swing toward conflict and segregation. The Euro-American population did not surpass the Mexican-American population until the first decade of the twentieth century. But, already by the 1890s, the rate of Mexican and Euro-American marriages had declined by half, Euro-Americans had begun to dominate white collar jobs and business ownership, and neighborhoods had become ethnically segregated. Tucson had become a community of ethnic enclaves (Sheridan 1986).

Ironically, this swing toward segregation may have helped to preserve the ethnic identity of Tucson's Mexican-American community during the late nineteenth and early twentieth centuries, an identity that otherwise may have been lost due to assimilation. Mexican-American households continued to use utilitarian Mexican and Native American pottery, and to consume meat from cattle heads and feet, cuts used in traditional Sonoran dishes. This process can be seen in archaeological remains, with Mexican households more likely to have these items. Even so, by the early 1900s, the overall number of artifacts manufactured in Mexico declined, and meat was less likely to be butchered in traditional ways (Mabry et al. 1994; Thiel 2004).

Many of the Chinese men who had helped to build the railroad chose to remain in the community, including a group who rented Leopoldo Carrillo's farm at the San Agustín Mission site during the 1890s. The Chinese gardeners who lived there grew produce and raised pigs (and perhaps sheep) to sell to their fellow Tucsonans.

Analysis of artifacts and food remains from a well found at the mission site, and filled between approximately 1890 and 1900, indicates that the Chinese men attempted to replicate the diet and ways of serving food they had known back in China. A variety of plants were utilized, including maize, wheat, and grapes (see Chapter 14). Many different kinds of meat were served, including imported dried fish from China and the Pacific Ocean (see Chapter 13). Local meat sources—such as mollusks collected from the Santa Cruz River, pigs raised by the farmers, and smaller amounts of cattle and sheep—added variety to the diet. Sauces imported from China and purchased at local Chinese-run grocery stores helped further in recreating the taste of dishes of the homeland. These efforts were further accentuated by purchasing traditional Chinese vessels—rice bowls, sauce bowls, and small porcelain cups—to serve foods and beverages in, as well as an iron wok to prepare foods (see Chapter 12).

There was a dichotomy, though, between the private and public lives of the Chinese farmers. While at home, in a private setting, they maintained their Chinese traditions. In the open, at work in the fields, or as they traveled through town peddling produce, the Chinese men adopted Western clothing and used western tools (Lister and Lister 1989). Western clothing may have been adopted because it was more readily available and more suitable for the harsh climate of Arizona. However, the clothing may also have been used in an attempt to blend in after harsh immigration laws were passed by the United States government.

THE MODERN COMMUNITY OF TUCSON

The Rio Nuevo Archaeology project sought to uncover information within the planned heritage parks at the San Agustín Mission and the Tucson Presidio, as well as to mitigate the effects of construction on the Clearwater site and archaeological remains at other locations. The work conducted has provided valuable new information, illuminating many aspects of Tucson's past that were previously either unknown or inadequately understood.

Current residents of Tucson proved to be immensely interested in the work, with over 5,000 people visiting the excavations and about 125 helping as volunteer archaeologists. The work was extensively covered by the local newspaper, radio, and television media, along with articles in *Smithsonian* and *American Archaeology* magazines, thereby reaching national and international audiences (Bawaya 2001; Lichtenstein 2002).

Today, Tucson is a community largely composed of people who have recently moved here from elsewhere. Many new residents know little about the area's past. Visitors to the Rio Nuevo excavations were often surprised to learn of the Spanish presidio and mission, and the long timespan of the prehistoric occupations. One goal of the project was to educate the public—a goal met through a website, school programs and teachers' workshops, and a major exhibit at the Arizona Historical Society.

In the future, another goal of the Rio Nuevo project will be met. In 1999, voters approved Proposition 400, a tax-increment financing measure. A selling point of this initiative was the Tucson Presidio and San Agustín Mission heritage parks, prominently displayed on campaign materials. With the completion of archaeological and historical research and the development of plans for the parks, the next phase, actual construction of park facilities, has begun. Residents and tourists will be able to visit the parks and learn about the communities that preceded twenty-first century Tucson.

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APPENDIX A

SUPPLEMENTARY DATA ON RIO NUEVO SHELL ARTIFACTS

Arthur W. Vokes
Arizona State Museum

Table A.1. Specific contexts and temporal associations of the shell material from the Rio Nuevo Archaeology project.

Site Number/Excavation Area

Prime Feature Identifier (Feature Type): Temporal Assignment

RNA	Subfeature	Context	Stratum	Level	Unit	Artifact Form	Shell Species	Count	Minimum Number of Individuals
AZ BB:13:6 (ASM)/RNA 2: San Agustín Mission Locus									
Feature 0 (nonfeature excavation unit): unassigned									
		Natural overburden	2	2	103	Whole shell bead	*Olivella* sp.	1	1
		Natural overburden	2	2	103	Whole shell	*Helisoma* sp.	1	1
		Natural overburden	2	2	103	Worked fragment, unknown form	*Haliotis rufescens*	1	1
		Natural overburden	2	2	103	Unworked fragment	*Helisoma* sp.	1	1
		Cultural overburden	4	1	3	Whole shell bead	*Olivella dama*	1	1
		Plowzone	1	2	5	Whole shell	*Helisoma* sp.	1	1
		Natural overburden	2	1	5	Unworked fragment	*Laevicardium elatum*	1	1
		Plowzone	1	1	58	Unworked fragment	*Anodonta californiensis*	1	1
		Natural overburden	2	1	60	Whole shell	Ancylidae (Limpets family)	2	2
		Natural overburden	2	1	60	Whole shell	*Helisoma* sp.	1	1
		Natural overburden	2	1	61	Unworked fragment	*Anodonta californiensis*	3	1
		Natural overburden	2	1	61	Unworked fragment	*Laevicardium elatum*	1	1
		Cultural overburden	4	1	61	Plain bracelet	*Glycymeris gigantea*	1	1
		Natural overburden	2	1	84	Plain bracelet	*Glycymeris gigantea*	1	1
		Cultural overburden	4	1	85	Plain bracelet	*Glycymeris gigantea*	1	1
		Cultural overburden	4	1	85	Whole shell	*Helisoma* sp.	1	1
		Natural overburden	2	1	86	Cut pendant, other geometric	*Haliotis rufescens*	1	1
		Natural overburden	2	1	86	Unworked fragment	*Helisoma* sp.	1	1
		Cultural overburden	4	1	91	Unworked fragment	*Physa virgata*	1	1
		Cultural overburden	4	3	91	Whole shell	*Helisoma* sp.	2	2
Feature 1 (historic-era feature, wall segment): Spanish period									
		Cultural overburden	4	1	73	Whole shell	*Helisoma* sp.	1	1
		Cultural overburden	4	1	79	Whole shell	*Helisoma* sp.	1	1

Table A.1. Continued.

Site Number/Excavation Area									
Prime Feature Identifier (Feature Type): Temporal Assignment									
RNA	Subfeature	Context	Stratum	Level	Unit	Artifact Form	Shell Species	Count	Minimum Number of Individuals
AZ BB:13:6 (ASM)/RNA 2: San Agustín Mission Locus (continued)									
Feature 2 (pithouse): Hohokam periods									
		Roof/Wall fall	11	1	3	Unworked fragment	*Laevicardium elatum*	1	1
Feature 4 (historic-era well): American Territorial period									
		Fill	50	1	76	Whole shell	*Helisoma* sp.	1	1
		Fill	50	1	76	Unworked fragment	*Anodonta californiensis*	2	1
		Fill	50	1	76	Unworked fragment	*Acmaea* sp.	1	1
		Fill	50	2	34	Cap bead	Unidentified marine univalve	1	1
		Fill	50	2	34	Whole shell	*Helisoma* sp.	2	2
		Fill	50	2	34	Worked fragment, unknown form	*Haliotis rufescens*	1	1
		Fill	50	2	34	Unworked fragment	*Anodonta californiensis*	23	1
		Fill	50	2	59	Unworked fragment	*Anodonta californiensis*	6	1
		Fill	50	2	62	Whole shell	*Acmaea* sp.	3	3
		Fill	50	3	34	Whole shell	*Acanthina tyrianthina*	2	2
		Fill	50	3	34	Unworked fragment	*Helisoma* sp.	2	2
		Fill	50	3	34	Unworked fragment	*Anodonta californiensis*	36	16
		Fill	50	3	34	Unworked fragment	*Haliotis rufescens*	1	1
		Fill	50	3	59	Unworked fragment	*Anodonta californiensis*	7	2
		Fill	50	3	62	Unworked fragment	*Anodonta californiensis*	4	3
		Fill	50	4	34	Whole shell	*Acanthina tyrianthina*	4	4
		Fill	50	4	34	Whole shell	*Helisoma* sp.	3	3
		Fill	50	4	34	Unworked fragment	*Anodonta californiensis*	27	8
		Fill	50	4	62	Whole shell	*Helisoma* sp.	1	1
		Fill	50	4	62	Unworked fragment	*Anodonta californiensis*	2	1
		Fill	50	5	34	Whole shell	*Helisoma* sp.	1	1
		Fill	50	5	34	Unworked fragment	*Anodonta californiensis*	165	74

Table A.1. Continued.

Site Number/Excavation Area

Prime Feature Identifier (Feature Type): Temporal Assignment

RNA	Subfeature	Context	Stratum	Level	Unit	Artifact Form	Shell Species	Count	Minimum Number of Individuals
AZ BB:13:6 (ASM)/RNA 2: San Agustín Mission Locus (continued)									
Feature 4 (historic-era well): American Territorial period (continued)									
		Fill	50	5	62	Whole shell	*Helisoma* sp.	1	1
		Fill	50	5	62	Unworked fragment	*Anodonta californiensis*	8	1
		Fill	50	5	62	Unworked fragment	*Helisoma* sp.	1	1
		Fill	50	6	34	Whole shell	*Helisoma* sp.	3	3
		Fill	50	6	34	Unworked fragment	*Anodonta californiensis*	57	8
		Fill	50	7	34	Whole shell	*Helisoma* sp.	6	6
		Fill	50	7	34	Whole shell	*Acmaea* sp.	1	1
		Fill	50	7	34	Unworked fragment	*Helisoma* sp.	2	2
		Fill	50	9	34	Whole shell	*Helisoma* sp.	5	5
		Fill	50	10	34	Whole shell	*Helisoma* sp.	1	1
		Fill	50	11	34	Whole shell	*Helisoma* sp.	8	8
		Fill	50	12	34	Whole shell	*Helisoma* sp.	4	4
		Fill	50	12	34	Unworked fragment	*Anodonta californiensis*	1	1
		Fill	50	13	34	Whole shell	*Helisoma* sp.	11	11
		Fill	50	14	34	Unworked fragment	*Anodonta californiensis*	30	12
		Fill	50.01	1	76	Whole shell	*Helisoma* sp.	1	1
		Fill	50.01	4	76	Whole shell	*Helisoma* sp.	1	1
		Fill	50.01	5	76	Whole shell	*Helisoma* sp.	2	2
		Fill	50.01	5	76	Unworked fragment	*Helisoma* sp.	1	1
		Fill	50.01	5	76	Unworked fragment	*Anodonta californiensis*	1	1
		Fill	50.01	7	76	Whole shell	*Helisoma* sp.	16	16
		Fill	50.01	7	76	Unworked fragment	*Anodonta californiensis*	3	1
		Fill	50.01	8	34	Whole shell	*Physa virgata*	1	1

Table A.1. Continued.

Site Number/Excavation Area									
	Prime Feature Identifier (Feature Type): Temporal Assignment								
RNA	Subfeature	Context	Stratum	Level	Unit	Artifact Form	Shell Species	Count	Minimum Number of Individuals
AZ BB:13:6 (ASM)/RNA 2: San Agustín Mission Locus (continued)									
	Feature 4 (historic-era well): American Territorial period (continued)								
		Fill	50.01	8	34	Whole shell	*Helisoma* sp.	2	2
		Fill	50.01	8	34	Unworked fragment	*Anodonta californiensis*	3	2
		Fill	50.01	8	76	Whole shell	*Helisoma* sp.	40	40
		Fill	50.01	8	76	Whole shell	*Tegula* sp	1	1
		Fill	50.01	8	76	Unworked fragment	*Helisoma* sp.	3	2
		Fill	50.01	9	76	Whole shell	*Helisoma* sp.	13	13
		Fill	50.01	9	76	Unworked fragment	*Helisoma* sp.	1	1
		Fill	50.01	10	76	Unworked fragment	*Anodonta californiensis*	80	35
		Fill	50.01	11	76	Unworked fragment	*Anodonta californiensis*	50	22
	Feature 5 (fenceline): American Territorial period								
		Fill	50	1	34	Unworked fragment	*Anodonta californiensis*	1	1
	Feature 15 (pithouse): Cienega phase								
		Fill	10	1	100	Unworked fragment	*Anodonta californiensis*	2	1
		Roof/Wall fall	11	1	100	Unworked fragment	*Anodonta californiensis*	6	1
	Feature 31 (extramural pit): prehistoric, unknown period								
		Fill	50	1	95	Unworked fragment	*Anodonta californiensis*	1	1
	Feature 52 (extramural pit): American Territorial period								
		Fill	50	1	107	Whole shell	*Helisoma* sp.	3	3
		Fill	50	2	108	Whole shell	*Helisoma* sp.	12	12
		Fill	50	2	108	Unworked fragment	*Helisoma* sp.	2	1
		Fill	50	3	108	Whole shell	*Helisoma* sp.	3	3

Table A.1. Continued.

Site Number/Excavation Area Prime Feature Identifier (Feature Type): Temporal Assignment RNA	Subfeature	Context	Stratum	Level	Unit	Artifact Form	Shell Species	Count	Minimum Number of Individuals
AZ BB:13:6 (ASM)/RNA 2: San Agustín Mission Locus (continued)									
Feature 61 (extramural pit): American Territorial period									
		Fill	50	1	126	Whole shell	*Helisoma* sp.	2	2
		Fill	50	1	126	Whole shell	*Helisoma* sp.	2	2
		Fill	50	1	126	Unworked fragment	*Anodonta californiensis*	5	2
		Fill	50	1	133	Whole shell	*Helisoma* sp.	1	1
		Fill	50	1	133	Whole shell	*Physa virgata*	1	1
		Fill	50	1	133	Unworked fragment	*Helisoma* sp.	1	1
		Fill	50	1	133	Unworked fragment	*Anodonta californiensis*	4	2
Feature 69 (extramural pit): Cienega phase									
		Fill	50	1	145	Cut pendant, unknown form	*Pteria/Pinctada*	2	1
			50	3	145	Unworked fragment	*Anodonta californiensis*	2	1
Feature 97 (pithouse): Cienega phase									
	97.07	Posthole fill	30	1	125	Whole shell bead	*Olivella dama*	1	1
Feature 100 (pithouse): Cienega phase									
		Floor fill	10	2	135	Unworked fragment	*Laevicardium elatum*	1	1
Feature 112 (pithouse): Cienega phase									
		Fill	10	1	138	Cut pendant, other geometric	*Anodonta californiensis*	4	1
		Floor fill	11	1	122	Carved manufacturing waste/Debris	*Anodonta californiensis*	6	1
Feature 121 (pithouse): Cienega phase									
		Roof/Wall fall	11	1	139	Cut pendant, unknown form	*Anodonta californiensis*	7	1
Feature 128 (pithouse): Cienega phase									
		Fill	10	2	165	Unworked fragment	*Laevicardium elatum*	1	1

Table A.1. Continued.

Site Number/Excavation Area Prime Feature Identifier (Feature Type): Temporal Assignment RNA	Subfeature	Context	Stratum	Level	Unit	Artifact Form	Shell Species	Count	Minimum Number of Individuals
AZ BB:13:6 (ASM)/RNA 2: San Agustín Mission Locus (continued)									
Feature 151 (pithouse): Cienega phase									
		Floor fill	11	1	160	Cut pendant, rectangular	*Haliotis* sp.	1	1
Feature 166 (trash deposit): Spanish period									
		Fill	50	1	173	Whole shell bead	*Olivella* sp.	1	1
Feature 180 (pithouse): Cienega phase									
		Fill	50	1	186	Whole shell	*Helisoma* sp.	1	1
AZ BB:13:6 (ASM)/RNA 8A: Congress Street Locus									
Feature 308 (pithouse): Hohokam periods									
		Fill	10	1	199	Unworked fragment	*Anodonta californiensis*	21	1
		Fill	10	1	204	Bracelet, marginal nicking	*Glycymeris* sp.	1	1
		Fill	10	1	204	Unworked fragment	*Anodonta californiensis*	2	1
		Fill	10	1	205	Carved manufacturing waste/Debris	*Spondylus* sp.	1	1
		Fill	10	1	206	Plain bracelet	*Glycymeris* sp.	1	0
		Fill	10	1	206	Carved bracelet, frog	*Glycymeris* sp.	1	1
		Fill	10	1	206	Worked fragment, unknown form	*Anodonta californiensis*	1	1
		Fill	10	1	206	Unworked fragment	*Anodonta californiensis*	2	2
		Fill	10	2	199	Plain bracelet	*Glycymeris gigantea*	3	1
		Fill	10	2	199	Plain bracelet	*Glycymeris* sp.	1	1
		Fill	10	2	199	Worked fragment, unknown form	*Anodonta californiensis*	3	1
		Fill	10	2	199	Unworked fragment	*Anodonta californiensis*	2	1
		Floor fill	10	2	204	Worked fragment, unknown form	*Anodonta californiensis*	3	1
		Floor fill	10	2	206	Plain bracelet	*Glycymeris gigantea*	1	1
		Floor fill	10	2	206	Plain bracelet	*Glycymeris* sp.	1	1

Table A.1. Continued.

Site Number/Excavation Area

Prime Feature Identifier (Feature Type): Temporal Assignment

RNA	Subfeature	Context	Stratum	Level	Unit	Artifact Form	Shell Species	Count	Minimum Number of Individuals
AZ BB:13:6 (ASM)/RNA 8A: Congress Street Locus (continued)									
Feature 308 (pithouse): Hohokam periods (continued)									
		Floor fill	10	2	206	Worked fragment, unknown form	*Anodonta californiensis*	1	1
		Floor fill	10	2	206	Unworked fragment	*Anodonta californiensis*	2	1
		Fill	10	3	199	Unworked fragment	*Anodonta californiensis*	6	1
		Floor fill	10	4	199	Plain bracelet	*Glycymeris* sp.	1	1
		Floor fill	10	4	199	Unworked fragment	*Anodonta californiensis*	4	1
	308.02	Floor pit	30	1	204	Whole shell bead	*Theodoxus luteofasciatus*	1	1
	308.02	Floor pit	30	1	204	Cut pendant, zoomorphic	*Glycymeris* sp.	1	1
	308.02	Floor pit	30	1	204	Plain bracelet	*Glycymeris gigantea*	1	1
	308.02	Floor pit	30	1	204	Unworked fragment	*Anodonta californiensis*	4	2
	308.02	Floor pit	30	1	204	Unworked fragment	*Spondylus* sp.	1	1
	308.03	Floor pit	30	1	206	Plain bracelet	*Glycymeris* sp.	1	1
	308.03	Floor pit	30	1	206	Plain bracelet	*Glycymeris gigantea*	1	1
	308.03	Floor pit	30	1	206	Unworked fragment	*Anodonta californiensis*	1	1
		Unknown	99			Plain bracelet	*Glycymeris gigantea*	1	1
		Unknown	99			Unworked fragment	*Anodonta californiensis*	1	1
Feature 547 (extramural pit): Early Ceramic period or Hohokam periods									
		Fill	50	1	215	Unworked fragment	*Anodonta californiensis*	2	1
		Fill	50.01	1	215	Unworked fragment	*Anodonta californiensis*	2	1
Feature 574 (inhumation): Early Agricultural period or Hohokam periods									
		Fill	50	1	221	Disk bead	*Spondylus/Chama*	6	6

Table A.1. Continued.

Site Number/Excavation Area Prime Feature Identifier (Feature Type): Temporal Assignment RNA	Subfeature	Context	Stratum	Level	Unit	Artifact Form	Shell Species	Count	Minimum Number of Individuals
AZ BB:13:6 (ASM)/RNA 8A: Congress Street Locus (continued)									
Feature 603 (inhumation): Early Agricultural period									
		Near right foot	50	1	232	Disk bead	*Chama* sp.	3	3
		Around left wrist/Hand	50	1	232	Disk bead	*Spondylus/Chama*	19	19
			50	1	232	Geometric, curvilinear	Unidentified marine, nacreous	2	1
Feature 605 (inhumation): Early Agricultural period									
		Clustered around neck	50	1	234	Claw bead	*Spondylus/Chama*	43	32
		Clustered around neck	50	1	234	Claw bead	*Chama* sp.	4	4
AZ BB:13:6 (ASM)/RNA 8B: Congress Street/Brickyard Loci									
Feature 3220 (pithouse): Cienega phase									
		Floor fill	10	1	3106	Whole shell	*Succinea* sp.	1	1
Feature 3238 (extramural pit): Cienega phase									
		Fill	50	1	3151	Whole shell	*Helisoma* sp.	1	1
		Fill	50	1	3151	Unworked fragment	*Physa virgata*	2	1
		Fill	50	1	3151	Unworked fragment	*Helisoma* sp.	5	3
Feature 3242 (extramural pit): Cienega phase									
		Fill	50	1	3189	Whole shell	*Helisoma* sp.	1	1
		Fill	50	1	3189	Unworked fragment	*Helisoma* sp.	5	2
Feature 3260 (pithouse): Cienega phase									
		Unknown				Disk bead	*Pteria/Pinctada*	1	1
		Floor fill	11	1	3123	Whole shell	*Helisoma* sp.	1	1

Table A.1. Continued.

Site Number/Excavation Area								
Prime Feature Identifier (Feature Type): Temporal Assignment								
RNA	Subfeature	Context	Stratum	Level	Unit	Artifact Form	Shell Species	Count	Minimum Number of Individuals
AZ BB:13:6 (ASM)/RNA 8B: Congress Street/Brickyard Loci (continued)									
Feature 3262 (pithouse): Cienega phase									
		Floor fill	11	1	3130	Unworked fragment	*Helisoma* sp.	2	1
Feature 3264 (pithouse): Cienega phase									
		Fill	10	2	3126	Whole shell bead	*Olivella dama*	1	1
Feature 3270 (pithouse): Cienega phase									
		Floor fill	11	1	3128	Whole shell	*Helisoma* sp.	1	1
		Floor fill	11	1	3128	Whole shell	*Helisoma* sp.	1	1
Feature 3273 (pithouse): Cienega phase									
		Floor fill	11	1	3147	Cut pendant, triangular	*Spondylus/Chama*	1	1
		Floor fill	11	1	3147	Unworked fragment	Unidentified marine bivalve	1	1
	3273.02	Wall groove	30	1	3147	Unworked fragment	*Crucibulum spinosum*	1	1
Feature 3294 (pithouse): Cienega phase									
		Fill	10	1	3143	Whole shell	*Succinea* sp.	1	1
		Fill	10	1	3143	Whole shell	*Helisoma* sp.	1	1
		Fill	10	1	3143	Unworked fragment	*Trachycardium* sp.	1	1
		Floor fill	11	1	3143	Unworked fragment	*Anodonta californiensis*	5	1
Feature 3317 (activity surface): Cienega phase									
		Fill	50	1	3161	Unworked fragment	*Helisoma* sp.	6	1
Feature 3323 (pithouse): Cienega phase									
		Fill	10	1	3175	Cut pendant, bird	Unidentified marine bivalve	1	1

Table A.1. Continued.

Site Number/Excavation Area								
Prime Feature Identifier (Feature Type): Temporal Assignment								
RNA	Subfeature	Context	Stratum	Level	Unit	Artifact Form	Shell Species	Count	Minimum Number of Individuals
AZ BB:13:6 (ASM)/RNA 8B: Congress Street/Brickyard Loci (continued)									
Feature 3327 (pithouse): Cienega phase									
		Floor fill	11	2	3177	Whole shell	*Helisoma* sp.	1	1
	3327.02	Wall groove	30	1	3177	Unworked fragment	Unidentified marine bivalve	1	1
	3327.02	Wall groove	30	1	3177	Unworked fragment	*Helisoma* sp.	2	1
Feature 3332 (pithouse): Cienega phase									
		Subfloor fill	5	1	3166	Whole shell	*Crucibulum spinosum*	1	1
Feature 9168 (pithouse): Cienega phase									
		Fill	10	1	3125	Whole shell bead	*Olivella dama*	1	1
		Fill	10	1	3129	Whole shell	*Helisoma* sp.	1	1
		Floor fill	11	1	3129	Unworked fragment	*Helisoma* sp.	1	1
Feature 9357 (pithouse): Cienega phase									
		Roof/Wall fall	11	1	3117	Whole shell bead	*Theodoxus luteofasciatus*	1	1
AZ BB:13:6 (ASM)/RNA 11: Mission Gardens Locus									
Feature 0 (nonfeature excavation unit): unassigned									
		Unknown context	99			Plain bracelet	*Glycymeris gigantea*	1	1
Feature 3000 (southern wall): Spanish period									
		Unknown	99			Plain bracelet	*Glycymeris* sp.	1	1
		Unknown	99			Unworked fragment	Unidentified marine bivalve	1	1
Feature 3001 (extramural pit): Hohokam periods									
		Cultural overburden	4	1	3005	Unworked fragment	*Succinea* sp.	1	1
		Cultural overburden	4	1	3005	Unworked fragment	*Anodonta californiensis*	1	1

Table A.1. Continued.

Site Number/Excavation Area

Prime Feature Identifier (Feature Type): Temporal Assignment

RNA	Subfeature	Context	Stratum	Level	Unit	Artifact Form	Shell Species	Count	Minimum Number of Individuals
AZ BB:13:6 (ASM)/RNA 11: Mission Gardens Locus (continued)									
Feature 3006 (historic-era well): American Territorial period									
		Fill	50	2	3021	Plain bracelet	*Glycymeris* sp.	2	1
		Fill	50	3	3021	Unworked fragment	*Anodonta californiensis*	1	1
		Fill	50.01	2	3021	Unworked fragment	*Anodonta californiensis*	1	1
Feature 3026 (wall): Spanish period									
		Cultural overburden	4	1	3003	Whole shell bead	*Olivella dama*	1	1
Feature 3038 (pithouse): Late Agua Caliente phase									
		Fill	11	2	3025	Carved bracelet, snake	*Glycymeris* sp.	1	1
		Floor fill	11	2	3027	Plain bracelet	*Glycymeris* sp.	3	1
Feature 3067 (extramural pit): Hohokam periods									
		Fill	50	1	3005	Incised bracelet	*Glycymeris* sp.	1	1
		Fill	50	1	3017	Plain bracelet in process	*Glycymeris gigantea*	1	1
AZ BB:13:13 (ASM)/RNA 9: Tucson Museum of Art Area									
Feature 0 (nonfeature excavation unit): unassigned									
		Cultural overburden	4	2	200	Unworked fragment	*Anodonta californiensis*	1	1
		Cultural overburden	4.01	1	200	Whole shell bead	*Olivella dama*	1	1
		Cultural overburden	4.01	1	200	Unworked fragment	*Chione* sp.	1	1
		Cultural overburden	4.01	2	201	Unworked fragment	Unidentified marine univalve	1	1
		Cultural overburden	4.03	1	201	Unworked fragment	*Laevicardium elatum*	1	1
		Cultural overburden	4.03	1	201	Unworked fragment	*Trachycardium* sp.	3	1
		Cultural overburden	4.02	1	203	Whole shell bead	Unidentified marine univalve	1	1
		Cultural overburden	4.02	1	203	Unworked fragment	*Laevicardium elatum*	1	1
		Cultural overburden	4.02	1	203	Unworked fragment	*Trachycardium* sp.	1	1

Table A.1. Continued.

Site Number/Excavation Area

Prime Feature Identifier (Feature Type): Temporal Assignment

RNA	Subfeature	Context	Stratum	Level	Unit	Artifact Form	Shell Species	Count	Minimum Number of Individuals
AZ BB:13:13 (ASM)/RNA 9: Tucson Museum of Art Area (continued)									
Feature 0 (nonfeature excavation unit): unassigned (continued)									
		Cultural overburden	4.02	1	203	Unworked fragment	*Laevicardium elatum*	2	1
		Cultural overburden	4.01	2	205	Unworked fragment	Unidentified marine bivalve	1	1
		Cultural overburden	4.02	1	205	Unworked fragment	Unidentified marine bivalve	1	1
		Cultural overburden	4.01	2	206	Whole shell bead	*Olivella* sp.	1	1
		Cultural overburden	4.01	1	217	Unworked fragment	*Laevicardium elatum*	1	1
		Cultural overburden	4	2	221	Unworked fragment	Unidentified marine bivalve	1	1
		Cultural overburden	4.01	1	224	Unworked fragment	Unidentified nacreous shell	1	1
		Cultural overburden	4.02	1	224	Unworked fragment	*Laevicardium elenense*	3	1
		Cultural overburden	4.02	1	224	Unworked fragment	*Anodonta californiensis*	1	1
		Cultural overburden	4.01	2	229	Whole shell	*Helisoma* sp.	1	1
		Cultural overburden	4.01	2	229	Unworked fragment	*Dosinia* sp.	1	1
		Cultural overburden	4.01	2	229	Unworked fragment	*Protothaca* sp.	1	1
		Cultural overburden	4.02	1	348	Plain bracelet	*Glycymeris gigantea*	1	1
		Cultural overburden	4.02	3	348	Unworked fragment	*Protothaca grata*	2	1
		Cultural overburden	4.02	3	348	Unworked fragment	*Turritella leucostoma*	1	1
		Cultural overburden	4.02	3	348	Unworked fragment	*Anodonta californiensis*	2	1
		Cultural overburden	4.02	3	348	Unworked fragment	*Laevicardium elatum*	1	1
		Cultural overburden	4.03	1	348	Whole shell pendant	*Turritella leucostoma*	1	1
		Cultural overburden	4.03	1	348	Unworked fragment	*Anodonta californiensis*	1	1
		Cultural overburden	4.03	1	348	Unworked fragment	*Turbo* sp.	1	1
		Cultural overburden	4.03	1	348	Unworked fragment	*Trachycardium panamense*	1	1
		Cultural overburden	4.03	2	348	Unworked fragment	*Megapitaria* sp.	1	1
		Cultural overburden	4.03	2	348	Unworked fragment	*Anodonta californiensis*	2	2
		Cultural overburden	4.03	4	348	Unworked fragment	*Trachycardium panamense*	1	1

Table A.1. Continued.

Site Number/Excavation Area

Prime Feature Identifier (Feature Type): Temporal Assignment

RNA	Subfeature	Context	Stratum	Level	Unit	Artifact Form	Shell Species	Count	Minimum Number of Individuals
AZ BB:13:13 (ASM)/RNA 9: Tucson Museum of Art Area (continued)									
Feature 0 (nonfeature excavation unit): unassigned (continued)									
		Fill	34.01	1	348	Unworked fragment	*Argopecten circularis*	2	1
		Fill	34.01	1	348	Unworked fragment	Unidentified marine bivalve	2	1
		Fill	34.01	1	348	Unworked fragment	*Ostrea* sp.	2	1
Feature 310 (extramural pit): American periods									
		Fill	50	1	210	Whole shell	*Strombus granulatus*	1	1
Feature 314 (historic-era structure): American periods									
		Wall/Roof fall	11	2	214	Unworked fragment	*Anodonta californiensis*	5	2
		Floor fill	11	3	214	Unworked fragment	*Anodonta californiensis*	1	1
AZ BB:13:13 (ASM)/RNA 12: Tucson Presidio Site									
Feature 0 (nonfeature excavation unit)									
		Disturbed fill	80		250	Unworked fragment	*Ostrea* sp.	1	1
		Disturbed fill	80		260	Cut pendant, washer shape	*Laevicardium elatum*	1	1
		Cultural overburden	4	1	272	Unworked fragment	*Ostrea* sp.	1	1
		Cultural overburden	4	2	272	Geometric pendant in process	*Laevicardium elatum*	1	1
		Cultural overburden	4	2	272	Unworked fragment	*Trachycardium* sp.	1	1
		Cultural overburden	4	2	272	Unworked fragment	*Protothaca* sp.	1	1
		Cultural overburden	4	2	272	Unworked fragment	*Anodonta californiensis*	2	2
		Cultural overburden	4	2	272	Unworked fragment	*Ostrea* sp.	1	1
		Cultural overburden	4	3	272	Unworked fragment	*Anodonta californiensis*	2	2
		Cultural overburden	4.01	1	272	Unworked fragment	*Anodonta californiensis*	2	2
		Cultural overburden	4.02	1	272	Unworked fragment	*Lavecardium elenense*	1	1
		Cultural overburden	4.02	1	272	Unworked fragment	*Turritella leucostoma*	1	1

Table A.1. Continued.

Site Number/Excavation Area Prime Feature Identifier (Feature Type): Temporal Assignment RNA	Subfeature	Context	Stratum	Level	Unit	Artifact Form	Shell Species	Count	Minimum Number of Individuals
AZ BB:13:13 (ASM)/RNA 12: Tucson Presidio Site (continued)									
Feature 0 (nonfeature excavation unit) (continued)									
		Cultural overburden	4	1	281	Unworked fragment	*Ostrea* sp.	1	1
		Cultural overburden	4	2	281	Unworked fragment	*Ostrea* sp.	7	1
		Cultural overburden	4.01	1	281	Unworked fragment	*Ostrea* sp.	1	1
		Cultural overburden	4.01	1	281	Unworked fragment	Unidentified marine bivalve	1	1
		Cultural overburden	4.01	1	283	Unworked fragment	*Ostrea* sp.	1	1
		Cultural overburden	4	1	286	Plain bracelet	*Glycymeris* sp.	1	1
		Cultural overburden	4	1	291	Pendant, unknown form	*Pecten* sp.	1	1
		Cultural overburden	4	1	291	Unworked fragment	*Anodonta californiensis*	1	1
		Disturbed fill	80		299	Geometric pendant in process	*Laevicardium elatum*	1	1
		Disturbed fill	80		299	Unworked fragment	*Ostrea* sp.	1	1
		Cultural overburden	4	1	300	Unworked fragment	*Ostrea* sp.	2	1
		Cultural overburden	4	1	306	Whole shell bead	*Cerithium stercusmuscarum*	1	1
		Cultural overburden	4	1	317	Unworked fragment	*Ostrea* sp.	1	1
		Cultural overburden	4	1	318	Unworked fragment	Unidentified marine shell	1	1
		Cultural overburden	4	1	319	Unworked fragment	*Trachycardium panamense*	1	1
		Cultural overburden	4.01	1	319	Whole shell	*Turritella leucostoma*	2	2
		Cultural overburden	4.01	1	319	Unworked fragment	*Turritella leucostoma*	1	1
		Cultural overburden	4.01	1	320	Unworked fragment	*Ostrea* sp.	4	1
		Cultural overburden	4.01	2	320	Unworked fragment	*Dosinia* sp.	1	1
		Cultural overburden	4.01	2	320	Unworked fragment	*Ostrea* sp.	2	1
		Cultural overburden	4	1	321	Unworked fragment	*Anodonta californiensis*	1	1
		Cultural overburden	4.01	1	322	Unworked fragment	*Anodonta californiensis*	1	1
		Cultural overburden	4	1	328	Plain bracelet	*Glycymeris* sp.	1	1
		Cultural overburden	4.01	1	328	Unworked fragment	*Ostrea* sp.	1	1

Table A.1. Continued.

Site Number/Excavation Area									
Prime Feature Identifier (Feature Type): Temporal Assignment									
RNA	Subfeature	Context	Stratum	Level	Unit	Artifact Form	Shell Species	Count	Minimum Number of Individuals
AZ BB:13:13 (ASM)/RNA 12: Tucson Presidio Site (continued)									
Feature 0 (nonfeature excavation unit) (continued)									
		Cultural overburden	4.02	1	328	Unworked fragment	*Anodonta californiensis*	2	2
		Cultural overburden	4.02	2	328	Unworked fragment	*Trachycardium panamense*	1	1
		Cultural overburden	4.02	2	328	Unworked fragment	*Anodonta californiensis*	4	2
		Cultural overburden	4.02	2	328	Unworked fragment	*Chione* sp.	1	1
		Cultural overburden	4.02	3	328	Unworked fragment	*Chione* sp.	1	1
		Cultural overburden	4.02	4	328	Unworked fragment	*Trachycardium panamense*	1	1
		Cultural overburden	4	1	331	Plain bracelet	*Glycymeris gigantea*	1	1
		Cultural overburden	4	1	343	Unworked fragment	*Anodonta californiensis*	1	1
		Cultural overburden	4	1	343	Unworked fragment	*Ostrea* sp.	1	1
		Cultural overburden	4	1	344	Whole shell bead	*Olivella dama*	1	1
		Cultural overburden	4	2	382	Unworked fragment	*Ostrea* sp.	2	1
Feature 356/363 (two extramural pits): American Territorial period									
		Mixed fill	50	2	257	Whole shell pendant	*Argopecten circularis*	1	1
Feature 359 (extramural pit): American Territorial period									
		Fill	50	1	297	Unworked fragment	*Ostrea* sp.	12	5
		Fill	50	2	271	Plain bracelet	*Glycymeris gigantea*	1	1
Feature 360 (historic-era structure, privy): American Territorial period									
		Fill	50.02	1	262	Unworked fragment	*Ostrea* sp.	1	1
		Fill	50.02	4	262	Unworked fragment	*Ostrea* sp.	1	1
Feature 368 (ramada): American Territorial period									
	368.03	Pit	30	1	328	Unworked fragment	*Ostrea* sp.	1	1

Table A.1. Continued.

Site Number/Excavation Area Prime Feature Identifier (Feature Type): Temporal Assignment RNA	Subfeature	Context	Stratum	Level	Unit	Artifact Form	Shell Species	Count	Minimum Number of Individuals
AZ BB:13:13 (ASM)/RNA 12: Tucson Presidio Site (continued)									
Feature 372 (extramural pit): American Territorial period									
		Fill	50	1	279	Unworked fragment	Unidentified marine bivalve	2	2
Feature 373 (extramural pit): Spanish period									
		Fill	50	1	282	Unworked fragment	*Ostrea* sp.	1	1
		Fill	50	1	285	Unworked fragment	*Ostrea* sp.	2	1
		Fill	50	1	357	Whole shell bead	*Olivella* sp.	1	1
		Fill	50	1	357	Unworked fragment	*Ostrea* sp.	2	1
		Fill	50	1	357	Unworked fragment	*Anodonta californiensis*	1	1
		Fill	50	2	282	Unworked fragment	*Anodonta californiensis*	3	2
		Fill	50	2	357	Unworked fragment	*Anodonta californiensis*	2	1
Feature 376 (extramural pit): American Territorial period									
		Fill	50	1	290	Unworked fragment	*Laevicardium elatum*	2	2
		Fill	50	1	290	Unworked fragment	*Anodonta californiensis*	6	2
		Fill	50	1	353	Whole shell bead	*Columbella strombiformis*	1	1
		Fill	50	1	353	Unworked fragment	*Anodonta californiensis*	2	2
		Fill	50	2	290	Whole shell bead	*Couns perplexus*	1	1
		Fill	50	2	290	Plain ring pendant	*Glycymeris* sp.	1	1
		Fill	50	2	290	Unworked fragment	*Ostrea* sp.	2	1
		Fill	50	3	290	Unworked fragment	*Ostrea* sp.	4	2
		Fill	50	4	290	Unworked fragment	*Anodonta californiensis*	2	2
		Fill	50	4	290	Unworked fragment	*Laevicardium elatum*	1	1
		Fill	50	4	290	Unworked fragment	*Pecten vogdesi*	1	1
		Fill	50	4	290	Unworked fragment	*Ostrea* sp.	4	1
		Fill	50	5	281	Plain bracelet	*Glycymeris gigantea*	1	1

Table A.1. Continued.

Site Number/Excavation Area Prime Feature Identifier (Feature Type): Temporal Assignment RNA	Subfeature	Context	Stratum	Level	Unit	Artifact Form	Shell Species	Count	Minimum Number of Individuals
AZ BB:13:13 (ASM)/RNA 12: Tucson Presidio Site (continued)									
Feature 376 (extramural pit): American Territorial period (continued)									
		Fill	50	5	281	Unworked fragment	*Trachycardium panamense*	1	1
		Fill	50	5	281	Unworked fragment	*Anodonta californiensis*	1	1
		Fill	50	5	281	Unworked fragment	*Dosinia ponderosa*	1	1
		Fill	50.01	1	353	Unworked fragment	*Anodonta californiensis*	1	1
		Fill	50.03	1	353	Unworked fragment	*Anodonta californiensis*	1	1
		Fill	50.03	2	353	Unworked fragment	*Glycymeris gigantea*	1	1
		Fill	50.03	2	353	Unworked fragment	*Dosinia* sp.	1	1
		Fill	50.05	1	353	Unworked fragment	*Anodonta californiensis*	1	1
Feature 383 (extramural pit): American Territorial period									
		Fill	50	1	308	Unworked fragment	*Ostrea* sp.	1	1
Feature 385 (extramural pit): American Territorial period									
		Fill	50	1	300	Unworked fragment	*Ostrea* sp.	1	1
		Fill	50	1	309	Unworked fragment	*Anodonta californiensis*	1	1
		Fill	50	1	309	Unworked fragment	*Laevicardium elatum*	1	1
		Fill	50	2	303	Unworked fragment	*Anodonta californiensis*	1	1
		Fill	50.01	1	300	Unworked fragment	*Anodonta californiensis*	1	1
		Fill	50.01	1	300	Unworked fragment	Unidentified marine bivalve	1	1
Feature 394 (extramural hearth): American Territorial period									
		Fill	50	1	330	Unworked fragment	*Spisula* sp.	1	1
		Fill	50	1	330	Unworked fragment	Unidentified marine bivalve	2	2

Table A.1. Continued.

Site Number/Excavation Area Prime Feature Identifier (Feature Type): Temporal Assignment RNA	Subfeature	Context	Stratum	Level	Unit	Artifact Form	Shell Species	Count	Minimum Number of Individuals
AZ BB:13:13 (ASM)/RNA 12: Tucson Presidio Site (continued)									
Feature 398 (extramural pit): American Territorial period									
		Fill	50	1	335	Unworked fragment	*Chione* sp.	1	1
Feature 408 (historic-era structure, privy): American Territorial period									
		Fill	50	1	350	Plain bracelet	*Glycymeris gigantea*	1	1
		Fill	50	7	350	Unworked fragment	*Megapitaria* sp.	1	1
		Fill	50	7	350	Unworked fragment	*Ostrea* sp.	1	1
Feature 409 (extramural pit): American Territorial period									
		Fill	50	1	351	Unworked fragment	Unidentified marine bivalve	1	1
		Fill	50	2	351	Worked fragment, unknown form	*Anodonta californiensis*	1	1
		Fill	50	2	351	Unworked fragment	*Argopecten circularis*	1	1
		Fill	50	3	383	Unworked fragment	*Trachycardium* sp.	1	1
Feature 417 (pithouse): Hohokam Pioneer period									
		Fill	10	1	356	Plain bracelet	*Glycymeris gigantea*	1	1
Feature 437 (extramural pit): American Territorial period									
		Fill	50	3	384	Plain bracelet	*Glycymeris gigantea*	1	1
Feature 441 (extramural pit): Spanish period									
		Fill	50	1	385	Unworked fragment	Unidentified marine univalve	1	1
		Fill	50	2	385	Unworked fragment	*Anodonta californiensis*	1	1

Table A.1. Continued.

Site Number/Excavation Area Prime Feature Identifier (Feature Type): Temporal Assignment RNA	Subfeature	Context	Stratum	Level	Unit	Artifact Form	Shell Species	Count	Minimum Number of Individuals
AZ BB:13:481 (ASM)/RNA 2: San Agustín Mission Locus Canals									
Feature 9 (canal): Historic era									
		Fill	59	1	104	Whole shell	*Helisoma* sp.	2	2
		Fill	59	1	104	Unworked fragment	*Anodonta californiensis*	3	2
		Fill	59	1	87	Unworked fragment	*Anodonta californiensis*	1	1
		Fill	59	1	90	Whole shell	*Helisoma* sp.	19	19
		Fill	59	1	90	Unworked fragment	*Anodonta californiensis*	5	2
		Fill	59	1	96	Whole shell	*Physa virgata*	2	2
		Fill	59	1	96	Whole shell	*Helisoma* sp.	19	19
		Fill	59	1	96	Unworked fragment	*Anodonta californiensis*	7	3
		Fill	59	1	96	Unworked fragment	*Helisoma* sp.	7	3
Feature 53 (canal): Early Agricultural period									
		Fill	59	1	112	Unworked fragment	*Anodonta californiensis*	2	1
AZ BB:13:481 (ASM)/RNA 8A & 8B2: Congress Street/Brickyard Loci Canals									
Feature 138 (canal): Historic era									
		Fill	59	1	143	Whole shell bead	*Olivella* sp.	1	1
		Fill	59	1	143	Whole shell pendant	*Turritella* sp.	1	1
		Fill	59	1	143	Whole shell	*Helisoma* sp.	95	89
		Fill	59	1	143	Whole shell	*Succinea* sp.	1	1
		Fill	59	1	143	Whole shell	*Physa virgata*	1	1
		Fill	59	1	143	Unworked fragment	*Anodonta californiensis*	8	2
Feature 139 (canal): Early Agricultural period									
		Fill	59	2	439	Whole shell	*Helisoma* sp.	1	1

Table A.1. Continued.

Site Number/Excavation Area Prime Feature Identifier (Feature Type): Temporal Assignment									
RNA	Subfeature	Context	Stratum	Level	Unit	Artifact Form	Shell Species	Count	Minimum Number of Individuals
AZ BB:13:481 (ASM)/RNA 8A & 8B2: Congress Street/Brickyard Loci Canals (continued)									
Feature 144 (canal): Hohokam periods									
		Fill	59			Cut pendant, unknown form in process	*Laevicardium elatum*	1	1
AZ BB:13:481 (ASM)/RNA 11: Mission Gardens Locus Canal									
Feature 201 (canal): Protohistoric period									
		Fill	59	1	3500	Plain bracelet	*Glycymeris gigantea*	1	1
		Fill	59	1	3500	Unworked fragment	*Anodonta californiensis*	8	2

APPENDIX B

SUPPLEMENTARY DATA ON RIO NUEVO PROJECT MACROBOTANICAL SAMPLES

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Table B.1. General characteristics of Rio Nuevo project flotation samples.

AZ (ASM) Site Number	Feature Number	FN	Volume (liters)	Weight (gm)	Uncharred Seeds	Insect Fragments	Gastropod Shells
BB:13:13	301	1620	5.5	9.8	0	1-50	0
BB:13:13	303	1737	4.0	39.7	0	0	0
BB:13:13	304	1735	2.0	24.6	0	0	0
BB:13:13	305	1736	5.0	36.5	0	0	0
BB:13:13	310	1738	5.0	12.9	0	0	0
BB:13:13	314	1705	4.0	3.8	0	0	0
BB:13:13	314	1722	4.0	4.6	0	0	0
BB:13:13	314	1723	5.0	9.5	0	0	0
BB:13:13	314	1825	5.0	5.1	1-50	0	0
BB:13:13	317	1721	5.0	8.8	0	0	1-50
BB:13:13	321	1888	5.0	6.4	0	0	0
BB:13:13	327	1937	4.0	7.7	0	0	0
BB:13:13	350.02	2006	16.0	41.3	0	0	1-50
BB:13:13	350.05	2648	14.0	70.2	0	0	0
BB:13:13	354	2502	No data	17.5	0	0	1-50
BB:13:13	356	2016	5.0	17.0	0	1-50	1-50
BB:13:13	356	2023	4.0	8.7	0	0	0
BB:13:13	357	2044	5.5	22.2	0	0	0
BB:13:13	357	2070	4.0	6.6	0	0	0
BB:13:13	359	2141	3.0	22.4	0	0	0
BB:13:13	359	2142	4.5	10.5	0	0	0
BB:13:13	359	2685	5.0	35.1	0	0	0
BB:13:13	360	2140	4.0	12.6	0	1-50	0
BB:13:13	360	2204	3.5	17.2	0	0	0
BB:13:13	360	3008	6.0	17.5	0	0	0
BB:13:13	361	2079	2.5	47.4	0	0	0
BB:13:13	363	2096	5.0	3.0	0	0	1-50
BB:13:13	364	2115	5.0	4.7	0	0	0
BB:13:13	364	2121	6.0	14.9	0	0	0
BB:13:13	365	2166	3.0	3.5	0	0	0
BB:13:13	371	2436	9.5	21.9	0	0	0
BB:13:13	372	2348	3.5	27.7	0	0	1-50
BB:13:13	373	2373	No data	6.8	0	0	0
BB:13:13	373	2448	5.5	26.0	0	0	0
BB:13:13	373	2458	4.5	12.1	0	0	0
BB:13:13	373	3958	4.5	28.7	0	0	0
BB:13:13	375.03	2511	No data	4.3	0	0	0
BB:13:13	376	2514	1.0	26.9	0	0	0
BB:13:13	376	2579	4.0	13.8	0	0	0
BB:13:13	376	2609	5.5	38.8	0	0	0
BB:13:13	376	2645	6.0	37.7	0	0	0
BB:13:13	376	2947	5.5	13.3	0	0	0
BB:13:13	380	2776	No data	9.4	0	0	0
BB:13:13	380	2779	6.0	8.7	0	0	0
BB:13:13	380	2783	6.5	8.6	0	0	0
BB:13:13	380	2787	6.5	7.0	0	0	0
BB:13:13	380	3132	4.5	23.1	0	0	1-50

Table B.1. Continued.

AZ (ASM) Site Number	Feature Number	FN	Volume (liters)	Weight (gm)	Uncharred Seeds	Insect Fragments	Gastropod Shells
BB:13:13	380	3135	16.0	30.2	0	0	0
BB:13:13	382	2742	6.0	16.4	0	0	0
BB:13:13	385	2888	6.0	9.8	0	0	0
BB:13:13	385	2968	No data	20.9	0	0	0
BB:13:13	385	3028	No data	12.9	0	0	0
BB:13:13	385	3206	5.0	24.3	0	0	0
BB:13:13	394	3235	6.0	37.6	0	0	0
BB:13:13	396	3334	4.5	33.4	0	0	0
BB:13:13	406	3522	6.0	14.5	0	0	0
BB:13:13	408	3675	5.0	49.2	0	0	1-50
BB:13:13	408	4320	4.5	53.0	0	0	0
BB:13:13	408	4400	6.0	18.7	0	0	0
BB:13:13	409	4097	12.0	65.4	0	0	0
BB:13:13	409	4119	4.5	47.9	0	0	0
BB:13:13	412	3974	4.5	10.2	0	0	0
BB:13:13	416	3959	5.0	8.3	0	0	0
BB:13:13	417	3992	5.5	36.3	0	0	0
BB:13:13	417	3998	5.5	8.2	0	1-50	0
BB:13:13	417	4067	5.5	6.3	0	0	0
BB:13:13	420	4030	11.0	51.1	0	0	0
BB:13:13	422	4043	8.0	41.6	0	0	0
BB:13:13	423	4042	5.0	12.0	0	0	0
BB:13:13	430	4082	6.0	23.0	0	0	0
BB:13:13	441	4287	3.0	9.8	0	0	0
BB:13:481	141	6693	7.0	10.2	0	0	1-50
BB:13:6	0	7567	14.0	12.2	0	0	0
BB:13:6	4	5089	4.5	177.6	0	1-50	0
BB:13:6	4	5252	5.5	74.6	0	1-50	1-50
BB:13:6	4	5360	4.5	27.8	0	0	0
BB:13:6	4	5405	5.0	37.4	0	0	1-50
BB:13:6	4	5464	5.0	28.5	0	1-50	1-50
BB:13:6	4	6306	5.0	37.7	0	1-50	1-50
BB:13:6	4	6371	4.5	48.6	0	0	0
BB:13:6	4	6424	6.0	40.3	0	1-50	1-50
BB:13:6	4	6546	5.0	32.1	0	0	0
BB:13:6	7	5724	4.5	7.1	0	0	0
BB:13:6	13	5698	5.0	8.4	0	0	1-50
BB:13:6	13	5821	5.0	11.8	0	0	1-50
BB:13:6	15	5768	6.0	8.5	0	0	1-50
BB:13:6	15	5855	6.0	11.6	0	0	1-50
BB:13:6	17	5968	4.5	7.1	0	0	0
BB:13:6	20	6791	6.0	10.7	0	0	0
BB:13:6	28	6682	7.0	28.7	0	0	1-50
BB:13:6	29	5582	4.5	2.9	0	0	1-50
BB:13:6	29	5691	5.0	2.4	0	0	1-50
BB:13:6	30	5673	6.0	11.9	0	0	0
BB:13:6	32.01	5840	4.0	7.3	0	0	0

Table B.1. Continued.

AZ (ASM) Site Number	Feature Number	FN	Volume (liters)	Weight (gm)	Uncharred Seeds	Insect Fragments	Gastropod Shells
BB:13:6	32.01	5844	3.5	6.6	0	0	1-50
BB:13:6	32.01	5845	3.5	4.3	0	0	0
BB:13:6	57	6170	5.0	9.6	0	0	0
BB:13:6	57	6174	6.0	15.3	0	0	1-50
BB:13:6	57.01	6182	1.5	0.7	0	0	0
BB:13:6	61	5975	5.0	210.0	0	0	0
BB:13:6	61	6026	5.5	311.3	0	0	0
BB:13:6	64	6250	5.0	25.6	0	0	1-50
BB:13:6	65	6115	4.0	15.7	0	0	1-50
BB:13:6	65	6232	3.5	9.6	0	0	1-50
BB:13:6	65.01	6188	4.0	6.4	0	0	1-50
BB:13:6	65.01	6192	5.0	17.1	0	0	0
BB:13:6	69	6199	5.0	8.7	0	0	1-50
BB:13:6	69	6270	4.5	10.8	0	0	0
BB:13:6	69	6292	5.0	10.9	0	0	0
BB:13:6	70	6788	4.0	4.1	0	0	0
BB:13:6	71	5907	5.0	10.5	0	0	0
BB:13:6	73	6255	5.5	13.7	0	0	0
BB:13:6	76	6728	5.3	3.2	0	0	0
BB:13:6	77	6078	5.0	17.1	0	0	1-50
BB:13:6	79	6143	5.0	6.6	0	0	1-50
BB:13:6	81	6254	6.0	6.9	0	0	1-50
BB:13:6	82	6253	5.0	5.9	0	0	1-50
BB:13:6	86	6266	5.0	2.6	1-50	0	0
BB:13:6	100	6132	5.5	9.3	0	0	0
BB:13:6	110	6336	6.0	17.0	0	0	0
BB:13:6	112	6054	5.5	13.4	0	0	0
BB:13:6	112	6068	6.0	44.6	101-500	0	0
BB:13:6	112	6125	6.0	38.5	0	0	1-50
BB:13:6	122	6127	5.5	48.3	0	1-50	0
BB:13:6	125	6145	2.0	1.2	0	0	0
BB:13:6	126	6528	5.0	9.6	0	0	0
BB:13:6	126.03	6377	4.0	5.8	0	0	1-50
BB:13:6	128	6579	5.0	20.8	0	0	0
BB:13:6	151	6479	5.5	15.6	0	0	0
BB:13:6	161	6530	5.8	21.0	0	0	1-50
BB:13:6	166	6663	4.0	39.5	0	1-50	1-50
BB:13:6	166	6696	5.5	35.6	0	0	0
BB:13:6	177	6560	3.5	32.7	0	0	0
BB:13:6	177	6562	5.0	27.4	0	0	1-50
BB:13:6	178	6512	5.5	44.5	1-50	0	0
BB:13:6	178	6524	6.0	96.7	0	0	0
BB:13:6	193	6634	4.5	640.0	0	0	0
BB:13:6	203	6614	4.5	33.5	0	0	0
BB:13:6	308	6894	4.0	13.8	0	0	0
BB:13:6	308	6915	4.0	13.1	0	0	0
BB:13:6	308	6997	4.5	1.3	0	0	0

Table B.1. Continued.

AZ (ASM) Site Number	Feature Number	FN	Volume (liters)	Weight (gm)	Uncharred Seeds	Insect Fragments	Gastropod Shells
BB:13:6	308	7004	4.5	7.1	0	0	1-50
BB:13:6	308.02	7063	12.0	16.3	1-50	0	1-50
BB:13:6	308.06	7077	2.0	26.3	0	0	1-50
BB:13:6	506	6806	4.0	24.2	0	0	0
BB:13:6	506	6870	5.5	13.7	0	0	0
BB:13:6	506	6875	4.5	4.8	0	0	0
BB:13:6	506	6876	5.0	3.1	0	0	0
BB:13:6	510	6907	5.0	11.1	0	0	0
BB:13:6	511	7028	4.0	2.4	0	0	0
BB:13:6	511	7059	5.0	4.1	0	0	0
BB:13:6	511.01	7085	6.5	34.4	0	1-50	1-50
BB:13:6	511.05	7090	5.8	14.4	0	0	0
BB:13:6	516	6922	5.5	17.3	0	0	0
BB:13:6	516	6925	9.0	25.6	0	1-50	0
BB:13:6	516	6928	12.5	23.7	0	0	0
BB:13:6	516	7528	11.0	31.9	0	0	0
BB:13:6	516	7531	10.0	4.9	0	0	0
BB:13:6	516	7533	9.0	18.1	0	0	0
BB:13:6	529	7038	4.3	16.6	0	0	0
BB:13:6	529	7039	6.0	14.6	0	0	1-50
BB:13:6	529	7040	4.0	5.1	0	0	0
BB:13:6	540	6965	5.0	1.0	0	0	0
BB:13:6	541	6964	4.0	0.7	0	1-50	0
BB:13:6	544	7013	6.5	8.5	0	0	0
BB:13:6	546	6972	5.0	147.0	0	0	0
BB:13:6	547	6976	3.0	54.3	0	0	0
BB:13:6	547	6981	5.5	2.9	0	0	0
BB:13:6	547	6992	4.0	3.6	0	0	0
BB:13:6	548	7037	4.5	12.5	0	0	0
BB:13:6	572	7247	26.0	27.2	0	0	0
BB:13:6	572	7485	14.5	494.6	0	0	0
BB:13:6	576	7352	13.0	11.3	0	0	0
BB:13:6	579	7540	12.0	2.0	0	1-50	0
BB:13:6	580	7434	9.8	14.9	0	1-50	0
BB:13:6	580.01	7435	9.5	102.8	0	0	0
BB:13:6	580.01	7436	5.0	5.9	0	0	0
BB:13:6	581	7215	23.5	44.4	0	0	1-50
BB:13:6	581	7443	24.0	56.7	0	0	0
BB:13:6	581	7488	8.0	236.7	0	0	0
BB:13:6	584	7495	11.0	161.6	0	0	0
BB:13:6	592	7542	3.5	6.5	0	0	0
BB:13:6	593	7534	13.0	12.9	0	0	0
BB:13:6	595	7513	10.5	4.3	0	0	0
BB:13:6	601	7535	11.0	8.9	0	0	0
BB:13:6	608	7624	6.0	4.7	0	0	0
BB:13:6	624	7651	10.0	2.4	0	0	0
BB:13:6	626	7666	11.0	6.2	0	1-50	0

Table B.1. Continued.

AZ (ASM) Site Number	Feature Number	FN	Volume (liters)	Weight (gm)	Uncharred Seeds	Insect Fragments	Gastropod Shells
BB:13:6	628	7657	10.0	835.0	0	0	0
BB:13:6	629	7667	12.0	14.3	0	0	0
BB:13:6	630	7640	9.0	12.5	0	0	0
BB:13:6	632	7660	11.0	9.0	0	0	0
BB:13:6	3001	7828	5.0	12.4	0	0	0
BB:13:6	3001	7832	5.0	8.9	0	0	1-50
BB:13:6	3005	8051	6.5	14.6	0	0	1-50
BB:13:6	3005	8059	7.0	11.4	1-50	0	1-50
BB:13:6	3005	8063	7.0	10.3	0	0	0
BB:13:6	3006	8023	5.0	8.9	0	0	1-50
BB:13:6	3006	8065	5.5	9.3	1-50	0	1-50
BB:13:6	3006	8089	6.0	9.0	1-50	0	1-50
BB:13:6	3006	8100	5.0	7.4	1-50	0	1-50
BB:13:6	3006	8117	5.0	4.9	1-50	0	1-50
BB:13:6	3006	8136	4.5	7.0	1-50	0	1-50
BB:13:6	3014	7833	6.0	18.7	0	0	1-50
BB:13:6	3014	7843	6.5	16.4	0	0	1-50
BB:13:6	3014	7858	14.0	52.0	0	0	0
BB:13:6	3014	8175	1.5	17.6	0	0	1-50
BB:13:6	3014	8182	6.5	39.6	0	0	0
BB:13:6	3014.02	8202	2.0	4.9	0	0	0
BB:13:6	3024	8024	10.0	136.2	0	0	0
BB:13:6	3024	8032	9.0	118.4	51-100	0	1-50
BB:13:6	3024	8039	8.5	546.0	51-100	0	1-50
BB:13:6	3038	8105	5.0	12.6	1-50	0	1-50
BB:13:6	3038	8118	5.0	6.7	1-50	0	1-50
BB:13:6	3038	8187	12.5	18.2	0	0	1-50
BB:13:6	3038.02	8229	9.0	12.8	0	0	0
BB:13:6	3038.03	8228	6.0	9.2	0	0	0
BB:13:6	3067	7808	6.0	13.3	0	0	0
BB:13:6	3072	7860	5.0	7.8	0	0	0
BB:13:6	3083	8216	4.0	9.3	0	0	0
BB:13:6	3083.01	8244	6.0	62.7	0	0	0
BB:13:6	3105	8270	0.5	0.4	0	0	0
BB:13:6	3220	8372	10.5	6.0	1-50	1-50	1-50
BB:13:6	3220	8378	4.0	0.6	0	0	0
BB:13:6	3223	8339	6.0	3.0	1-50	1-50	1-50
BB:13:6	3229	9182	5.0	5.4	0	0	0
BB:13:6	3242	9213	4.5	5.7	0	0	1-50
BB:13:6	3245.03	8527	4.5	1.3	0	0	0
BB:13:6	3248	8710	4.0	2.8	1-50	0	0
BB:13:6	3253	8639	1.5	1.7	0	0	0
BB:13:6	3260	8591	6.0	13.9	0	0	0
BB:13:6	3260.01	8615	4.0	1.5	1-50	0	0
BB:13:6	3262	8571	4.0	0.7	0	0	0
BB:13:6	3262	8621	4.5	4.2	0	0	0
BB:13:6	3262	8625	5.5	2.6	0	0	1-50

Table B.1. Continued.

AZ (ASM) Site Number	Feature Number	FN	Volume (liters)	Weight (gm)	Uncharred Seeds	Insect Fragments	Gastropod Shells
BB:13:6	3262	8630	5.0	2.1	0	0	1-50
BB:13:6	3264	8556	6.0	2.4	0	0	0
BB:13:6	3264	8582	6.0	2.5	0	0	0
BB:13:6	3264	8616	4.5	1.5	0	0	0
BB:13:6	3270	8576	4.0	1.7	0	1-50	1-50
BB:13:6	3270	8759	5.5	1.7	0	0	1-50
BB:13:6	3270.02	8889	5.0	3.6	0	0	0
BB:13:6	3270.02	8897	9.5	8.8	0	1-50	0
BB:13:6	3270.02	8906	6.0	1.2	0	1-50	1-50
BB:13:6	3270.04	8907	5.5	1.4	0	0	0
BB:13:6	3270.05	8977	4.5	2.2	0	0	0
BB:13:6	3272	8648	5.5	3.9	0	0	1-50
BB:13:6	3272	8649	6.0	7.4	0	0	1-50
BB:13:6	3273	8838	5.0	1.6	0	0	0
BB:13:6	3273	8843	6.0	3.4	0	0	0
BB:13:6	3273.01	8859	6.5	1.3	0	0	1-50
BB:13:6	3274	8827	5.5	4.3	0	0	1-50
BB:13:6	3274	8839	5.0	1.9	1-50	1-50	1-50
BB:13:6	3285	9091	4.0	3.9	0	0	0
BB:13:6	3287	8705	3.5	1.9	0	0	1-50
BB:13:6	3289	8704	5.0	1.1	0	1-50	1-50
BB:13:6	3293	8721	5.0	12.6	0	0	0
BB:13:6	3293	8741	6.0	4.6	0	0	0
BB:13:6	3293	8749	7.5	4.2	0	0	0
BB:13:6	3293	8752	6.0	4.6	0	0	0
BB:13:6	3293.01	8767	2.5	0.6	0	0	1-50
BB:13:6	3294	8778	4.0	0.8	0	0	0
BB:13:6	3295	8882	5.5	4.4	0	0	1-50
BB:13:6	3300.02	9038	4.0	5.1	0	0	0
BB:13:6	3308	9156	6.0	3.8	0	0	0
BB:13:6	3308	9170	5.0	12.8	1-50	1-50	1-50
BB:13:6	3313	8960	4.0	2.7	0	0	1-50
BB:13:6	3316	8993	7.0	2.0	0	1-50	1-50
BB:13:6	3318	8973	5.0	1.3	0	1-50	1-50
BB:13:6	3320	9006	5.5	5.5	0	0	1-50
BB:13:6	3323	9103	5.0	7.4	0	0	0
BB:13:6	3325.01	9226	3.0	1.6	0	0	1-50
BB:13:6	3325.01	9230	5.5	5.3	0	0	0
BB:13:6	3327	9058	4.0	2.8	0	1-50	1-50
BB:13:6	3327	9110	5.0	5.9	1-50	0	0
BB:13:6	3327	9128	5.0	6.7	0	0	1-50
BB:13:6	3327.03	9178	4.0	3.2	0	0	1-50
BB:13:6	3327.04	9179	4.5	3.7	0	0	1-50
BB:13:6	3328	8995	5.5	1.7	0	0	1-50
BB:13:6	3331	9076	5.0	5.9	0	0	0
BB:13:6	3332	9003	4.0	0.8	0	0	1-50
BB:13:6	3336	9054	5.0	6.6	0	0	0

Table B.1. Continued.

AZ (ASM) Site Number	Feature Number	FN	Volume (liters)	Weight (gm)	Uncharred Seeds	Insect Fragments	Gastropod Shells
BB:13:6	3358	9184	2.0	1.7	0	0	0
BB:13:6	3359	9205	11.0	4.3	0	0	0
BB:13:6	3359	9231	8.5	3.3	0	0	0
BB:13:6	3371.01	9303	6.0	14.1	0	0	0
BB:13:6	3374	9288	3.8	9.1	0	0	1-50
BB:13:6	9168	8554	6.0	2.1	1-50	0	0
BB:13:6	9168	8585	9.0	2.3	0	0	0
BB:13:6	9168	8620	5.5	2.5	0	0	1-50
BB:13:6	9168.02	8640	3.5	1.1	0	0	0
BB:13:6	9357	8351	5.0	1.2	0	0	0
BB:13:6	9357	8365	5.5	4.0	0	1-50	1-50
BB:13:6	9357	8369	6.5	4.5	0	0	0
BB:13:6	9357	8388	5.0	3.8	0	0	1-50
BB:13:6	9357	8389	4.0	5.0	0	0	0
BB:13:6	9357	8396	4.0	6.9	0	0	1-50
BB:13:6	9357	8425	6.0	2.9	0	1-50	1-50
BB:13:6	9357	8444	6.5	3.4	0	1-50	0
BB:13:6	9357	8457	6.0	3.2	0	0	1-50
BB:13:6	9357	8466	4.5	2.6	0	0	1-50
BB:13:6	9357	8489	5.0	2.3	0	0	0
BB:13:6	9357	8491	6.0	2.0	1-50	0	1-50
BB:13:6	9357.01	8515	4.0	1.1	0	0	0
BB:13:6	9357.01	8516	5.5	1.8	51-100	0	0
BB:13:6	9372	8420	4.5	4.5	0	0	0
BB:13:6	9372	8450	5.0	2.4	0	0	0

Table B.2. Frequencies of charred seeds and propagules in Rio Nuevo project flotation samples.

AZ (ASM) Site Number	Feature Number	FN	*Trianthema* sp.	*Amaranthus* sp.	*Rhus* sp.	Cactaceae	*Carnegiea gigantea*	*Echinocereus* sp.	*Opuntia* sp.	Cheno-am	*Chenopodium* sp.	*Cycloloma* sp.	*Polansia* sp.	Compositae	*Helianthus* sp.	Cruciferae	*Descurainia* sp.	*Brassica* sp.	*Sinapis alba*	*Cucurbita* sp.	*C. pepo*	*Citrullus lanatus*	*Juniperus* sp.	Cyperaceae	*Arctostaphylos* sp.	Gramineae
BB:13:13	301.00	1620	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
BB:13:13	303.00	1737	0	0	0	0	5	0	0	0	133	0	0	0	1	0	0	9	0	0	0	0	0	27	4	0
BB:13:13	304.00	1735	0	0	0	0	3	0	0	0	90	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
BB:13:13	305.00	1736	0	0	0	8	20	5	2	7	115	0	7	0	0	0	0	0	0	0	0	0	0	11	0	2
BB:13:13	310.00	1738	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	314.00	1722	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
BB:13:13	314.00	1723	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
BB:13:13	314.00	1825	0	1	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
BB:13:13	317.00	1721	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	321.00	1888	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
BB:13:13	350.02	2006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	350.05	2648	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
BB:13:13	354.00	2502	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	357.00	2070	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	359.00	2141	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
BB:13:13	360.00	2140	0	0	0	0	0	0	0	0	3	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	360.00	2204	10	0	0	0	0	0	0	0	77	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	360.00	3008	7	0	0	0	0	0	0	0	51	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	361.00	2079	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	364.00	2115	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	364.00	2121	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	3
BB:13:13	365.00	2166	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	371.00	2436	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	372.00	2348	2	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table B.2. Continued.

AZ (ASM) Site Number	Feature Number	FN	*Agreostis/ Muhlenbergia* Type	*Hordeum* cf. *pusillum*	*Panicum* sp.	*Sporobolus* sp.	*Triticum* sp.	*Zea mays*	*Avena sativa*	Labiatae	Leguminosae	*Phaseolus vulgaris*	*Prosopis juliflora*	*Trifolium* sp.	*Melia azederach*	*Polygonum* sp.	*Rumex* sp.	*Portulaca* sp.	*Rubus* sp.	*Malus* sp.	*Capsicum* sp.	cf. *Nicotiana* sp.	*Solanum* or *Physalis* Type	*Vitis vinifera*	Unidentified
BB:13:13	301.00	1620	0	0	0	0	0	0	0	0	0	0	8	0	0	1	0	0	0	0	0	0	0	0	0
BB:13:13	303.00	1737	4	1	0	0	47	2	0	0	103	0	0	0	0	0	1	9	0	0	0	0	2	0	135
BB:13:13	304.00	1735	0	1	0	0	88	4	0	180	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
BB:13:13	305.00	1736	0	0	1	0	3	3	0	60	0	0	1	2	0	0	0	55	0	0	3	0	133	0	3
BB:13:13	310.00	1738	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
BB:13:13	314.00	1722	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	314.00	1723	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	314.00	1825	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
BB:13:13	317.00	1721	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	321.00	1888	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	350.02	2006	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	350.05	2648	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	354.00	2502	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
BB:13:13	357.00	2070	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	359.00	2141	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	360.00	2140	0	0	0	0	1	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	7	0	0
BB:13:13	360.00	2204	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0
BB:13:13	360.00	3008	0	0	0	0	1	2	0	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0
BB:13:13	361.00	2079	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	364.00	2115	0	0	0	0	0	0	0	1	4	0	0	0	0	0	0	0	1	0	0	0	0	0	2
BB:13:13	364.00	2121	0	0	0	0	0	0	0	3	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0
BB:13:13	365.00	2166	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	371.00	2436	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	372.00	2348	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	6	0	0	0	0	0	0

Table B.2. Continued.

AZ (ASM) Site Number	Feature Number	FN	*Trianthema* sp.	*Amaranthus* sp.	*Rhus* sp.	Cactaceae	*Carnegiea gigantea*	*Echinocereus* sp.	*Opuntia* sp.	Cheno-am	*Chenopodium* sp.	*Cycloloma* sp.	*Polansia* sp.	Compositae	*Helianthus* sp.	Cruciferae	*Descurainia* sp.	*Brassica* sp.	*Sinapis alba*	*Cucurbita* sp.	*C. pepo*	*Citrullus lanatus*	*Juniperus* sp.	Cyperaceae	*Arctostaphylos* sp.	Gramineae
BB:13:13	373.00	2373	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	373.00	2448	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	373.00	2458	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
BB:13:13	373.00	3940	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	373.00	3958	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	375.03	2511	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
BB:13:13	376.00	2579	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	376.00	2645	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0
BB:13:13	376.00	2947	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	380.00	2776	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	380.00	2779	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	380.00	2787	0	0	0	0	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	380.00	3132	0	0	0	0	0	2	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	380.00	3135	1	1	0	0	0	4	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
BB:13:13	382.00	2742	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	385.00	2888	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	396.00	3334	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	406.00	3522	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	408.00	3675	172	0	0	0	0	0	0	0	559	0	0	12	0	0	0	0	0	0	0	0	0	0	0	10
BB:13:13	408.00	4320	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	408.00	4400	6	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0
BB:13:13	409.00	4097	0	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	409.00	4119	2	0	0	0	1	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	416.00	3959	2	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table B.2. Continued.

AZ (ASM) Site Number	Feature Number	FN	*Agreostis/ Muhlenbergia* Type	*Hordeum* cf. *pusillum*	*Panicum* sp.	*Sporobolus* sp.	*Triticum* sp.	*Zea mays*	*Avena sativa*	Labiatae	Leguminosae	*Phaseolus vulgaris*	*Prosopis juliflora*	*Trifolium* sp.	*Melia azederach*	*Polygonum* sp.	*Rumex* sp.	*Portulaca* sp.	*Rubus* sp.	*Malus* sp.	*Capsicum* sp.	cf. *Nicotiana* sp.	*Solanum* or *Physalis* Type	*Vitis vinifera*	Unidentified
BB:13:13	373.00	2373	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	373.00	2448	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	373.00	2458	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	373.00	3940	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	373.00	3958	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	375.03	2511	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	376.00	2579	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	376.00	2645	0	0	0	0	0	6	0	1	0	0	0	0	0	0	0	9	0	0	1	0	0	0	0
BB:13:13	376.00	2947	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	380.00	2776	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	380.00	2779	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	380.00	2787	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	380.00	3132	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	380.00	3135	0	0	0	0	0	3	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	382.00	2742	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
BB:13:13	385.00	2888	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	396.00	3334	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	406.00	3522	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	408.00	3675	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
BB:13:13	408.00	4320	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	408.00	4400	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	40	0	0	0	0	0	2
BB:13:13	409.00	4097	0	0	0	0	13	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	121	0	0
BB:13:13	409.00	4119	0	0	0	0	3	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	416.00	3959	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table B.2. Continued.

AZ (ASM) Site Number	Feature Number	FN	*Trianthema* sp.	*Amaranthus* sp.	*Rhus* sp.	Cactaceae	*Carnegiea gigantea*	*Echinocereus* sp.	*Opuntia* sp.	Cheno-am	*Chenopodium* sp.	*Cycloloma* sp.	*Polansia* sp.	Compositae	*Helianthus* sp.	Cruciferae	*Descurainia* sp.	*Brassica* sp.	*Sinapis alba*	*Cucurbita* sp.	*C. pepo*	*Citrullus lanatus*	*Juniperus* sp.	Cyperaceae	*Arctostaphylos* sp.	Gramineae
BB:13:13	417.00	3992	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	417.00	3998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
BB:13:13	420.00	4030	0	0	0	2	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	422.00	4043	126	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	423.00	4042	0	0	0	0	5	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:481	141.00	6693	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	4.00	5089	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0
BB:13:6	4.00	5252	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0
BB:13:6	4.00	5360	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0
BB:13:6	4.00	5405	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	2	0	0	0	0
BB:13:6	4.00	5464	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1
BB:13:6	4.00	6306	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	4.00	6371	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	4.00	6424	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
BB:13:6	4.00	6546	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	7.00	5724	0	0	0	0	0	1	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	13.00	5698	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	13.00	5821	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	15.00	5855	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	15.00	6001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	17.00	5968	0	0	0	0	0	0	0	0	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	28.00	6682	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	29.00	5582	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table B.2. Continued.

AZ (ASM) Site Number	Feature Number	FN	*Agrostis/ Muhlenbergia* Type	*Hordeum* cf. *pusillum*	*Panicum* sp.	*Sporobolus* sp.	*Triticum* sp.	*Zea mays*	*Avena sativa*	Labiatae	Leguminosae	*Phaseolus vulgaris*	*Prosopis juliflora*	*Trifolium* sp.	*Melia azederach*	*Polygonum* sp.	*Rumex* sp.	*Portulaca* sp.	*Rubus* sp.	*Malus* sp.	*Capsicum* sp.	cf. *Nicotiana* sp.	*Solanum* or *Physalis* Type	*Vitis vinifera*	Unidentified
BB:13:13	417.00	3992	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:13	417.00	3998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
BB:13:13	420.00	4030	0	0	0	0	6	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
BB:13:13	422.00	4043	0	0	0	0	5	7	0	0	0	1	0	0	0	0	0	0	0	5	6	0	0	0	0
BB:13:13	423.00	4042	0	0	0	0	3	6	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
BB:13:481	141.00	6693	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	4.00	5089	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	4.00	5252	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	4.00	5360	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	4.00	5405	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	4.00	5464	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	4.00	6306	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
BB:13:6	4.00	6371	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	4.00	6424	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
BB:13:6	4.00	6546	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	7.00	5724	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	13.00	5698	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	13.00	5821	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	15.00	5855	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	15.00	6001	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	17.00	5968	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	28.00	6682	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	29.00	5582	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table B.2. Continued.

AZ (ASM) Site Number	Feature Number	FN	*Trianthema* sp.	*Amaranthus* sp.	*Rhus* sp.	Cactaceae	*Carnegiea gigantea*	*Echinocereus* sp.	*Opuntia* sp.	Cheno-am	*Chenopodium* sp.	*Cycloloma* sp.	*Polansia* sp.	Compositae	*Helianthus* sp.	Cruciferae	*Descurainia* sp.	*Brassica* sp.	*Sinapis alba*	*Cucurbita* sp.	*C. pepo*	*Citrullus lanatus*	*Juniperus* sp.	Cyperaceae	*Arctostaphylos* sp.	Gramineae
BB:13:6	32.01	5840	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	32.01	5844	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	32.01	5845	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	57.00	6170	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	57.00	6174	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	61.00	5975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	61.00	6026	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	64.00	6250	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	65.00	6115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
BB:13:6	65.01	6188	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	65.01	6192	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	69.00	6199	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	69.00	6270	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	69.00	6292	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	71.00	5907	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	76.00	6728	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
BB:13:6	76.00	6728	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	77.00	6078	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	79.00	6143	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	86.00	6266	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	110.00	6336	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	112.00	6054	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	112.00	6068	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	112.00	6125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table B.2. Continued.

AZ (ASM) Site Number	Feature Number	FN	*Agreostis/ Muhlenbergia* Type	*Hordeum* cf. *pusillum*	*Panicum* sp.	*Sporobolus* sp.	*Triticum* sp.	*Zea mays*	*Avena sativa*	Labiatae	Leguminosae	*Phaseolus vulgaris*	*Prosopis juliflora*	*Trifolium* sp.	*Melia azederach*	*Polygonum* sp.	*Rumex* sp.	*Portulaca* sp.	*Rubus* sp.	*Malus* sp.	*Capsicum* sp.	cf. *Nicotiana* sp.	*Solanum* or *Physalis* Type	*Vitis vinifera*	Unidentified
BB:13:6	32.01	5840	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	32.01	5844	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	32.01	5845	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	57.00	6170	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	57.00	6174	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	61.00	5975	0	0	0	0	30	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	61.00	6026	0	0	0	0	4	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
BB:13:6	64.00	6250	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	65.00	6115	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	65.01	6188	0	0	0	0	0	3	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	65.01	6192	0	0	0	0	0	17	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	69.00	6199	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	69.00	6270	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	69.00	6292	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	71.00	5907	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	76.00	6728	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	76.00	6728	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	77.00	6078	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	79.00	6143	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	86.00	6266	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	110.00	6336	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	112.00	6054	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	112.00	6068	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	112.00	6125	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table B.2. Continued.

AZ (ASM) Site Number	Feature Number	FN	*Trianthema* sp.	*Amaranthus* sp.	*Rhus* sp.	Cactaceae	*Carnegiea gigantea*	*Echinocereus* sp.	*Opuntia* sp.	Cheno-am	*Chenopodium* sp.	*Cycloloma* sp.	*Polansia* sp.	Compositae	*Helianthus* sp.	Cruciferae	*Descurainia* sp.	*Brassica* sp.	*Sinapis alba*	*Cucurbita* sp.	*C. pepo*	*Citrullus lanatus*	*Juniperus* sp.	Cyperaceae	*Arctostaphylos* sp.	Gramineae
BB:13:6	125.00	6145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	128.00	6579	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	151.00	6479	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	161.00	6530	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	166.00	6663	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	166.00	6696	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	177.00	6560	0	0	1	4	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
BB:13:6	177.00	6562	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	178.00	6512	0	0	0	0	2	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
BB:13:6	178.00	6524	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	203.00	6614	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	308.00	6997	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	308.00	7004	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	308.02	7063	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	308.06	7077	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	506.00	6870	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	506.00	6876	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	510.00	6907	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	511.00	7059	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	511.01	7085	0	0	0	0	3	0	0	0	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	516.00	6922	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	516.00	7528	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	516.00	7531	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	516.00	7533	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table B.2. Continued.

AZ (ASM) Site Number	Feature Number	FN	*Agreostis/ Muhlenbergia* Type	*Hordeum* cf. *pusillum*	*Panicum* sp.	*Sporobolus* sp.	*Triticum* sp.	*Zea mays*	*Avena sativa*	Labiatae	Leguminosae	*Phaseolus vulgaris*	*Prosopis juliflora*	*Trifolium* sp.	*Melia azederach*	*Polygonum* sp.	*Rumex* sp.	*Portulaca* sp.	*Rubus* sp.	*Malus* sp.	*Capsicum* sp.	cf. *Nicotiana* sp.	*Solanum* or *Physalis* Type	*Vitis vinifera*	Unidentified
BB:13:6	125.00	6145	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	128.00	6579	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	151.00	6479	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	161.00	6530	0	0	0	0	1	4	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	166.00	6663	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	166.00	6696	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	177.00	6560	0	0	0	0	6	39	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	177.00	6562	0	0	1	0	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	178.00	6512	0	0	0	0	29	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
BB:13:6	178.00	6524	0	0	0	0	115	8	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
BB:13:6	203.00	6614	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	308.00	6997	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	308.00	7004	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	308.02	7063	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	308.06	7077	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	506.00	6870	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
BB:13:6	506.00	6876	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
BB:13:6	510.00	6907	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	511.00	7059	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	511.01	7085	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	516.00	6922	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	516.00	7528	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	516.00	7531	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
BB:13:6	516.00	7533	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table B.2. Continued.

AZ (ASM) Site Number	Feature Number	FN	*Trianthema* sp.	*Amaranthus* sp.	*Rhus* sp.	Cactaceae	*Carnegiea gigantea*	*Echinocereus* sp.	*Opuntia* sp.	Cheno-am	*Chenopodium* sp.	*Cycloloma* sp.	*Polansia* sp.	Compositae	*Helianthus* sp.	Cruciferae	*Descurainia* sp.	*Brassica* sp.	*Sinapis alba*	*Cucurbita* sp.	*C. pepo*	*Citrullus lanatus*	*Juniperus* sp.	Cyperaceae	*Arctostaphylos* sp.	Gramineae
BB:13:6	529.00	7038	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	529.00	7039	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	529.00	7040	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
BB:13:6	547.00	6976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	547.00	6992	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	548.00	7037	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	580.01	7435	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	580.01	7436	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	581.00	7215	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	581.00	7488	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	584.00	7495	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	593.00	7534	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	601.00	7535	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	628.00	7657	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
BB:13:6	630.00	7640	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3001.00	7828	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3005.00	8059	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
BB:13:6	3006.00	8023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3006.00	8065	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3006.00	8089	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3006.00	8100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3006.00	8117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3006.00	8136	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3014.00	7843	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table B.2. Continued.

AZ (ASM) Site Number	Feature Number	FN	*Agrostis/ Muhlenbergia* Type	*Hordeum* cf. *pusillum*	*Panicum* sp.	*Sporobolus* sp.	*Triticum* sp.	*Zea mays*	*Avena sativa*	Labiatae	Leguminosae	*Phaseolus vulgaris*	*Prosopis juliflora*	*Trifolium* sp.	*Melia azederach*	*Polygonum* sp.	*Rumex* sp.	*Portulaca* sp.	*Rubus* sp.	*Malus* sp.	*Capsicum* sp.	cf. *Nicotiana* sp.	*Solanum* or *Physalis* Type	*Vitis vinifera*	Unidentified
BB:13:6	529.00	7038	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	529.00	7039	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	529.00	7040	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	547.00	6976	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	547.00	6992	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	548.00	7037	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	580.01	7435	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	580.01	7436	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	581.00	7215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
BB:13:6	581.00	7488	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
BB:13:6	584.00	7495	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	593.00	7534	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	601.00	7535	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	628.00	7657	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	630.00	7640	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3001.00	7828	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3005.00	8059	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3006.00	8023	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3006.00	8065	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3006.00	8089	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3006.00	8100	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3006.00	8117	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3006.00	8136	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3014.00	7843	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table B.2. Continued.

AZ (ASM) Site Number	Feature Number	FN	*Trianthema* sp.	*Amaranthus* sp.	*Rhus* sp.	Cactaceae	*Carnegiea gigantea*	*Echinocereus* sp.	*Opuntia* sp.	Cheno-am	*Chenopodium* sp.	*Cycloloma* sp.	*Polanisa* sp.	Compositae	*Helianthus* sp.	Cruciferae	*Descurainia* sp.	*Brassica* sp.	*Sinapis alba*	*Cucurbita* sp.	*C. pepo*	*Citrullus lanatus*	*Juniperus* sp.	Cyperaceae	*Arctostaphylos* sp.	Gramineae
BB:13:6	3024.00	8032	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3024.00	8039	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3038.00	8105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3038.00	8118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3038.00	8187	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3038.02	8229	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3083.00	8216	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3220.00	8372	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3220.00	8378	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3223.00	8339	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3229.00	9182	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3248.00	8710	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3260.01	8615	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3262.00	8630	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3264.00	8556	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3270.00	8576	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3270.00	8759	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3270.02	8889	0	0	0	0	0	1	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
BB:13:6	3270.02	8897	0	2	0	0	0	0	0	0	6	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
BB:13:6	3270.02	8906	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3270.04	8907	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3270.05	8977	0	0	0	0	0	0	0	5	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
BB:13:6	3272.00	8648	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
BB:13:6	3272.00	8649	0	0	0	0	5	1	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Table B.2. Continued.

AZ (ASM) Site Number	Feature Number	FN	*Agreostis/ Muhlenbergia* Type	*Hordeum* cf. *pusillum*	*Panicum* sp.	*Sporobolus* sp.	*Triticum* sp.	*Zea mays*	*Avena sativa*	Labiatae	Leguminosae	*Phaseolus vulgaris*	*Prosopis juliflora*	*Trifolium* sp.	*Melia azederach*	*Polygonum* sp.	*Rumex* sp.	*Portulaca* sp.	*Rubus* sp.	*Malus* sp.	*Capsicum* sp.	cf. *Nicotiana* sp.	*Solanum* or *Physalis* Type	*Vitis vinifera*	Unidentified
BB:13:6	3024.00	8032	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26	0	0
BB:13:6	3024.00	8039	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3038.00	8105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3038.00	8118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3038.00	8187	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3038.02	8229	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3083.00	8216	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3220.00	8372	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3220.00	8378	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3223.00	8339	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3229.00	9182	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3248.00	8710	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3260.01	8615	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3262.00	8630	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3264.00	8556	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3270.00	8576	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3270.00	8759	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3270.02	8889	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3270.02	8897	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3270.02	8906	0	0	0	2	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3270.04	8907	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3270.05	8977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3272.00	8648	0	0	0	0	0	6	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
BB:13:6	3272.00	8649	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0

Table B.2. Continued.

AZ (ASM) Site Number	Feature Number	FN	*Trianthema* sp.	*Amaranthus* sp.	*Rhus* sp.	Cactaceae	*Carnegiea gigantea*	*Echinocereus* sp.	*Opuntia* sp.	Cheno-am	*Chenopodium* sp.	*Cycloloma* sp.	*Polansia* sp.	Compositae	*Helianthus* sp.	Cruciferae	*Descurainia* sp.	*Brassica* sp.	*Sinapis alba*	*Cucurbita* sp.	*C. pepo*	*Citrullus lanatus*	*Juniperus* sp.	Cyperaceae	*Arctostaphylos* sp.	Gramineae
BB:13:6	3273.01	8859	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3274.00	8839	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3289.00	8704	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3293.00	8741	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3293.00	8752	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3293.01	8767	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3295.00	8882	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3308.00	9170	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3313.00	8960	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3318.00	8973	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3320.00	9006	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3323.00	9103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3325.01	9226	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
BB:13:6	3325.01	9230	0	0	0	0	1	3	0	0	4	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
BB:13:6	3327.00	9058	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3327.00	9110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3327.03	9178	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
BB:13:6	3327.04	9179	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3328.00	8995	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3331.00	9076	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3336.00	9054	0	0	0	0	0	2	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3358.00	9184	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3359.00	9205	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
BB:13:6	3359.00	9231	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table B.2. Continued.

AZ (ASM) Site Number	Feature Number	FN	*Agrostis/ Muhlenbergia* Type	*Hordeum* cf. *pusillum*	*Panicum* sp.	*Sporobolus* sp.	*Triticum* sp.	*Zea mays*	*Avena sativa*	Labiatae	Leguminosae	*Phaseolus vulgaris*	*Prosopis juliflora*	*Trifolium* sp.	*Melia azederach*	*Polygonum* sp.	*Rumex* sp.	*Portulaca* sp.	*Rubus* sp.	*Malus* sp.	*Capsicum* sp.	cf. *Nicotiana* sp.	*Solanum* or *Physalis* Type	*Vitis vinifera*	Unidentified
BB:13:6	3273.01	8859	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3274.00	8839	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3289.00	8704	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3293.00	8741	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3293.00	8752	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3293.01	8767	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3295.00	8882	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3308.00	9170	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3313.00	8960	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3318.00	8973	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3320.00	9006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3323.00	9103	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3325.01	9226	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3325.01	9230	0	0	0	0	0	12	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
BB:13:6	3327.00	9058	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3327.00	9110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
BB:13:6	3327.03	9178	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
BB:13:6	3327.04	9179	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3328.00	8995	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
BB:13:6	3331.00	9076	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3336.00	9054	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3358.00	9184	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3359.00	9205	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3359.00	9231	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table B.2. Continued.

AZ (ASM) Site Number	Feature Number	FN	*Trianthema* sp.	*Amaranthus* sp.	*Rhus* sp.	Cactaceae	*Carnegiea gigantea*	*Echinocereus* sp.	*Opuntia* sp.	Cheno-am	*Chenopodium* sp.	*Cycloloma* sp.	*Polansia* sp.	Compositae	*Helianthus* sp.	Cruciferae	*Descurainia* sp.	*Brassica* sp.	*Sinapis alba*	*Cucurbita* sp.	*C. pepo*	*Citrullus lanatus*	*Juniperus* sp.	Cyperaceae	*Arctostaphylos* sp.	Gramineae
BB:13:6	3371.01	9303	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	9168.00	8554	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	9357.00	8365	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	9357.00	8369	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	9357.00	8388	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	9357.00	8389	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	9357.00	8396	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	9357.00	8425	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	9357.00	8444	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	9357.00	8457	0	0	0	0	3	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	9357.00	8466	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
BB:13:6	9357.00	8489	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	9357.00	8491	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	9357.01	8515	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	9357.01	8516	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	9372.00	8420	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table B.2. Continued.

AZ (ASM) Site Number	Feature Number	FN	*Agreostis/ Muhlenbergia* Type	*Hordeum* cf. *pusillum*	*Panicum* sp.	*Sporobolus* sp.	*Triticum* sp.	*Zea mays*	*Avena sativa*	Labiatae	Leguminosae	*Phaseolus vulgaris*	*Prosopis juliflora*	*Trifolium* sp.	*Melia azederach*	*Polygonum* sp.	*Rumex* sp.	*Portulaca* sp.	*Rubus* sp.	*Malus* sp.	*Capsicum* sp.	cf. *Nicotiana* sp.	*Solanum* or *Physalis* Type	*Vitis vinifera*	Unidentified
BB:13:6	3371.01	9303	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	9168.00	8554	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	9357.00	8365	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	9357.00	8369	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	9357.00	8388	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	9357.00	8389	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	9357.00	8396	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	9357.00	8425	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	9357.00	8444	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	9357.00	8457	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	9357.00	8466	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	9357.00	8489	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	9357.00	8491	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	9357.01	8515	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	9357.01	8516	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	9372.00	8420	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table B.3. Frequencies of wood charcoal in Rio Nuevo project flotation samples.

AZ (ASM) Site Number	Feature	FN	Agavaceae	*Atriplex* sp.	*Juniperus* sp.	*Quercus* sp.	*Fouquieria* sp.	Gramineae	*Phragmites* sp.	Leguminosae	*Cercidium* sp.	*Cercidium floridum*	*Olneya* sp.	*Prosopis juliflora*	*Pinus* sp.	*Pseudotsuga menziesii*	*Populus/Salix* Type	Ulmaceae	*Celtis* sp.	Unidentified
BB:13:13	301	1620	0	0	0	0	0	0	0	0	0	0	0	19	0	0	1	0	0	0
BB:13:13	303	1737	0	0	0	0	0	0	1	0	0	0	0	20	0	0	0	0	0	0
BB:13:13	304	1735	17	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0
BB:13:13	305	1736	1	0	0	0	0	0	0	0	0	0	0	14	0	0	3	0	0	2
BB:13:13	310	1738	0	0	0	0	0	0	0	0	0	0	0	19	0	0	0	0	0	1
BB:13:13	314	1705	0	0	0	0	0	0	0	0	0	0	0	16	0	0	4	0	0	0
BB:13:13	314	1722	0	0	0	0	0	0	0	0	0	0	3	17	0	0	0	0	0	0
BB:13:13	314	1723	0	0	0	0	0	0	0	0	0	0	0	19	1	0	0	0	0	0
BB:13:13	314	1825	0	1	0	0	0	0	0	0	0	0	0	14	0	0	5	0	0	0
BB:13:13	317	1721	0	1	0	0	0	0	0	0	0	0	0	19	0	0	0	0	0	0
BB:13:13	321	1888	0	0	0	0	0	0	0	0	0	0	0	16	0	0	4	0	0	0
BB:13:13	327	1937	0	0	0	0	0	0	0	0	0	0	0	19	0	0	1	0	0	0
BB:13:13	350.02	2006	0	0	0	0	0	0	1	0	0	0	0	18	0	0	1	0	0	0
BB:13:13	350.05	2648	0	0	0	0	0	0	0	0	0	0	6	14	0	0	0	0	0	0
BB:13:13	354	2502	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:13	356	2016	0	0	0	0	0	0	0	0	0	0	0	17	0	3	0	0	0	0
BB:13:13	356	2023	0	0	2	0	0	0	0	0	0	0	0	17	0	0	0	0	1	0
BB:13:13	357	2044	0	0	0	0	0	0	0	0	0	0	0	16	0	3	0	0	0	1
BB:13:13	357	2070	0	0	4	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0
BB:13:13	359	2141	0	0	0	0	0	0	0	0	0	0	0	18	0	2	0	0	0	0
BB:13:13	359	2142	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:13	359	2685	0	0	0	0	0	0	0	0	0	0	0	19	1	0	0	0	0	0
BB:13:13	360	2140	0	0	0	0	0	0	0	0	0	0	0	13	0	7	0	0	0	0
BB:13:13	360	2204	0	0	0	0	0	0	0	0	0	0	0	6	0	14	0	0	0	0
BB:13:13	360	3008	0	0	0	4	0	0	0	0	0	0	0	5	0	9	2	0	0	0
BB:13:13	361	2079	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:13	363	2096	0	1	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0
BB:13:13	364	2115	0	0	1	0	0	0	0	0	0	0	0	19	0	0	0	0	0	0
BB:13:13	364	2121	0	0	0	0	0	0	1	0	0	0	0	19	0	0	0	0	0	0

Table B.3. Continued.

AZ (ASM) Site Number	Feature	FN	Agavaceae	*Atriplex* sp.	*Juniperus* sp.	*Quercus* sp.	*Fouquieria* sp.	Gramineae	*Phragmites* sp.	Leguminosae	*Cercidium* sp.	*Cercidium floridum*	*Olneya* sp.	*Prosopis juliflora*	*Pinus* sp.	*Pseudotsuga menziesii*	*Populus/Salix* Type	Ulmaceae	*Celtis* sp.	Unidentified
BB:13:13	365	2166	0	0	0	0	0	0	0	0	0	0	0	18	0	0	2	0	0	0
BB:13:13	371	2436	0	0	4	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0
BB:13:13	372	2348	0	0	0	0	0	0	0	0	0	0	0	17	0	3	0	0	0	0
BB:13:13	373	2373	0	0	0	0	0	0	0	0	0	0	0	16	0	0	4	0	0	0
BB:13:13	373	2448	0	0	0	0	0	0	0	0	0	0	0	17	0	0	0	0	0	3
BB:13:13	373	2458	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:13	373	3958	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:13	375.03	2511	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:13	376	2514	0	0	0	0	0	0	0	0	0	0	0	19	0	1	0	0	0	0
BB:13:13	376	2579	0	0	0	2	0	0	0	0	0	0	0	18	0	0	0	0	0	0
BB:13:13	376	2609	0	0	3	0	0	0	0	0	0	0	0	16	0	0	1	0	0	0
BB:13:13	376	2645	0	0	1	0	0	0	0	0	0	0	0	19	0	0	0	0	0	0
BB:13:13	376	2947	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:13	380	2776	0	1	3	0	1	0	1	0	0	0	0	4	0	0	10	0	0	0
BB:13:13	380	2779	0	0	0	0	17	0	0	0	0	0	0	1	0	0	2	0	0	0
BB:13:13	380	2783	0	0	4	0	3	0	0	0	0	0	0	9	2	0	2	0	0	0
BB:13:13	380	2787	0	0	0	0	2	0	0	0	0	0	0	15	0	0	3	0	0	0
BB:13:13	380	3132	0	3	0	0	0	0	0	0	0	0	0	16	0	0	1	0	0	0
BB:13:13	380	3135	0	1	2	0	0	0	3	0	0	0	0	12	0	0	2	0	0	0
BB:13:13	382	2742	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:13	385	2888	0	0	0	0	0	0	0	0	0	0	0	19	0	0	0	0	0	1
BB:13:13	385	2968	0	0	0	0	0	0	0	0	0	0	0	19	0	0	0	0	1	0
BB:13:13	385	3028	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:13	385	3206	0	1	0	0	1	0	0	0	0	0	0	18	0	0	0	0	0	0
BB:13:13	394	3235	0	0	0	0	0	0	0	0	0	0	0	5	1	12	2	0	0	0
BB:13:13	396	3334	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0
BB:13:13	406	3522	0	0	0	0	0	0	0	0	0	0	0	10	0	10	0	0	0	0
BB:13:13	408	3675	0	0	0	0	0	0	0	0	0	0	0	6	0	8	3	0	0	0
BB:13:13	408	4320	0	0	0	0	0	0	0	0	0	0	0	1	0	17	2	0	0	0

Table B.3. Continued.

AZ (ASM) Site Number	Feature	FN	Agavaceae	*Atriplex* sp.	*Juniperus* sp.	*Quercus* sp.	*Fouquieria* sp.	Gramineae	*Phragmites* sp.	Leguminosae	*Cercidium* sp.	*Cercidium floridum*	*Olneya* sp.	*Prosopis juliflora*	*Pinus* sp.	*Pseudotsuga menziesii*	*Populus/Salix* Type	Ulmaceae	*Celtis* sp.	Unidentified
BB:13:13	408	4400	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0
BB:13:13	409	4097	0	0	0	0	1	0	0	0	0	0	0	16	0	0	3	0	0	0
BB:13:13	409	4119	0	0	0	0	0	0	0	0	0	0	0	18	0	0	2	0	0	0
BB:13:13	412	3974	0	1	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0
BB:13:13	416	3959	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:13	417	3992	0	0	0	0	0	0	0	0	0	0	0	18	0	0	2	0	0	0
BB:13:13	417	3998	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:13	417	4067	0	1	0	0	0	0	0	0	0	0	0	16	0	0	1	0	0	0
BB:13:13	420	4030	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:13	422	4043	0	0	0	0	0	0	0	0	0	0	0	12	0	0	8	0	0	0
BB:13:13	423	4042	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:13	430	4082	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:13	441	4287	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0
BB:13:481	141	6693	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	0	7567	0	0	0	0	0	0	0	0	0	0	0	3	0	0	2	0	0	0
BB:13:6	4	5089	0	0	0	0	1	0	0	0	0	0	2	13	0	0	4	0	0	0
BB:13:6	4	5252	0	0	0	0	1	0	0	0	0	0	0	18	0	0	0	0	0	1
BB:13:6	4	5360	0	0	1	0	0	0	0	0	0	0	3	16	0	0	0	0	0	0
BB:13:6	4	5405	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	4	5464	0	0	0	0	0	0	0	0	0	0	1	16	0	0	3	0	0	0
BB:13:6	4	6306	0	0	0	0	0	0	0	0	10	0	0	8	0	2	0	0	0	0
BB:13:6	4	6371	0	0	0	0	0	0	0	0	0	8	0	8	0	0	4	0	0	0
BB:13:6	4	6424	0	0	1	0	0	0	0	0	0	0	0	18	0	0	1	0	0	0
BB:13:6	4	6546	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	7	5724	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0
BB:13:6	13	5698	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	13	5821	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	15	5768	0	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0

Table B.3. Continued.

AZ (ASM) Site Number	Feature	FN	Agavaceae	*Atriplex* sp.	*Juniperus* sp.	*Quercus* sp.	*Fouquieria* sp.	Gramineae	*Phragmites* sp.	Leguminosae	*Cercidium* sp.	*Cercidium floridum*	*Olneya* sp.	*Prosopis juliflora*	*Pinus* sp.	*Pseudotsuga menziesii*	*Populus/Salix* Type	Ulmaceae	*Celtis* sp.	Unidentified
BB:13:6	15	5855	0	0	0	0	0	0	0	0	0	0	0	2	0	0	6	0	0	0
BB:13:6	20	6791	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	28	6682	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0
BB:13:6	29	5582	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0
BB:13:6	29	5691	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
BB:13:6	30	5673	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0
BB:13:6	32.01	5840	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
BB:13:6	32.01	5844	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0
BB:13:6	32.01	5845	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	57	6170	0	0	0	0	0	0	0	0	0	0	0	17	0	0	0	0	0	0
BB:13:6	57	6174	0	0	0	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0
BB:13:6	57.01	6182	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
BB:13:6	61	5975	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	61	6026	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	64	6250	0	0	0	0	0	0	0	0	0	0	0	19	0	0	0	0	0	1
BB:13:6	65	6115	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
BB:13:6	65	6232	0	3	0	0	0	0	0	0	0	0	0	17	0	0	0	0	0	0
BB:13:6	65.01	6188	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0
BB:13:6	65.01	6192	0	0	0	0	0	0	0	16	0	0	0	4	0	0	0	0	0	0
BB:13:6	69	6199	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0
BB:13:6	69	6270	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	69	6292	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
BB:13:6	70	6788	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0
BB:13:6	71	5907	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0
BB:13:6	73	6255	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
BB:13:6	76	6728	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
BB:13:6	77	6078	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
BB:13:6	79	6143	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0
BB:13:6	81	6254	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0

Table B.3. Continued.

AZ (ASM) Site Number	Feature	FN	Agavaceae	*Atriplex* sp.	*Juniperus* sp.	*Quercus* sp.	*Fouquieria* sp.	Gramineae	*Phragmites* sp.	Leguminosae	*Cercidium* sp.	*Cercidium floridum*	*Olneya* sp.	*Prosopis juliflora*	*Pinus* sp.	*Pseudotsuga menziesii*	*Populus/Salix* Type	Ulmaceae	*Celtis* sp.	Unidentified
BB:13:6	82	6253	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
BB:13:6	86	6266	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0
BB:13:6	100	6132	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0
BB:13:6	110	6336	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	112	6054	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	0	0	0
BB:13:6	112	6068	0	0	0	0	0	0	0	4	0	0	0	0	0	0	16	0	0	0
BB:13:6	112	6125	0	0	0	0	0	0	0	0	0	0	0	19	0	0	1	0	0	0
BB:13:6	122	6127	0	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0	7
BB:13:6	125	6145	0	1	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0
BB:13:6	126	6528	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0
BB:13:6	126.03	6377	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0
BB:13:6	128	6579	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0
BB:13:6	151	6479	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0
BB:13:6	161	6530	0	0	0	0	0	0	0	0	0	0	4	16	0	0	0	0	0	0
BB:13:6	166	6663	0	0	0	0	2	0	0	0	0	0	0	9	9	0	0	0	0	0
BB:13:6	166	6696	0	0	0	0	0	0	0	0	0	0	0	5	13	0	0	0	0	2
BB:13:6	177	6560	0	0	0	0	3	0	0	0	0	0	0	14	3	0	0	0	0	0
BB:13:6	177	6562	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	178	6512	0	0	2	0	0	0	0	0	0	0	0	13	0	0	2	0	0	3
BB:13:6	178	6524	0	0	0	0	1	0	1	0	0	0	0	14	0	0	0	3	0	0
BB:13:6	193	6634	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	203	6614	1	0	7	0	3	0	0	0	0	0	0	0	0	0	9	0	0	0
BB:13:6	308	6894	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0
BB:13:6	308	6915	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
BB:13:6	308	6997	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0
BB:13:6	308	7004	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	308.02	7063	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	506	6806	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
BB:13:6	506	6875	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2

Table B.3. Continued.

AZ (ASM) Site Number	Feature	FN	Agavaceae	*Atriplex* sp.	*Juniperus* sp.	*Quercus* sp.	*Fouquieria* sp.	Gramineae	*Phragmites* sp.	Leguminosae	*Cercidium* sp.	*Cercidium floridum*	*Olneya* sp.	*Prosopis juliflora*	*Pinus* sp.	*Pseudotsuga menziesii*	*Populus/Salix* Type	Ulmaceae	*Celtis* sp.	Unidentified
BB:13:6	511	7028	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
BB:13:6	511	7059	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0
BB:13:6	511.01	7085	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
BB:13:6	511.05	7090	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
BB:13:6	516	6925	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	516	6928	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
BB:13:6	516	7528	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0
BB:13:6	516	7531	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0
BB:13:6	516	7533	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
BB:13:6	529	7039	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0
BB:13:6	540	6965	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
BB:13:6	541	6964	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0
BB:13:6	544	7013	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
BB:13:6	546	6972	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
BB:13:6	547	6981	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0
BB:13:6	548	7037	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
BB:13:6	572	7247	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	572	7485	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	576	7352	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
BB:13:6	579	7540	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0
BB:13:6	580	7434	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
BB:13:6	580.01	7435	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0
BB:13:6	581	7215	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	581	7443	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0
BB:13:6	581	7488	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
BB:13:6	592	7542	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
BB:13:6	595	7513	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
BB:13:6	608	7624	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0
BB:13:6	624	7651	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table B.3. Continued.

AZ (ASM) Site Number	Feature	FN	Agavaceae	*Atriplex* sp.	*Juniperus* sp.	*Quercus* sp.	*Fouquieria* sp.	Gramineae	*Phragmites* sp.	Leguminosae	*Cercidium* sp.	*Cercidium floridum*	*Olneya* sp.	*Prosopis juliflora*	*Pinus* sp.	*Pseudotsuga menziesii*	*Populus/Salix* Type	Ulmaceae	*Celtis* sp.	Unidentified
BB:13:6	626	7666	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
BB:13:6	632	7660	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
BB:13:6	3001	7828	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	3001	7832	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0
BB:13:6	3005	8051	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	3005	8059	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0
BB:13:6	3005	8063	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0
BB:13:6	3006	8023	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	3006	8065	0	0	0	0	0	0	0	0	0	0	0	6	0	0	7	0	0	0
BB:13:6	3006	8089	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	3006	8100	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	3006	8117	0	0	1	0	0	0	0	0	0	0	0	19	0	0	0	0	0	0
BB:13:6	3006	8136	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0
BB:13:6	3014	7833	0	1	0	0	0	0	0	0	0	0	0	19	0	0	0	0	0	0
BB:13:6	3014	7843	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	3014	7858	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	3014	8175	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	3014	8182	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	3014.02	8202	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0
BB:13:6	3024	8024	0	0	0	0	2	0	0	0	0	0	0	4	0	0	5	0	0	9
BB:13:6	3024	8032	0	0	0	17	0	0	0	0	0	0	0	2	0	0	1	0	0	0
BB:13:6	3024	8039	0	0	0	0	4	0	0	0	3	0	0	0	0	0	0	0	13	0
BB:13:6	3038	8105	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0
BB:13:6	3038	8118	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0
BB:13:6	3038	8187	0	1	0	0	0	0	0	0	0	0	0	19	0	0	0	0	0	0
BB:13:6	3038.03	8228	0	0	1	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0
BB:13:6	3067	7808	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	3072	7860	0	0	0	0	0	0	0	0	0	0	0	18	0	0	0	0	0	0
BB:13:6	3083	8216	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0

Table B.3. Continued.

AZ (ASM) Site Number	Feature	FN	Agavaceae	*Atriplex* sp.	*Juniperus* sp.	*Quercus* sp.	*Fouquieria* sp.	Gramineae	*Phragmites* sp.	Leguminosae	*Cercidium* sp.	*Cercidium floridum*	*Olneya* sp.	*Prosopis juliflora*	*Pinus* sp.	*Pseudotsuga menziesii*	*Populus/Salix* Type	Ulmaceae	*Celtis* sp.	Unidentified
BB:13:6	3083.01	8244	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	3105	8270	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
BB:13:6	3220	8372	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0
BB:13:6	3223	8339	0	0	0	0	0	1	0	0	0	0	0	5	0	0	0	0	0	0
BB:13:6	3229	9182	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0
BB:13:6	3242	9213	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0
BB:13:6	3245.03	8527	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
BB:13:6	3248	8710	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
BB:13:6	3253	8639	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
BB:13:6	3260	8591	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	3260.01	8615	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0
BB:13:6	3262	8571	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0
BB:13:6	3262	8621	0	0	0	0	0	0	0	0	0	0	0	19	0	0	0	0	0	0
BB:13:6	3262	8625	0	0	0	0	0	0	2	0	0	0	0	5	0	0	0	0	0	0
BB:13:6	3262	8630	0	0	0	0	0	0	0	0	0	0	11	3	0	0	0	0	0	0
BB:13:6	3264	8582	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0
BB:13:6	3264	8616	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0
BB:13:6	3270	8576	0	0	0	0	0	0	6	0	0	0	0	14	0	0	0	0	0	0
BB:13:6	3270	8759	0	2	0	0	0	0	1	0	0	0	0	4	0	0	0	0	0	0
BB:13:6	3270.02	8889	0	0	0	0	0	0	1	0	0	0	0	8	0	0	2	0	0	9
BB:13:6	3270.02	8897	0	12	0	0	0	0	1	8	0	0	0	0	0	0	0	0	0	0
BB:13:6	3270.02	8906	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0
BB:13:6	3270.04	8907	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
BB:13:6	3270.05	8977	0	0	0	0	0	3	1	13	0	0	0	3	0	0	0	0	0	0
BB:13:6	3272	8648	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	3272	8649	0	0	0	0	0	0	0	0	0	0	0	18	0	0	1	0	0	1
BB:13:6	3273	8838	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0
BB:13:6	3273	8843	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0
BB:13:6	3273.01	8859	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0

Table B.3. Continued.

AZ (ASM) Site Number	Feature	FN	Agavaceae	*Atriplex* sp.	*Juniperus* sp.	*Quercus* sp.	*Fouquieria* sp.	Gramineae	*Phragmites* sp.	Leguminosae	*Cercidium* sp.	*Cercidium floridum*	*Olneya* sp.	*Prosopis juliflora*	*Pinus* sp.	*Pseudotsuga menziesii*	*Populus/Salix* Type	Ulmaceae	*Celtis* sp.	Unidentified
BB:13:6	3274	8827	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0
BB:13:6	3274	8839	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0
BB:13:6	3285	9091	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
BB:13:6	3287	8705	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0
BB:13:6	3289	8704	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0
BB:13:6	3293	8721	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	3293	8741	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	3293	8749	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	3293	8752	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	3294	8778	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	3295	8882	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	3300.02	9038	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0
BB:13:6	3308	9156	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0
BB:13:6	3308	9170	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0
BB:13:6	3313	8960	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	3316	8993	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0
BB:13:6	3318	8973	0	2	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0
BB:13:6	3320	9006	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
BB:13:6	3323	9103	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
BB:13:6	3325.01	9230	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0
BB:13:6	3327	9058	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
BB:13:6	3327	9128	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0
BB:13:6	3327.04	9179	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0
BB:13:6	3328	8995	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0
BB:13:6	3332	9003	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
BB:13:6	3358	9184	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0
BB:13:6	3374	9288	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0
BB:13:6	9168	8554	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0

Table B.3. Continued.

AZ (ASM) Site Number	Feature	FN	Agavaceae	*Atriplex* sp.	*Juniperus* sp.	*Quercus* sp.	*Fouquieria* sp.	Gramineae	*Phragmites* sp.	Leguminosae	*Cercidium* sp.	*Cercidium floridum*	*Olneya* sp.	*Prosopis juliflora*	*Pinus* sp.	*Pseudotsuga menziesii*	*Populus/Salix* Type	Ulmaceae	*Celtis* sp.	Unidentified
BB:13:6	9168	8585	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	9168	8620	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0
BB:13:6	9168.02	8640	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0
BB:13:6	9357	8351	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0
BB:13:6	9357	8365	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	9357	8369	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	9357	8396	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
BB:13:6	9357	8425	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0
BB:13:6	9357	8444	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0
BB:13:6	9357	8457	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
BB:13:6	9357	8466	0	0	0	0	8	0	1	0	0	0	0	0	0	0	0	0	0	0
BB:13:6	9357	8489	0	0	0	0	0	0	1	0	0	0	0	7	0	0	2	0	0	0
BB:13:6	9357.01	8516	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
BB:13:6	9372	8420	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0
BB:13:6	9372	8450	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0