CHAPTER 11

SHELL ARTIFACTS

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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 im-

poundment 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	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	34	–	36
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.

Genus	Finished Artifact Forms: Beads: Cut Forms: Whole Shell	Beads: Cut Forms: Disk	Beads: Cut Forms: Claw	Beads: Cut Forms: Cap	Pendants: Whole Shell Pendant	Pendants: Cut Forms: Life Forms: Zoomorphic, Unknown	Pendants: Cut Forms: Life Forms: Pelican/Heron	Pendants: Cut Forms: Geometric Shapes: Washer	Pendants: Cut Forms: Geometric Shapes: Rectangular	Pendants: Cut Forms: Geometric Shapes: Triangular	Pendants: Cut Forms: Geometric Shapes: Other Geometric	Pendants: Cut Forms: Cut, Unknown Form	Pendants: Unknown Form	Bracelets: Plain Bracelet	Bracelets: Decorated: Bracelet, Marginal Nicking	Bracelets: Decorated: Carved Bracelet, Frog	Other: Plain Ring Pendant	Other: Geometric, Curvilinear	Manufacturing Evidence: Artifacts in Process: Geometric Pendant	Manufacturing Evidence: Artifacts in Process: Cut Pendant, Unknown Form	Manufacturing Evidence: Artifacts in Process: Plain Bracelet	Manufacturing Evidence: Carved Manufacturing Debris	Fragmentary Material: Worked, Unknown Form	Fragmentary Material: 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.

Genus	Prehistoric					Historic					Total	
	Early Agricultural	Ceramic					Euro-American					
	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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