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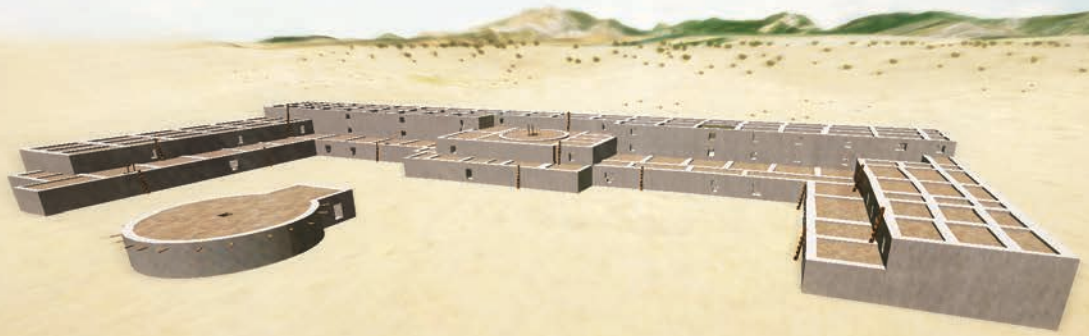
Chaco's Legacy



Discerning Migration and Emulation along the Middle San Juan River

inside this issue

ISSUE EDITOR:

Paul F. Reed

ONLINE EXCLUSIVES:

For additional commentary, images, references, and links, visit our website at:

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Cover image: Digital reconstruction of Salmon Pueblo in A.D. 1100. This is one of many such visualizations created for *Chaco's Legacy*, an interactive exhibit newly installed at Salmon Ruins Museum and Aztec Ruins National Monument. Digital reconstruction: Douglas W. Gann. Cover design: Kathleen Bader.

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Archaeology Southwest

Exploring and protecting the places of our past

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Chaco's Legacy: Discerning Migration and Emulation along the Middle San Juan River

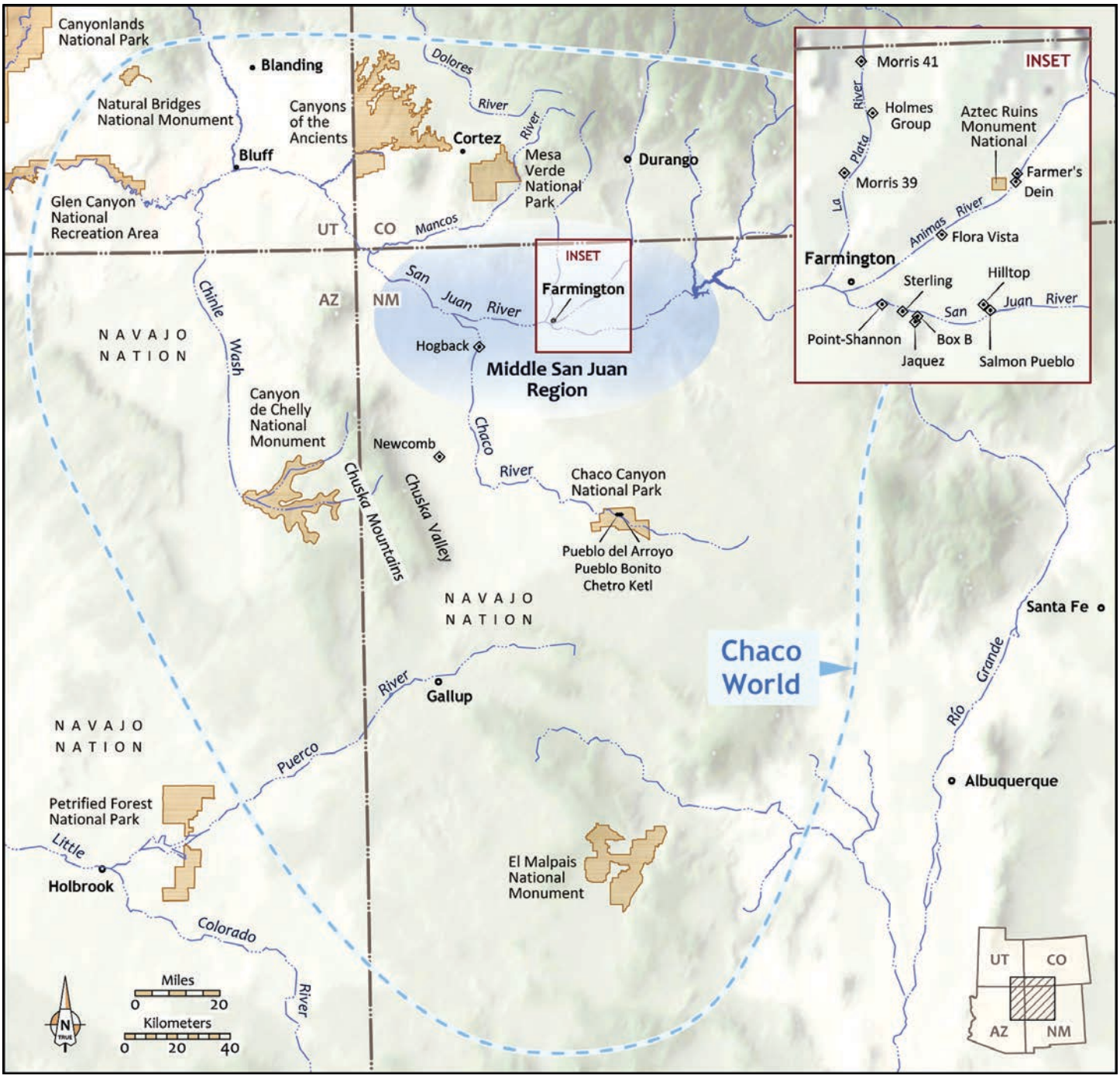
PAUL F. REED
ARCHAEOLOGY SOUTHWEST AND SALMON RUINS MUSEUM

Chaco: perhaps the most researched yet least understood phenomenon of the ancient Southwest, and a topic that captivates many, if attendance at lectures is any indication. Chaco refers to a place—Chaco Canyon—as well as to an ancient Pueblo society that developed from that place (see page 7). Chacoan society peaked between A.D. 1000 and 1150, although it influenced the Pueblo world for twice that long, from 850 to 1250. By 1100, Chacoan society was far-flung, with perhaps as many as 200 affiliated sites spread across the entire Four Corners area.

Aerial view of Salmon Pueblo, looking south-southeast. Note the San Juan River. PHOTO: ©ADRIEL HEISEY

This network was a key aspect of the Chacoan world (see *Archaeology Southwest Magazine* 14:1). So-called "outlier" sites (well outside the canyon) were quite variable, from large settlements to ten-room pueblos. Archaeologists especially recognize Chacoan presence or influence in a place when it has a "great house" resembling those in Chaco Canyon. Some of these great houses beyond the canyon were distinctive, massive, carefully planned and executed buildings that would have been visible for miles (see page 6).

I work at one of these affiliated great houses, Salmon Pueblo; another place with four great houses, the Aztec Community, is nearby (see map on page 4). (Note that "Salmon" is pronounced "saul-mun," the surname of the homesteaders who settled on the property and who strove to protect the site.) Salmon and Aztec are among seventeen known great houses and related Chaco-era sites in the Middle San Juan River region (MSJ) of northwest New Mexico, about two- to three-days' foot travel north of Chaco Canyon (see *Archaeology Southwest Magazine* 16:2 and 20:3). Most of our current understanding of Chaco–MSJ relationships is based on



Major places mentioned in this issue, with the Middle San Juan region indicated in blue and the extent of Chacoan influence in the Southwest indicated by the dotted outline. By 1100, Chacoan society was far-flung, with perhaps 200 affiliated sites spread across an area roughly the size of Ireland. Salmon Pueblo is forty-five miles north of Chaco Canyon (a little more than two-days' travel on foot); Aztec Ruins National Monument is about ten miles farther north. MAP: CATHERINE GILMAN

evidence from these two large sites (see page 6), though several colleagues and I have been turning our attention to roughly contemporaneous sites in the region (see pages 16–19).

New–Old Questions

On behalf of Archaeology Southwest, and with funding from the National Science Foundation (NSF), I led the *Chaco*

Migration or Emulation project. Our team of researchers sought to determine if great houses in the MSJ represent migration or emulation. In other words, did Chacoans (people from the canyon) move north and build these great houses for themselves, or for themselves and local groups? Did local people build them for leaders who wished to join the Chacoan network? Are some great houses a result of migration and others a result of emulation? And finally, why are these important questions?

If evidence shows that local MSJ residents built the vast great houses at Salmon and Aztec (and smaller great houses at a few other sites in the region), this would imply that it was very important to them to join Chacoan society—enough so that they learned how to emulate a highly specialized building tradition. The same could be true of pottery making, weaving, basketmaking, woodworking, and other technologies they may have emulated. What economic, social, spiritual, or other benefits might they have derived from a full- or partial-scale emulation? How might they have changed and been changed by Chacoan society?

If, on the other hand, evidence shows that Chacoans migrated to the MSJ and built Salmon, Aztec, and a few other structures, this raises significant questions about their motivations for doing so. Why did they move there? What did Chacoans need or want from the MSJ? Did they seek to colonize the area, or to control its resources or its people? Were they overlords, neighbors, or interlopers? What did immigrants and locals think of one another? How might we characterize the social and economic relationships between the two groups?

But what if some combination of both strategies occurred—Chacoans migrating and locals emulating? And what if one group of people established a pueblo, and another group (or a combination of both) ended up living there for generations? Many of the same questions I have just articulated would still be relevant, but the answers might be more nuanced.

In a sense, these are "old" questions. Early explorers and archaeologists readily observed the similarities among Salmon, Aztec, and the incredible buildings in Chaco Canyon. Earl Morris (see page 26), the first archaeologist to undertake long-term work at Aztec (1916–1927), felt that Chacoans were responsible for its construction. Likewise, Cynthia Irwin-Williams (see page 27), who directed excavations at Salmon in the 1970s, viewed that pueblo as a Chacoan colony. In light of subsequent research on these two sites, ongoing research on contemporaneous sites in the MSJ, new concepts in Chaco research, and advances in archaeological method and theory, our team decided to return to the most basic question: *Chaco Migration or Emulation?*

Masons or builders not trained in Chaco masonry traditions would have had difficulty replicating such skilled craftsmanship. Here are two examples of masonry at Aztec's West Pueblo. Top: An example of patterned masonry archaeologists classify as the McElmo style. Such precision indicates the work of Chacoan masons. Bottom: An example of what Gary Brown calls "nonconforming" McElmo masonry. These masons may have been apprentices drawn from the local population. PHOTOS: GARY M. BROWN, COURTESY OF THE NATIONAL PARK SERVICE

What Can and Cannot Be Copied

To distinguish between migration and emulation, we examined high- and low-visibility traits in the material culture (things people made and used) and architecture of great house sites in the MSJ region. Archaeological studies have shown that highly visible aspects of material culture, such as public architecture, ritual objects used in public ceremonies, high-status

objects, or pottery designs—things that attract attention—deliberately communicate social messages. Because people tend to copy such items, wide distributions can occur without migration—in other words, you might be able to copy the outward or general appearance of something without being a member of the group who originated its style or form.

In contrast, low-visibility material culture (such as architectural layouts, utilitarian objects, or food preferences) and low-visibility attributes of artifacts (such as hidden technological styles, raw material choices, or use patterns) are rarely displayed intentionally. Instead, they reflect behavior patterns shared by people with common settlement histories or learning backgrounds—in other words, unless you had learned very specific aspects of how to make or use something, you probably would not be able to replicate it exactly or use it in exactly the same way. These latent attributes are usually stable through time, providing strong indicators of actual population movement.

Who Made and Built What in the Chaco-era Middle San Juan? It's Complicated.

To document and explore the differential distribution of these two kinds of traits at great house sites in the MSJ, we examined settlement patterns, architecture, pottery, and perishable artifacts (things made of plant materials, wood, hides, fur, or feathers, for example). As we had anticipated, our analyses revealed a complex situation. Some sites, such as Salmon Pueblo, exhibit excellent evidence for Chacoan immigration and construction, followed by recruitment of local residents. Other sites, such as Aztec's West Pueblo, show evidence of initial Chacoan migration and considerable local input in construction and design. Still other great houses are exclusively local in character. This issue of *Archaeology Southwest Magazine* summarizes our findings.

Laurie Webster, an expert in fiber and perishable artifacts, brought her vast database to our study. Because production of textiles, baskets, and other perishable objects typically involves low-visibility technological steps, such artifacts help us recognize population movements and social boundaries. In fact, these technologies provide a better measure of shared settlement history and learning backgrounds than do decorative features, which can be widely emulated. In this issue, as an example, Webster compares wooden artifacts

Salmon and Aztec

At present, much of our understanding of the Middle San Juan (MSJ) region in the Chaco and post-Chaco eras is anchored in the great house communities known as Salmon Ruins (Salmon Pueblo) and Aztec Ruins (Aztec Community).

People built Salmon Pueblo beginning around A.D. 1090. It had about 300 rooms across three stories, an elevated tower kiva in its central portion, and a great kiva in its plaza. Unlike the settlement pattern identified at great houses in Chaco Canyon and at other outlying Chaco-affiliated sites, there were very few small pueblo houses associated with the Salmon great house, indicating that many people lived in it. After the 1120s, extensive remodeling occurred at Salmon, and it became a regional center. People left the pueblo in the 1280s.

Fine Chacoan masonry inside the tower kiva at Salmon Pueblo. This masony style is known as Type 3. PHOTO: PAUL F. REED

The Aztec Community consisted of four great houses and quite a few associated structures and dwellings. Built primarily in adobe, Aztec North (see page 18) probably predates Aztec West (West Ruin or West Pueblo). It has not been excavated. People established three-story Aztec West in 1100, and construction of its main 400 rooms continued until 1130. People added another 100 rooms over the next 150 years. In 1120, people began building Aztec East (East Ruin or East Pueblo) in symmetrical relationship to West Ruin, and construction and remodeling continued there for another 170 years. Only fourteen of the estimated 300 rooms at Aztec East have been excavated. Aztec served as the primary MSJ regional center and descendant Chacoan outpost into the 1280s.

In terms of scale, floor plan, beam selection and finishing, masonry techniques, and other attributes, the initial architects and builders of Salmon, Aztec West, and Aztec East closely adhered to traditions and standards seen in great houses in Chaco Canyon (see pages 12–15).

Visit archaeologysouthwest.org/asw28-1 to download earlier issues of *Archaeology Southwest Magazine* devoted to Salmon, Aztec, and the Middle San Juan.

— Paul F. Reed

from Aztec's West Pueblo with similar objects from sites in Chaco Canyon (see pages 8–9).

Ceramics expert Lori Reed and her team analyzed technological and stylistic attributes of ninth- through thirteenth-century pottery from the MSJ (see pages 10–11). Abundant and durable, pottery offers a multifaceted analytical tool for identifying local traditions, movements of people, and exchanges of goods. Specifically, Reed determined how to distinguish pottery made in Chaco Canyon from Chaco-style pottery made in the MSJ.

Gary Brown and Cheryl Paddock's architectural study of the Aztec Community has greatly expanded current understanding of the complex building patterns encoded in Chacoan great houses (see pages 12–15). Here, Brown argues that building the Aztec great houses almost certainly required the cooperation and involvement of large numbers of skilled personnel—and not all of them were Chacoans. This analysis has been critical to assessing Chacoan presence across the MSJ. Brown also delineates building stages at Aztec West, as informed by numerous tree-ring dates.

I examined patterns in how people settled the MSJ's landscapes (see pages 16–19). To evaluate Chacoan impact across the region, I compiled a database of ancient Pueblo sites and settlement. My findings indicate that Chacoan presence was highly variable across the San Juan, Animas, and La Plata River valleys. This was most likely related to variability in the size and density of existing populations in each valley when Chacoan immigrants arrived and, to another extent, variability in the composition of the Chacoan immigrant groups.

We also recruited Archaeology Southwest's Jeffery Clark to our project. Clark's understanding of the migration of Kayenta groups to the populated southern Southwest in the late 1200s and early 1300s (see, for example, *Archaeology Southwest Magazine* 26:3/4 and 27:3) gave him a useful perspective on our study. Using concepts Clark had developed to explain social processes tied to migration, he and I offer a new way of looking at Chacoan immigration to the MSJ and subsequent emulation of Chacoan traits (see pages 20–21).

Chaco's Legacy

As we approached the project's completion in 2009, we thought about how to communicate our results to the public, and we turned to Archaeology Southwest's digital media expert, Douglas Gann. Through another NSF award—this from a program entitled "Communicating Research to a Public Audience" (now defunct, unfortunately)—we conceived the *Chaco's Legacy* project. In the exhibition, we interpret our *Chaco Migration or Emulation* findings through a digital vision of the Chacoan world. The tour begins at great houses and small sites in Chaco Canyon, and continues north to the Salmon and Aztec communities (see pages 22–24). The experience will be available at the visitor center at Aztec Ruins National Monument, where, as rangers Tracy Bodnar and Lauren Blacik describe (see page 24), it will complement updated exhibits. It will also be installed at the Salmon Ruins Museum, and in time, we hope to make it available at Chaco Culture National Historical Park and on Archaeology Southwest's website. Zuni cultural consultant Dan Simplicio enriched this digital vision through his knowledge and guidance (see page 25). He challenges us to recognize the continuity among past, present, and future for Native peoples, and to continue to seek new and just ways of sharing this understanding.

What Was It about Chaco?

Chacoan society arose in an isolated canyon setting without highly visible resources. Recent analyses indicate that Chacoan society in the canyon included more than one social or ethnic group. Chacoans developed a ritual-ceremonial system that quickly spread across a large portion of the ancient Pueblo world.

Chacoan leaders managed this society through a sophisticated sociopolitical organization, yet they probably were not coercive or oppressive. The success of Chacoan society rested primarily on its ability to promote a ritual means of keeping the Pueblo world in balance.

—Paul F. Reed

Paul Reed led Preservation Archaeology field school students on a tour of Casa Rinconada, a great kiva on a ridge across from Pueblo Bonito in Chaco Culture National Historic Park, in 2013. IMAGE: ELY RARESHIDE

Investigating Ritual Wooden Artifacts from Aztec West

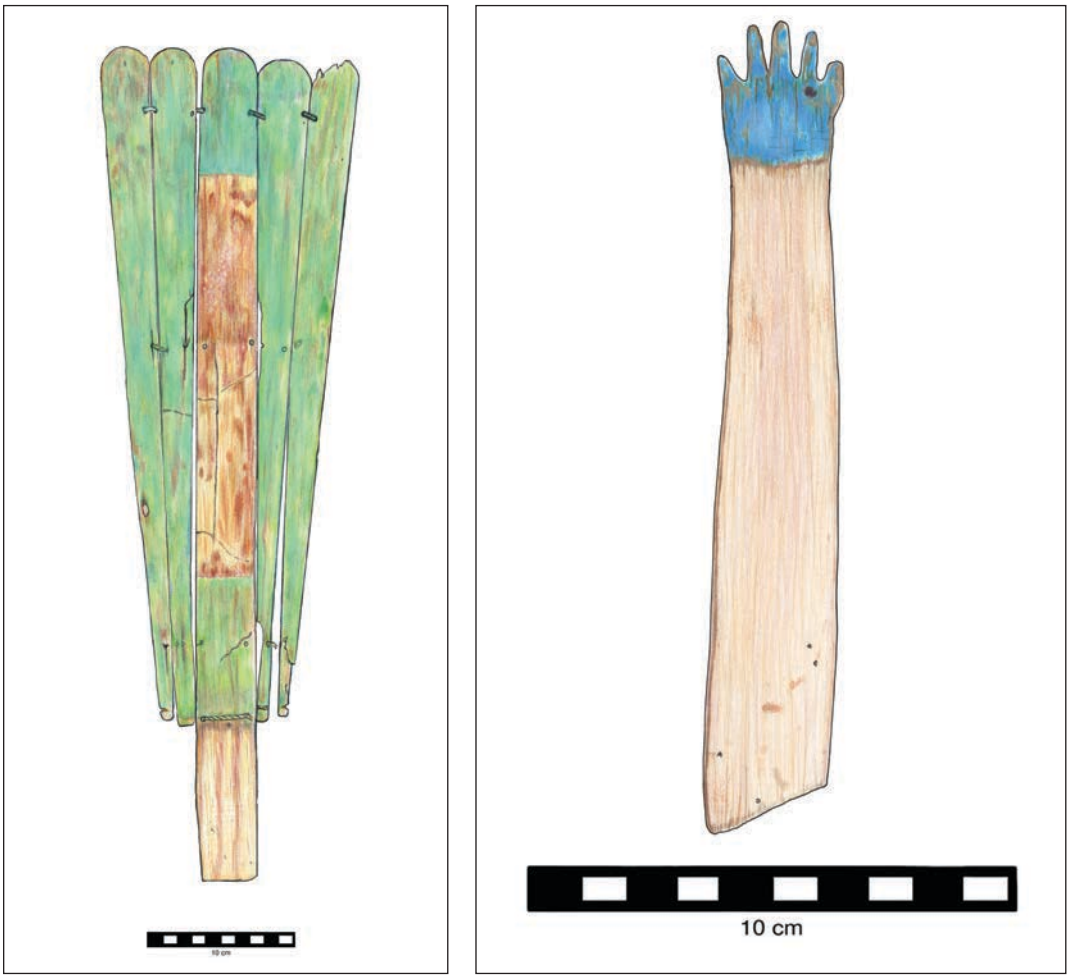
LAURIE D. WEBSTER
UNIVERSITY OF ARIZONA

For the* Chaco Migration or Emulation *project, I examined perishable artifacts from Aztec Ruins and Chaco Canyon. I sought to determine whether this evidence supports a migration of Chacoans to Aztec's West Ruin (see map on page 18), emulation of Chacoan styles by people in the Middle San Juan, or both. As part of this work, I analyzed the context, form, and low-visibility technological attributes of fourteen ritual wooden artifacts from Aztec West.

While directing excavations for the American Museum of Natural History (AMNH) in 1918, archaeologist Earl Morris (see page 26) came upon the broken remains of these painted wooden artifacts in the fill of second-story Room 72, which overlooks an early Chacoan kiva. He encountered additional fragments in adjacent rooms. A few of the objects are complete, but most had been broken—accidentally or deliberately—before Morris unearthed them. Surprisingly, Morris never published the assemblage. Seven decades later, in their 1990 administrative history of Aztec Ruins National Monument, Robert and Florence Lister briefly described the group, noting its close resemblance to painted wood from Chaco Canyon and urging that it "be examined forthwith."

Thus, I was very pleased to encounter the objects in a storage area at AMNH while conducting a preliminary survey of perishable artifacts in preparation for our project. Dating between 1110 and 1140, these flat, carved objects exhibit a variety of forms, including bird tails and wings, a sandal, a human arm, horns or crescents, and scalloped figures that may represent turkey tail-feather fans. Most are painted blue-green, and a few incorporate red or yellow paint. The wood appears to be pine or some other softwood. Recognizing their significance, I returned to photograph and document the objects, and I arranged to have nondestructive X-ray fluorescence analysis (see *Archaeology Southwest Magazine* 26:2) performed on the blue and green paint.

Both faces of a sandal-shaped object (AMNH29.0/8528) recovered from Room 72 of Aztec's West Pueblo in 1918. To prepare for publication and out of respect for tribal concerns, I asked artist Robert Ciaccio to prepare color drawings of the artifacts from photographs. That project was underwritten by Archaeology Southwest. You are seeing the first published color illustrations of this assemblage. ILLUSTRATIONS: ROBERT B. CIACCIO; REPRODUCED COURTESY OF THE AMERICAN MUSEUM OF NATURAL HISTORY



Birdtail-like object with handle (left) (AMNH29.0/8523) and arm with blue hand (right) (AMNH29.0/8534) recovered from Room 72 of Aztec's West Pueblo in 1918. ILLUSTRATIONS: ROBERT B. CIACCIO; REPRODUCED COURTESY OF THE AMERICAN MUSEUM OF NATURAL HISTORY

I compared the Aztec group with similar objects from Pueblo Bonito, Pueblo del Arroyo, and Chetro Ketl in Chaco Canyon (see map on page 4). The assemblages share a number of commonalities, such as the fact that most objects were broken when found, and they express some common themes, including bird wings and tail feathers (Aztec, Pueblo Bonito, and Chetro Ketl) and sandals (Aztec and Pueblo del Arroyo). More importantly, however, my examination documented several shared low-visibility technological attributes, including a similar texture in the unpainted areas, a common method of binding the pieces together during construction, and similar X-ray fluorescence readings for the blue-green paint.

These observations, together with stylistic and technological similarities among other ceremonial or high-status artifacts from Aztec and Chaco, including textiles, clay-coated coiled baskets, reed-stem containers, and wooden staffs, led me to propose that these artifacts were produced by individuals trained in the same learning networks. Because ethnographic evidence strongly suggests that Pueblo ritual objects, such as those found at Aztec West, would not have been traded or given to anyone who had not been initiated in their proper use, care, and disposal, it is likely that these items remained in the personal possession of those who had that specific knowledge. Therefore, in my view, the perishable evidence suggests that a group of ritual practitioners from Chaco Canyon moved to Aztec West during the early 1100s, bringing their ritual knowledge, ceremonial paraphernalia, and manufacturing practices to this newly founded great house community.

For black-and-white illustrations of these and comparable items, see Volume 22, No. 2 of Kiva: The Journal of Southwestern Anthropology and History *(Winter 2011), pages 139–171.*

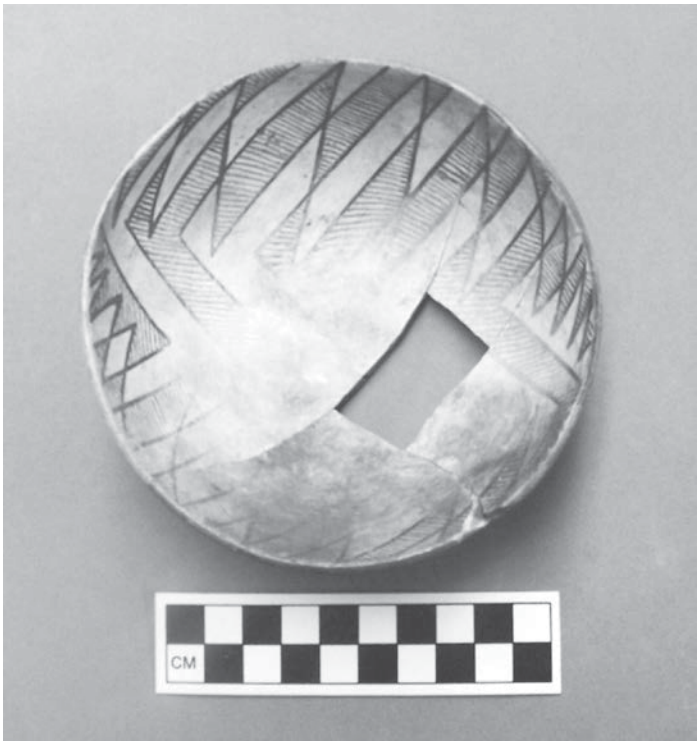
Food for Thought...

Formally designated in an earlier era, Salmon and Aztec's official names include the word "ruins." Descendant communities do not view such places as ruins, however. Pueblo people see the remains of settlements as footprints or markers of the lives and journeys of their ancestors. Rather than being used up or abandoned, these places are replete with stories, messages, and lessons, and ancestors remain there. This view resonates with today's archaeologists, who see sites not as "ruins," but as places rich with information about life in the past.

Identifying Local and Immigrant Potters in the Middle San Juan

LORI STEPHENS REED
AZTEC RUINS NATIONAL MONUMENT

On behalf of the *Chaco Migration or Emulation* project, my team and I examined several hundred whole pots and thousands of potsherds from Salmon Pueblo and Aztec West (see maps on pages 4 and 18), as well as items from smaller great houses and community sites in the surrounding area. In our view, the evidence suggests that the establishment of great houses first at Salmon and then at Aztec was a complex social process involving mutual engagement on the part of local and Chacoan artisans and specialists.



Researcher Dorothy Washburn has identified complex symmetry patterns executed by Chacoan potters, which she calls the Chaco Design System. Unique to black-on-white pots with hatched design elements, the patterns are most commonly found on pottery from the Chaco Canyon great houses, especially Pueblo Bonito. The classic cylinder jars from Pueblo Bonito (which we now know held cacao) consistently have these particular designs. This Chaco Black-on-white bowl (FS 32828) was imported into Salmon from Chaco Canyon. The painted design on the interior of the bowl shows the Chaco Design System. PHOTO: LORI REED, COURTESY OF SALMON RUINS MUSEUM

Technological and Design Signatures

Following on the work of Hayward Franklin, a ceramicist who worked at Salmon Pueblo in the 1970s, we characterized the local technology and resources used by Middle San Juan (MSJ) potters. In general, MSJ potters mixed crushed-rock temper into their clays (temper prevents clays from cracking during forming, hardening, and firing). Their pastes (fired clays) were soft and silty, as were their slips (clay mixed with water to form a coating).

We then developed a strategy for distinguishing pottery made in Chaco Canyon from emulation of Chacoan styles by local potters or production of Chacoan-style pottery in the MSJ by people trained in Chacoan traditions. Chacoan potters did several distinctive things: they applied a coating to pots in a semi-sheer layer (which we call a "washy slip"; see bowls on facing page), and they often painted symmetrically patterned hatched designs with a continuous line technique (the Chaco Design System; see photograph, this page). They also mixed sand or sand-and-sherd temper with their clays. Pottery made in the canyon has a hard, non-silty paste, and the slips are bright white and polished. Pottery made by Chacoans in the MSJ used the MSJ clays for pastes and slips, and continued the tradition of using sand and crushed-sherd temper, but with local shale mixed in. Chaco-style pottery made by non-Chacoans has a washy slip similar to that achieved by Chacoan potters working with MSJ clays, but it also usually has crushed-rock temper. Most tellingly, we see evidence that local MSJ potters could not accurately reproduce the complex Chacoan designs.

Patterns through Time

Before the late tenth century, people living in the MSJ did not import much nonlocal pottery, and most of that came from the Mesa Verde region. When local leaders began establishing great houses and participating in the Chacoan network in the eleventh century, the focus of cultural networks shifted toward the south. Residents of the MSJ imported black-on-white pottery from Chaco and corrugated cooking pots and black-on-white pottery from the Chuska valley (see map on page 4). Again, we know that this pottery was imported because of the nonlocal clays and

Another hallmark of Chacoan white ware pottery from A.D. 1000–1150 is the washy slip potters applied to these vessels. Top: A Chaco-McElmo Black-on-white bowl (AZRU-965, Morris FS 4281) imported into Aztec from Chaco Canyon. Note the section of white slip on the outside of the bowl just below the rim. Middle: McElmo Black-on-white bowl (AZRU-831, Morris FS 4580) made at Aztec but having Chacoan style characteristics. Here, the white slip on the outside of the bowl is an example of Chacoan style applied to locally made pottery. PHOTOS: COURTESY OF THE DIVISION OF ANTHROPOLOGY, AMERICAN MUSEUM OF NATURAL HISTORY

Bottom: A digital model of a Chaco Black-on-white cylinder pitcher with frog face. The vessel itself was recovered at Aztec (AZRU-1645). This 3D model is one of many featured in the Chaco's Legacy *exhibit (see pages 22–24). Ancient peoples of the Southwest seem to have held animals associated with water in special esteem.* DIGITAL MODEL: DOUGLAS W. GANN

tempers used. At local MSJ great houses such as Point/Shannon Bluff Pueblo, Aztec North, and at the Holmes Group (see pages 16–19), people were using significant amounts of these imported pots. This was also true at the Hilltop site, a small pueblo adjacent to Salmon that may have set the stage for its construction and for migration from Chaco to the MSJ (see page 17).

Trash deposits at Salmon dating just after the pueblo's founding in 1090 contained high percentages of pottery made in Chaco Canyon and the Chuska valley. We also documented locally made pots that featured the washy slips and design system associated with Chacoan craftspeople. These were probably made subsequently, as pots needed to be replaced or "inventory" needed to be built up.

The best and most abundant evidence of Chacoan immigrant potters comes from Aztec West, however. In our examination of pottery recovered from three kivas and three rooms dating between 1110 and 1130, we identified numerous whole pots and potsherds, including bowls, jars, pitchers, ladles, effigies, and a single cylinder jar fragment. Based on what we have determined about technology and design combinations, we can say that people brought some of these items from Chaco Canyon, Chacoan immigrant artisans made a few of the objects, and local potters made others in emulation of Chacoan styles.

We believe that immigrant potters learned about local materials from local potters, and local potters copied the washy slip technique as they began learning the design styles perfected by Chacoan potters. Interestingly, specific patterns in the Chaco Design System were associated with specific places in Chaco Canyon, so Chacoan potters in the MSJ were deliberately displaying this information, at least to other Chacoans. At present, we can only speculate as to whether emulators understood the messaging inherent in those designs, or were taught to do so.

Documenting Great House Architecture at Aztec Ruins

GARY M. BROWN
NATIONAL PARK SERVICE

Chaco's legacy in the Middle San Juan is powerfully evident at Aztec Ruins National Monument. But who exactly built the small great house now known as Aztec North? And who then built the massive great houses now known as Aztec West and East?

Long-term investigation of the community's spectacular architecture by me and other colleagues—which contributed to the *Chaco Migration or Emulation* project—shows that the cultural landscape comprising Aztec West and East was conceived, but not entirely built, by people from Chaco Canyon. Co-investigator Cheryl Paddock and I compiled evidence that indicates local builders with different skills and traditions also participated in construction. Most intriguing are attributes not easily categorized as local or nonlocal, which underscore the likelihood that mixed groups collaborated on certain aspects of great house construction.

View toward the east from the third story in the central core of Aztec West. The earliest dated structure, Kiva L, is located in the lower right corner of the photo. Although architects and specialists planned and built West Ruin as one massive, contiguous structure, construction efforts occurred in short stages: dates for rooms throughout the site fit into a twenty- to thirty-year period, including intact second-story remnants and roof fall from third-story roofs. The only distinct pattern is an abundance of tree-ring dates in the early 1100s toward the eastern portion of the great house and numerous dates slightly later toward the western portion. PHOTO: GARY M. BROWN, COURTESY OF THE NATIONAL PARK SERVICE

High-visibility and Low-visibility Clues to the Heritage of Aztec's Builders

Monumental construction is itself distinctly Chacoan, but many other attributes signify the work of Chacoan planners and builders. Chacoan "high style" consists of carefully selected, finely dressed (ground, pecked, or otherwise carefully shaped) sandstone masonry and thick core-veneer walls (inner cores of rubble or of solid, semi-coursed masonry, with specifically patterned veneers of facing stone). Great houses in Chaco Canyon had spacious rooms with high ceilings and large rectangular doorways connecting suites of rooms, some of which had exterior balconies. Core-veneer walls footed by deep, cobble-and-adobe-filled foundation trenches tapered as they rose to accommodate such monumental weight. Sophisticated roof construction incorporated carefully shaped timbers felled in distant forests.

All of these attributes are present at Aztec West and Aztec East. Although outsiders may have observed exterior wall treatments, and possibly room interiors, at Chaco Canyon great houses, it does not seem likely that they could have accurately reproduced the full range of features without extensive knowledge and training. Likewise, a non-Chacoan could have perceived the less-visible technological aspects of wall construction, such as intramural beams and solid core-veneer masonry, only if present during building, repair, or demolition. Therefore, we can reasonably say that a sizable workforce of skilled Chacoans was present at the establishment of the Aztec East and West great houses (and see page 14).

As far as we know from several excavated structures in the region, Animas valley builders were experienced in the use of adobe. They reinforced mud with cobbles or wooden poles, or

both, and they also laid walls with generous courses of puddled adobe. Several intriguing structures in the Aztec Community seem to bear a local signature. Beneath the Hubbard tri-wall structure (see map on page 18), which dates between 1130 and 1200, lies an earlier kiva built of distinctive rod-reinforced adobe. Beneath the opposite side of the tri-wall is an earlier multiroom structure made of adobe. Significantly, Aztec North, though unexcavated, shows a classic Chacoan footprint, but apparently lacks sandstone masonry (see map on page 18). There is evidence that builders used coursed adobe to construct the main room block, which would have been two stories high in places. South of the main room block lies an arc of cobble rooms enclosing a plaza with a large kiva depression. Pottery at Aztec North dates its construction around 1060–1080, before Aztec West.

The adobe structures beneath the tri-wall are arguably local. The fact that people built Aztec North with materials showing affinity to local construction also suggests that locals might have established it—which would not be the only time non-Chacoans observed the overall layout of a Chacoan great house and created it with local materials. If archaeologists were to excavate Aztec North, they might find direct evidence of local construction. As it happens, however, there is good evidence for local participation in construction at the East and West great houses.

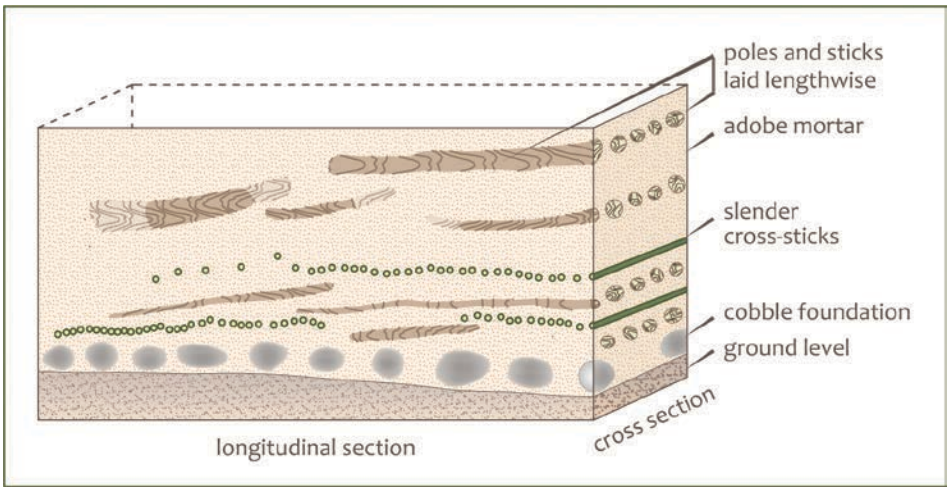
Mud and Masonry

Inside the imposing exterior walls of early twelfth-century West Ruin, archaeologists found…mud! Part of the west wing consists of Chaco-style rooms built with thick adobe walls that are clearly contiguous with sandstone core-veneer walls and constructed in accordance with the Chacoan floor plan. Excavators also found a distinct kind of adobe construction throughout the south wing. In some instances, parallel series of thin poles within adobe and masonry walls alternated with perpendicular shorter pole sections. This ingenious method of reinforcement—a low-visibility attribute—has not been documented in Chaco Canyon (or elsewhere, that we know of) and bears affinity to local vernacular architecture as we know it thus far. Courses of this stick-reinforced adobe alternated with courses of cobble masonry and courses of adobe (see illustration below).

We think that this *jacal* (hah-call)-masonry hybrid reflects a local Animas tradition into which Chacoan masonry techniques were introduced hand-in-hand with multistory architecture. In other words, locals versant in adobe construction were probably working alongside and following the plans of Chacoan builders. Later rebuilding to stabilize the hybrid construction with coursed sandstone masonry in certain walls in the south wing also indicates that the local innovation was part of the original construction. Because people normally plastered these adobe and hybrid-adobe walls, they would have looked the same as core-veneer walls.

Veneer masonry styles are today highly visible, but they would have been low-visibility characteristics when walls had been freshly plastered. Archaeologists recognize four basic styles of Chacoan masonry, Types 1 through 4, and a fifth style known as McElmo. At Aztec West, the initial architectural core contains fine examples of Types 3 and 4, which were contemporaneous, and it contains less characteristic—nonconforming—examples that we attribute to less-skilled masons, probably including locals, and to experimentation with softer local sandstones. The famous greenstone bands on the west exterior wall of West Ruin are probably a local interpretation of Type 3 on walls that otherwise consist of McElmo-style masonry. Most of the facing at Aztec West is McElmo style, however, and nearly all of the masonry observed at Aztec East is McElmo style. This style is highly variable at Aztec, with abundant examples of typical and nonconforming varieties. The latter arguably represent expedient and perhaps poorly trained workmanship.

In light of these apparent proficiencies, deficiencies, and variations, we suggest that, at the very least, building during the second and third Chacoan phases at Aztec West was a collaborative enterprise that included master Chacoan masons, apprentice masons drawn from the local population, and local adobe experts.



Distinctive stick-reinforced adobe found in the south wing of Aztec West seems to reflect local Animas innovation. GRAPHIC: CATHERINE GILMAN AND GARY M. BROWN

Building Sequences at Aztec

The key to understanding the architectural history of the East and West great houses at Aztec lies in the wood used to build them. With many thousands of roof beams and timbers framing doorways, windows, and other features, both pueblos have been gold mines for tree-ring dates. Dendrochronology has shown conclusively that people built almost all of West Ruin's 400 original Chacoan rooms within a few decades (1100–1130), whereas people built nearby East Ruin over the course of almost two centuries (1120–1290).

Interestingly, Chaco Canyon also had examples of quickly built great houses and others that grew over the course of centuries. In fact, many large Pueblo sites are the gradual result of incremental building stages, each representing a new social group or coordinated labor investment as the founding group sustained population growth. By the very swiftness of its construction, Aztec West must have been established by a very large founding group. A large group of local people also participated in this massive construction effort.

Striking greenstone or greywacke bands on the west exterior wall of Aztec's West Ruin are probably a local interpretation of a Chacoan masonry style archaeologists call Type 3. The rest of the masonry in this wall represents a type known as McElmo. PHOTO: COURTESY OF THE NATIONAL PARK SERVICE

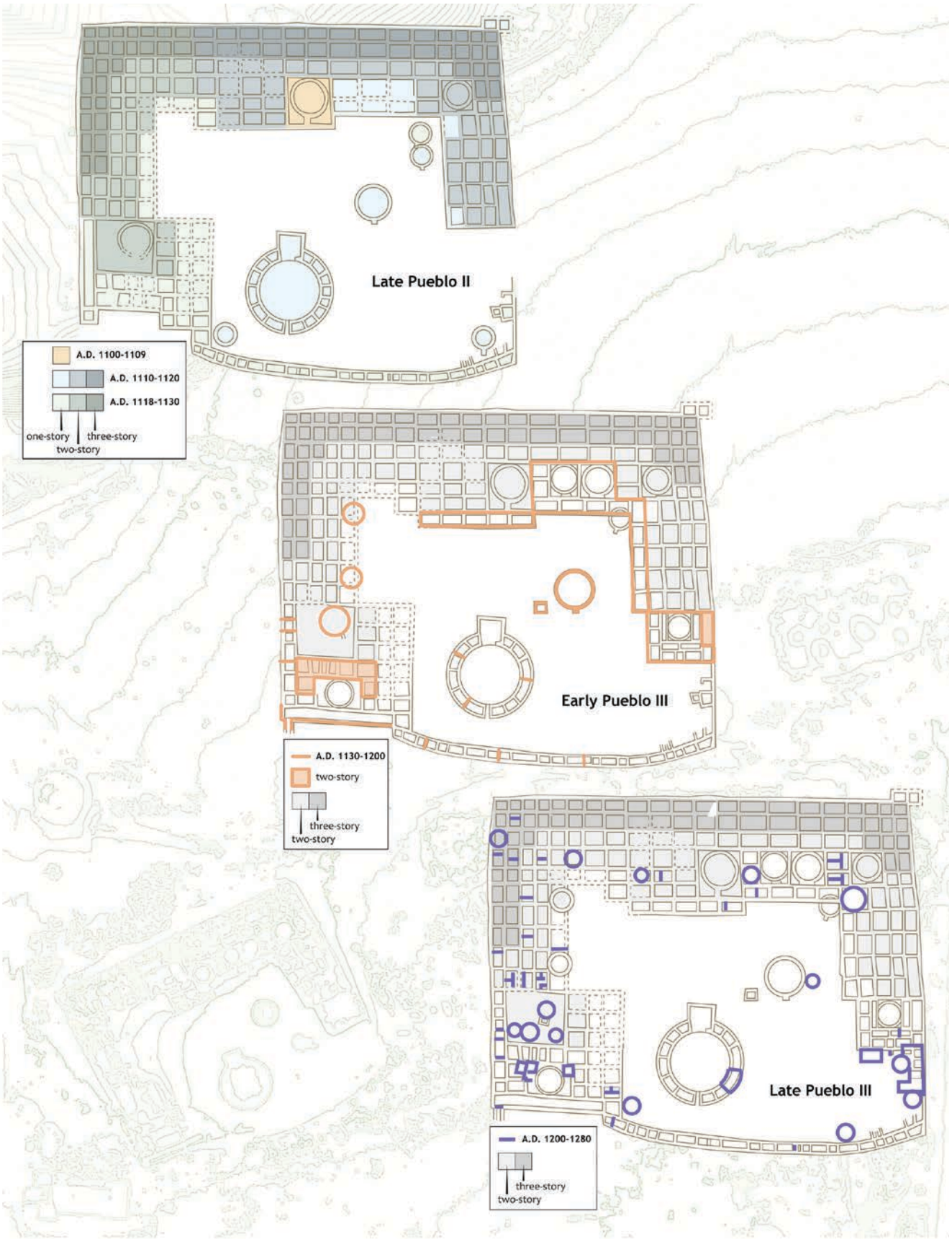
For years, we collected tree-ring samples and architectural data at Aztec West that indicated only two major stages of initial construction. Then, when tree-ring expert Tom Windes and I collected samples from several logs built into a circular kiva in the center of the main room block (Kiva L), we found a significant anomaly. These samples yielded the earliest cutting dates (the exact dates when trees were harvested) at West Ruin, which suggested there was an earlier building phase between 1100 and 1109. Rooms dating to what we now think of as the second Chacoan stage, 1110–1120, surrounded that kiva. This second stage included most of the east wing and central core of the room block. The third stage represents continuous construction farther west and including most of the west wing, 1118–1130.

One major abutment (walls built against existing construction) represents the addition of a new block of rooms onto the original Chacoan building. At the southern end of the east wing, people built a kiva surrounded by several small rooms. The layout of this addition and the type of kiva reflect a later architectural style that dates after 1130. Kivas in a renovated section of the main room block also reflect this later style. This renovation includes a row of rooms abutted against those previously facing the plaza from the north and the east. Remodeling blocked off numerous rooms toward the north as people built aboveground kivas into remodeled rooms. Although we do not know why the inhabitants closed these rooms off from future habitation, we do know that, prior to renovation, people had primarily stored raw materials and craft items in these rooms. The remodeling seems to represent a major change in how people used the Aztec West great house (see center of facing page).

Reorganization again took place in the 1200s, when people subdivided many large Chacoan rooms into smaller chambers with adobe partition walls. They also built numerous, relatively small circular kivas inside previously square rooms and in the plaza, belowground (see bottom of facing page).

Several Chacoan rooms were transformed during the late 1100s and 1200s into convenient trash dumps, burial places, and even turkey pens. Although many structures at Aztec West, including the great kiva, were used for ceremonies and public gathering during this time, construction consisted of simple domestic architecture within and adjacent to the great house. In this era, the Chacoan legacy focused on Aztec East, where major construction continued and the tradition of great house architecture persisted until the 1270s.

—Gary M. Brown; graphic on facing page by Catherine Gilman and Gary M. Brown, background contour map by Michael Brack


Late Pueblo II
A.D. 1100-1109
A.D. 1110-1120
A.D. 1118-1130
one-story
three-story
two-story
Early Pueblo III
A.D. 1130-1200
two-story
three-story
two-story
Late Pueblo III
A.D. 1200-1280
three-story
two-story

Finding Chacoan Immigrants and Seeking Emulation on the Middle San Juan Landscape

PAUL F. REED
ARCHAEOLOGY SOUTHWEST AND SALMON RUINS MUSEUM

A large part of my work on the *Chaco Migration or Emulation* project centered on the creation of a comprehensive database on settlement and architecture in the Middle San Juan (MSJ). I then used this database to assess the extent of Chacoan influence and presence in the region. My analysis revealed Chacoan migration and emulation of Chacoan great houses by local populations. I argue that these patterns played out differently among the three drainages that form the MSJ—the San Juan, Animas, and La Plata River valleys (see map on page 20)—because of differences in how many people were already living in each area when Chacoans arrived (or began planning their migrations). Differences in the streamflows in each valley also played a role (see *Archaeology Southwest Magazine* 20:3).

Situated downriver from Salmon, the Jaquez great house had about 125 rooms (less than half the size of Salmon) and a surrounding community of some 120 rooms (four times as many as Salmon). PHOTO: ©ADRIEL HEISEY

Attributes of Chacoan-built and Locally Built Great Houses

Together with previous studies of vernacular (everyday, domestic) architecture in the MSJ and Lori Reed's work on local and nonlocal pottery, Gary Brown and Cheryl Paddock's analysis of building techniques at Aztec (see pages 12–15) helped me distinguish Chacoan and MSJ construction at other sites in the region. It is worth noting, however, that many sites of this period (1090–1130) in the MSJ are known only from surface remains, so there are several instances in which I cannot say for certain, at present, whether a structure is local or Chacoan. I do not discuss such sites here.

Chacoan construction is characterized by consistently shaped and sized tabular sandstone; thick walls; specific veneers on wall exteriors; sandstone masonry in wall cores; and deep, cobble-filled foundation trenches. In general, great houses built by local MSJ populations have less regular, shaped and unshaped sandstone, igneous rock, or cobbles; thinner walls; unpatterned or non-Chacoan veneers; a mix of materials for wall cores; and shallow or nonexistent foundations.

These contrasts in both high- and low-visibility attributes suggest that local populations lacked either the ability or desire to skillfully copy Chacoan stone-shaping and veneer methods. Beyond this, the apparent lack of training in Chacoan construction methods suggests local MSJ builders were simply not aware of many of the lower-visibility methods utilized by Chacoan builders, such as complicated foundation- and wall-building techniques and specific veneer-creation methods.

The San Juan River Valley

The first identified Chacoans to migrate to the MSJ settled along the San Juan River just before A.D. 1100, establishing the great houses now known as Salmon (see page 6), Jaquez (hah-kez), and Sterling. Although the valley was fertile, there were not many people living in its middle and lower reaches at the time that Chacoans arrived: we know of only a few scattered Basketmaker III (A.D. 500–750), Pueblo I (750–900), and early Pueblo II (900–1050) sites in this part of the valley. Ceramic and architectural evidence suggests that Chacoans established the Hilltop site, which is adjacent to Salmon, as an entry point and temporary residence while they built the latter. The small pueblo near Jaquez, Box B, may have served a similar purpose while Chacoan immigrants built Jaquez and Sterling.

An example of core-veneer construction at Salmon Pueblo. Chacoans built walls that had inner cores of rubble or solid masonry with patterned veneers on the exterior. We consider this a low-visibility attribute specific to Chacoans, because the method would not have been apparent to someone who had not seen or known of such walls being built. PHOTO: DOUGLAS W. GANN

As at Aztec (see pages 12–15), the massive scale of construction, careful selection of tabular sandstone, and use of specific veneer patterns matching the finest examples in Chaco Canyon all indicate the presence of Chacoan people at Salmon. Because of its size and lack of substantial surrounding community, Salmon represents a unique form of great house in the MSJ—and perhaps even in the Chacoan world. Unlike the pattern typically suggested for Chacoan great houses, Salmon sheltered a substantial residential population that included immigrants and locals (see page 6). I hypothesize that there were several related, extended families and lineages from Chaco Canyon living at Salmon, totaling perhaps 50 to 75 people. The remainder of its 150–200 residents probably comprised local people recruited to live in the multiethnic pueblo.

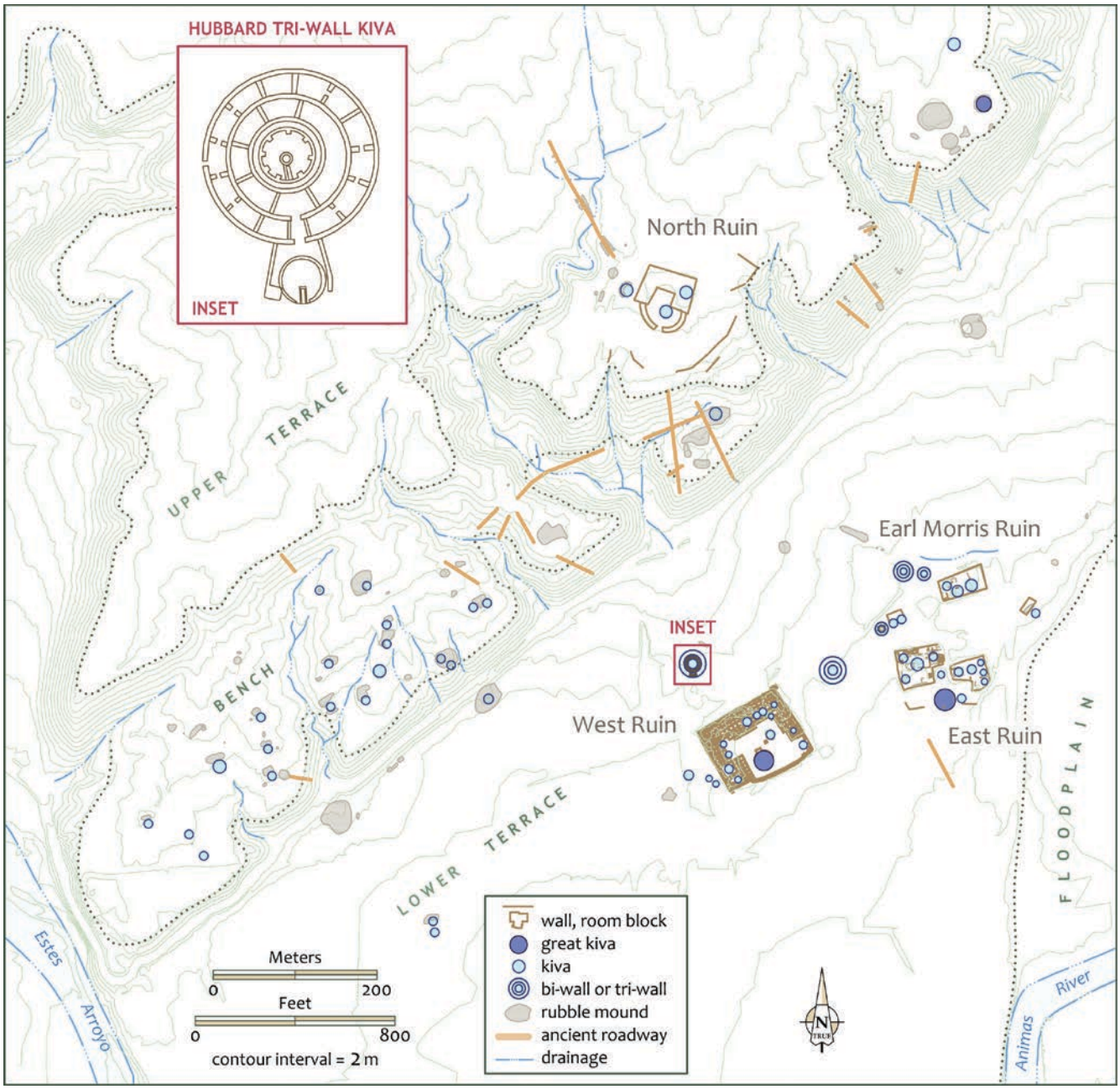
There is one locally built great house in the lower San Juan valley portion of the MSJ, at the Point/Shannon Bluff site. Although its founding is not well dated, this seems to have occurred in the period between A.D. 1075 to 1125, either just before or after Chacoans built Salmon Pueblo. The Point great house has not been excavated, so we know very little about it.

The Animas River Valley

In the early 1100s, a few years after the founding of Salmon, subsequent waves of immigrants from Chaco established great houses in the Animas and La Plata (see following) River valleys. Similar to the situation at Salmon on the Middle San Juan River, the Animas valley had only scattered population where the immigrants chose to build. Here, Chacoans established the great houses now known as Aztec West and Aztec East, which are part of a complex of sites known as the Aztec Community (see page 6). The dense concentration of sites in the Aztec Community represents the largest commitment made by Chacoan immigrants and their local partners in the entire Middle San Juan region (see page 18). Judging by this level of commitment, it is apparent that this group of Chacoans recognized the Animas setting as the best place to build the vast planned community they had in mind.

It is clear from Brown's discussion in this issue (see pages 12–13) that the great houses in the Aztec Community are not alike. Local people probably built Aztec North first, in the late 1000s, in emulation of the Chacoan model. Establishment of Aztec West (see pages 14–15) followed in 1100. As at Salmon, details of planning and construction provide excellent evidence that people from Chaco Canyon moved to Aztec and built much of this well-planned great house. Following archaeologists Steve Lekson and Ruth Van Dyke, and based on our group's research, I would suggest that the immigrants who founded Aztec West were among the primary leaders of Chaco Canyon, and that these people intended to re-create Chaco's built landscape at Aztec—in other words, they sought to make "downtown Aztec" just like "downtown Chaco." With construction of Aztec East, beginning in the 1120s, they fulfilled that intention.

In addition to Aztec North, there are two other great houses in the Animas valley local people probably built in emulation of Chacoan style in the period between A.D. 1075 and 1140: the



"Downtown" Aztec. The dense concentration of sites in the Aztec Community represents the largest commitment made by Chacoan immigrants and their local partners: people built at least four great houses within the area (the fourth great house dates to the 1200s and is not discussed in this issue). In total, these great houses contained nearly 900 rooms, with more than 600 additional rooms in the surrounding smaller pueblo sites. This clustering of great and small houses is unprecedented outside of Chaco Canyon. MAP: CATHERINE GILMAN AND MICHAEL BRACK

Dein site and the Farmer's site. As neither site has been formally excavated, little is known about these great houses.

The La Plata River Valley

In contrast to the lower and middle San Juan and Animas River valleys, there was substantial settlement in the La Plata valley between about A.D. 600 and 750, and again after 950. By the mid-to-late 1000s, when Chacoan groups began to look northward and consider migration, La Plata was already well populated. This migration required a different approach.

By whatever means—bargaining, trading, coercion, or something else—Chacoans obtained permission to build great

houses at only two locations along the La Plata River, at sites now known as Morris 41 and the Holmes Group, in the period between A.D. 1075 and 1125. With approximately 100 rooms at the former and thirty-five rooms at the latter, these Chacoan great houses are significantly smaller than the edifices at Aztec and Salmon. Even though—or perhaps because—the La Plata valley was a well-populated setting, Chacoans apparently felt the need to announce their presence. It is clear from the Pueblo archaeology in the La Plata valley that Chacoans never committed to a full-scale colonization as they did in the Salmon and Aztec areas.

Interestingly, La Plata has more great houses (eight in total) than the other two drainages do, although all are small to medium in size (between twenty-five and 100 rooms), and all are situated within large clusters of surrounding small pueblos. Moreover, most La Plata communities have more than one great house. The three largest communities—Holmes Group, Morris 39, and Morris 41—all contain at least two great houses, with one local and one Chacoan each at Holmes and Morris 41. (Morris 39 also has a third great house spatially separated from the rest of the site.) I suspect that once Chacoan immigrants built the northern great houses at Morris 41 and the Holmes Group, local leaders subsequently built their own versions to capitalize on Chacoan presence, join the Chacoan social and economic network, and raise their social status in the local community.

The reverse pattern is also possible, with local leaders building great house replicas first, perhaps to attract Chacoan attention, as seems to have happened in the Aztec Community. These patterns are similar to what we see at other great house communities in the greater San Juan Basin, such as at Newcomb or Hogback, where Chacoans arrived in already-populated areas.

My reconstruction of the builders' origins and the timing of great house construction in the MSJ raises other questions about the dynamics of ancient Pueblo settlement in the region. For example, can we detect the mechanisms that allowed Chacoan entry to the MSJ? How much cooperation or coercion was involved in the Chacoan colonization? Does La Plata represent an area where local people partially resisted Chacoan influence? Clearly, there is more work to do.

A scene from Chaco's Legacy *featuring Salmon Pueblo. Note the second-story tower kiva. See pages 22–24 to learn more about the creation of the* Chaco's Legacy *digital exhibit.* IMAGE: DOUGLAS W. GANN

Appraising Chaco's Legacy in the Middle San Juan

JEFFERY J. CLARK AND PAUL F. REED
ARCHAEOLOGY SOUTHWEST

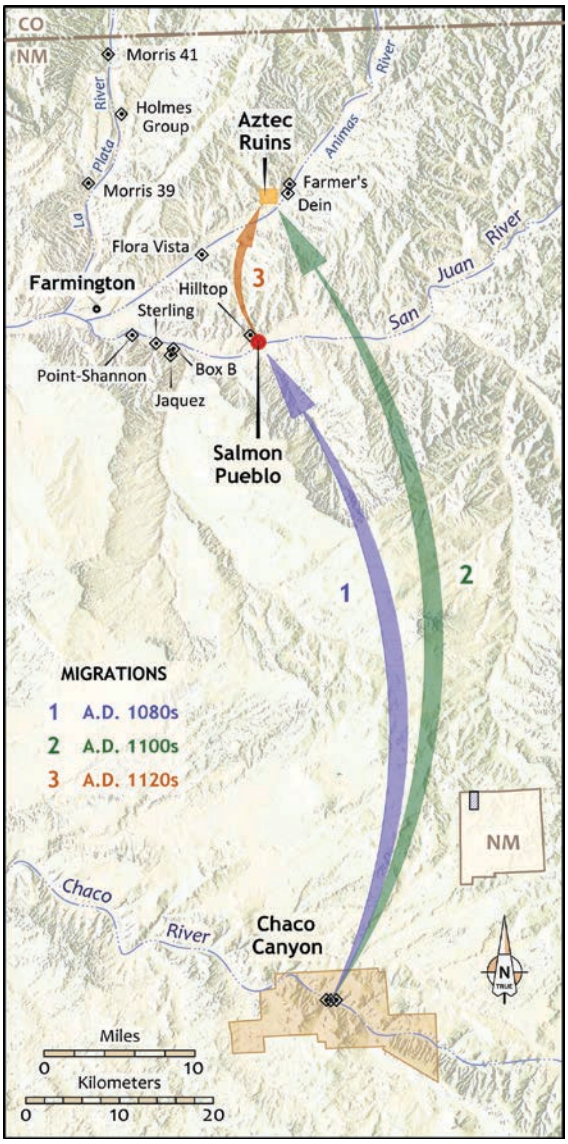
Researchers have debated the extent and character of Chaco influence in the Middle San Juan (MSJ) during the late eleventh and twelfth centuries. This debate has overshadowed the equally important question of who was living in the numerous less conspicuous and understudied settlements in the region. What was their experience of Chacoan presence or influence? What was the Chacoan experience of the local populations they encountered?

Most of our evidence for addressing the "migration or emulation" question has come from Salmon Pueblo and the Aztec Community. Much more work needs to be done to identify immigrant presence apart from these two sites. Moreover, determining the occurrence and scale of migration is only the first step. A next step is understanding the why, the motivation for moving. The ultimate goal is to determine the impact of migration.

Taking a step back, we note that biological and material culture evidence indicates that diverse groups immigrated to Chaco Canyon in the 800s and 900s, and joined the resident population already in the canyon, which had developed from Basketmaker III and Pueblo I roots (see archaeologysouthwest.org/asw28-1 for references to those studies). Regardless of their origins among and beyond Ancestral Pueblo populations, these groups left the canyon a different people. Changes in social organization, ideology, and identity are evident in textiles, ritual objects, decorated ceramics, and architecture.

Was Chacoan society tied to an ideology that served to integrate multiple ethnic groups residing in the canyon? If so, then tracking migration out of Chaco Canyon during the late-eleventh and twelfth centuries would be complicated by the fact that these emigrants may have retained deep-rooted practices from before they moved into the canyon, while at the same time participating in an overarching Chaco identity that emerged within the canyon.

Although the overarching Chaco identity probably subsumed multiple ethnicities in the canyon, another model may be useful for conceptualizing the spread of Chacoan material culture and the movement of Chacoan groups into the MSJ and other areas of the northern Southwest. If people emigrated from the main centers in Chaco Canyon before departing from the outlier settlements, roads that connected the latter to the former suggest a dispersed population that maintained ties based on heritage and homeland. Chacoan immigrants would have been skilled minorities with considerable ideological power or influence in the valleys in which they resettled. Continued contact among these dispersed groups would have helped consolidate and perpetuate their power in their new communities.



According to our research, Chacoans first built Salmon Pueblo, and then a second group of Chacoans built Aztec's West Pueblo. Finally, some Chacoan residents of Salmon Pueblo joined the Aztec Community. MAP: CATHERINE GILMAN

Although Chacoan influence was a common theme in the MSJ, each drainage revealed a different story (see pages 16–19). In the San Juan, Salmon Ruins is a genuine Chacoan enclave with classic Chacoan construction and a perishable collection demonstrating close connections to Pueblo Bonito. There are few candidates for local settlements in the immediate vicinity, suggesting sparse population prior to Salmon's construction. Genetic dental traits revealed by buried human remains seem to indicate the presence of Chacoan and local groups at Salmon, however, and there are settlements

farther upstream along the San Juan that were roughly contemporaneous.

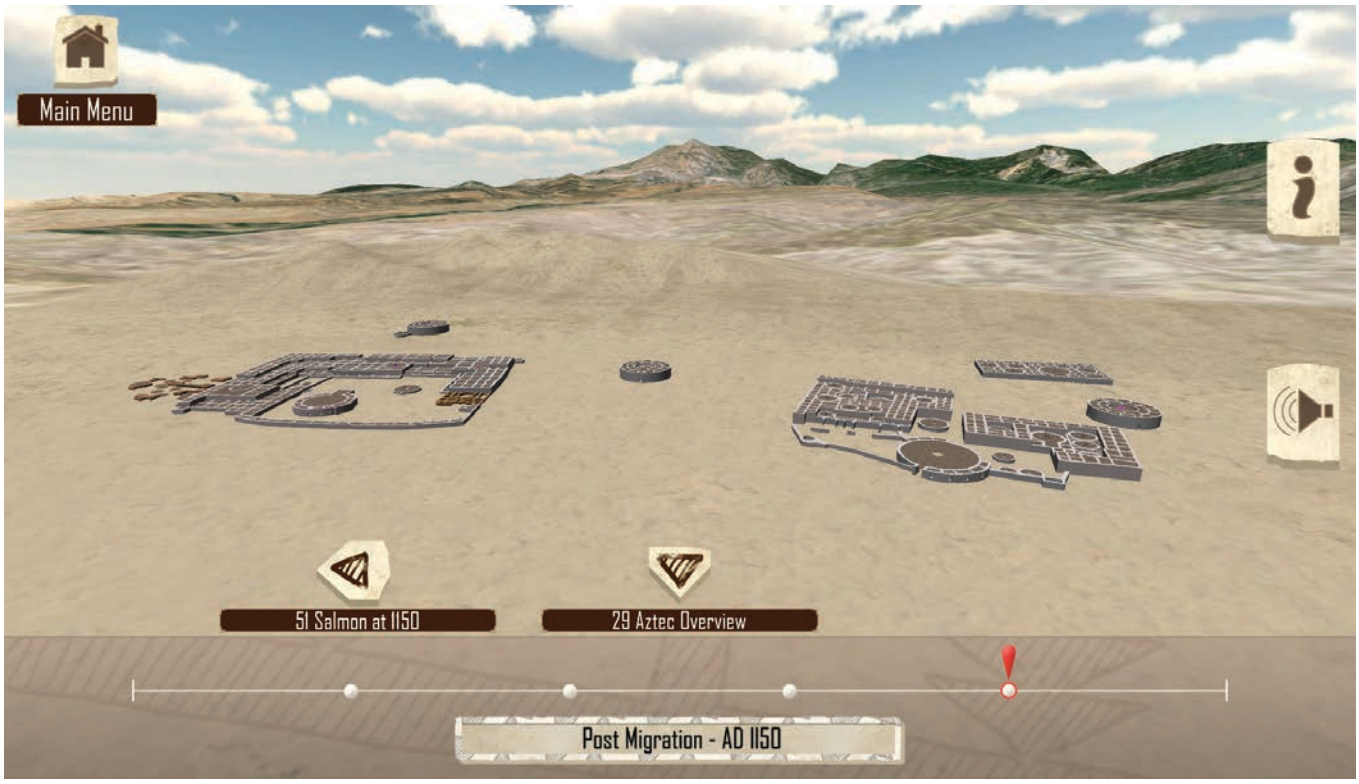
There is also compelling architectural evidence for strong Chacoan presence at Aztec East and West along the Animas River. Webster's study of perishables and Durand Gore's analysis of genetic dental traits show affinities with the inhabitants of Pueblo Bonito, thereby supporting the inference of Chacoan presence, as well. The prevalence of McElmo-style masonry is a notable and intriguing difference from Salmon Ruins. Brown and Paddock's careful examination of construction details at Aztec West suggests that Chacoan and non-Chacoan groups built this great house.

Brown also provides a tantalizing glimpse of enigmatic Aztec North, a great house apparently built with cobbles and adobe that may have predated the main great houses (see pages 12–13). Aztec North seems to have been an attempt by local groups to emulate a Chaco great house; if so, their admiration of things Chaco may have facilitated subsequent migration from the canyon. At Aztec North and other sites along the Animas, such as Flora Vista, numerous adobe and cobble residential sites are probably the architectural signature of local populations. Here, blended communities comprised primarily of local people and some Chacoans may have formed.

The La Plata drainage provides an important contrast to San Juan and Animas due to the absence of a prominent great house. The valley also exhibits evidence for substantial local populations before the eleventh century. During the 1100s, people built a number of small great houses in existing communities along the La Plata. This evidence, along with the prevalence of local architectural construction techniques, suggests that the small great houses were built by local converts or by very small groups of Chacoan immigrants who held considerably less power and skill than did their relations at Salmon Pueblo and the Aztec Community.

As is evident in their construction of great kivas and great houses and in their reproduction of ritual paraphernalia, Chacoan immigrants attempted to reconstruct idealized Chaco communities in the MSJ with variable success. Chacoan ideology was itself transformed over time by immigrants, their descendants, and local groups. This overarching identity ultimately became an integral part of a pan-Eastern Pueblo heritage, which persisted for centuries and is expressed today in the oral histories of many Pueblo groups.

To learn more about how evidence from human teeth informed the project, visit archaeologysouthwest.org/asw28-1.



A scene from the Chaco's Legacy *exhibit displaying the multiple great houses and tri-wall structures at Aztec.* IMAGE: DOUGLAS W. GANN

Sharing Chaco's Legacy

DOUGLAS W. GANN
ARCHAEOLOGY SOUTHWEST

More than we had bargained for… Initially, Paul Reed and I conceived of a digital exhibit that would follow a strategy Archaeology Southwest had used in the past, that is, an interactive touch screen presenting the evidence and the researchers' conclusions about migration and emulation through text, audio, and digital animations.

At the same time, Archaeology Southwest was developing a broader digital initiative, Virtual Southwest, which we intended to act as an online portal for sharing Southwestern archaeology though a three-dimensional (3D) digital simulation. The simulation would allow visitors to our website to explore the Southwest through time and space. We also intended to capitalize upon the flexible nature of digital resources by recycling assets created for the *Chaco's Legacy* exhibit—images, maps, 3D models of reconstructed sites and landscapes, and so on—into our Virtual Southwest system.

A scene from Chaco's Legacy *featuring an early small house village.* IMAGE: DOUGLAS W. GANN

As we began developing *Chaco's Legacy*, however, we encountered some flaws in our ideas about how to implement Virtual Southwest. Addressing these flaws led to parallel development of a new tool for sharing archaeology with public audiences. We call this tool Chronological Virtual Reality, or CVR.

Failing the Grandmother Test

The concept behind *Chaco's Legacy* and Virtual Southwest was informed by my own research on interactive exhibits in museum contexts. Public science communities generally assume that virtual exhibits should be given interpretive emphasis because younger people are more likely to utilize them—a supposition founded on the idea that the popularity of digital video gaming among young people means they will be attracted to digital exhibits.

I have come to the somewhat counterintuitive conclusion that young people generally avoid interactive exhibits and 3D animations. Instead, it is older audiences who appreciate the depth of information that can be shared via well-designed interactive exhibits. Such audiences also enjoy exploring 3D animations of conjectural reconstructions of ancient places. The reason for this apparent disconnect between exhibit technologies and expected audiences is simple: popular video games have production budgets of tens of millions of dollars. The experiences created through these games are vastly more sophisticated than anything well-meaning public archaeologists could ever hope to create, and most young people are far more sophisticated consumers of digital interactive experiences than most exhibit designers credit.

At first, Virtual Southwest tried to bridge that gap between the sophistication of today's games and what we could realistically accomplish with the 3D development tools we had already developed. We hoped to capitalize upon a three-dimensional programming system, or "game engine," to allow us to share, if not the level of graphical detail, at least the same modes of interaction that today's best video games offer. We selected a system called Unity 3D to serve as our project backbone, and

began to explore how we might import our digital assets into a virtual world that people could visit.

Our first attempt began with a simulation of a museum space with digital portals that led the visitor to digital reconstructions of Salmon and Aztec pueblos (see archaeologysouthwest.org/asw28-1). This system used a first-person-perspective game interface, meaning that visitors to Virtual Southwest could run, jump, explore, and—unfortunately—get lost, inside a virtual simulation space. By the time our trial project was completed, it was apparent that we needed programming assistance. We had developed a good collection of digital artifacts, sites, and landscapes, but we recognized that we were unlikely to master all of the nuanced programming code necessary to take *Chaco's Legacy* and Virtual Southwest to the next level.

A scene from Chaco's Legacy *showing Pueblo Bonito during the Classic Bonito phase.* IMAGE: DOUGLAS W. GANN

Fortunately, expert Unity programmer David Koontz agreed to work on the project. I admit to being rather crestfallen when, at our first meeting, David (rightly) asserted, "This will never work—it will not pass 'the grandmother test.'" What he meant was that mimicking the first-person interface of today's games created a virtual system that only experienced gamers could actually use. If our grandmothers could not use the exhibit, the user interface was deeply flawed.

The Chronological Virtual Reality System

David suggested using a path-and-node system that allows users to explore content through defined and fixed virtual paths. These paths guide visitors so that they do not end up lost in an ancient cornfield. What has evolved out of our work with David and Virtual Southwest is the CVR system. This is essentially a content management system for building interactive exhibits. We have designed it to share virtual reconstructions of landscapes, villages, and artifacts through multiple time periods.

Everything within the system is linked by a series of databases that contain various interpretive elements: blocks of text, audio segments, images, and so on. These elements are arranged by the path-and-node structure of the virtual tour system. Each node can share text, 3D models of artifacts through a dedicated 3D artifact browser, and audio narration though the exhibit speakers. Because we seek to encourage critical thinking and show how archaeology involves hypothesis testing, each tour node has a dedicated space for sharing various scholars' views on a topic.

Building the Chaco's Legacy *Exhibit*

While our programmer finished the details of the CVR system, we scoured the literature and the Chaco Research Archive, an excellent online source, to build virtual models of Chaco Canyon and the Middle San Juan (MSJ) through time and space. We constructed models for all of the "Downtown Chaco" great and small house sites through four distinct periods: the canyon during its initial settlement, construction at great house locations during the Pueblo I period (A.D. 850), building during the Classic Chaco period (1050), and massive constructions during the late Chaco phase (1100). We also created models of Salmon and Aztec through time.

These digital reconstructions were perhaps the most challenging aspect of the entire project. Representing ancient places and ancient cultures is fraught with potentials for errors or cultural gaffes, and, as Dan Simplicio affirms (see page 25), the involvement of Native advisors is absolutely critical. For this project, we decided that our simulations would illustrate the scope and scale of Chacoan buildings, the beauty and skill represented within ancient Chacoan arts, and the stark landscape of the Chacoan world. We decided that representing people in these models was too problematic. As archaeologist Steve Lekson has pointed out, when most artists try to reconstruct

A scene from Chaco's Legacy *showing Pueblo Bonito at its maximum size during the Late Bonito phase.* IMAGE: DOUGLAS W. GANN

Chaco, they simply map historic portrayals of Pueblo peoples onto the great houses. In reality, we do not know what Chaco's people actually looked like. Moreover, clothing, hairstyles, objects of personal adornment, objects of religious significance—any or all of these may be culturally sensitive. Sometime in the near future, Native groups might use these same tools to interpret Chaco with a more nuanced and sophisticated understanding of these ancient peoples, and Archaeology Southwest is committed to sharing the resources we have created to support such efforts.

Once the models were completed, we "plugged" them into the CVR system and launched the first simulation. I held my breath, almost certain the game engine would be overloaded—but no. The *Chaco's Legacy* exhibit serves ten great houses, roughly 100 small houses, and hundreds of artifacts, through four time periods, all rendered within a single system.

Next Steps

As this issue of *Archaeology Southwest Magazine* goes to press, the interactive touch screen exhibits are being installed at Salmon's and Aztec's visitors' centers. At present, we cannot offer *Chaco's Legacy* as an interactive world on our website, but we hope to overcome the requisite technological challenges soon. Because we developed *Chaco's Legacy* and the CVR system with funding from the National Science Foundation, we consider the work to be public property. We intend to release the source code and associated database modules, to encourage others to share their research through this dynamic new system.

Chaco's Legacy at Aztec Ruins National Monument

After more than fifty years and significant changes in scientific and cultural understanding, Aztec Ruins finally has an opportunity to update its exhibits and share the story of its Ancestral Pueblo inhabitants. This an especially fitting time for Aztec Ruins to replace its outdated exhibits: the park's current exhibits were installed as a part of Mission 66, a decade-long effort to enhance visitor facilities throughout the National Park Service in celebration of the agency's fiftieth anniversary in 1966. The NPS will celebrate its centennial in 2016.

The *Chaco's Legacy* kiosk in the new exhibits will offer stunning technology that allows visitors to explore ancient buildings as thoroughly as they wish. This experience invites new audiences into the museum and gives everyone a unique way to discover the Ancestral Pueblo world.

—Tracy Bodnar and Lauren Blacik, National Park Service

Zuni View of Chaco's Legacy

DAN SIMPLICIO, CULTURAL CONSULTANT
ZUNI, NEW MEXICO

Paul Reed asked me to serve as a cultural consultant for the *Chaco's Legacy* project. For more than twenty-five years, I have worked in a variety of positions for Zuni Pueblo and other entities, as an archaeologist, ethnographic consultant, council member, and health consultant.

A digital model of the great kiva at Aztec's West great house, as seen from inside the Virtual Southwest *simulation space (see page 22).* IMAGE: DOUGLAS W. GANN

As I reflected on the information conveyed by the *Chaco's Legacy* project, my immediate thoughts concerned the esoteric nature of the Pueblo Natives, although none of the images created were of a sensitive nature. I found the images to be a provocative educational tool that brings the ancient lifeways of the Pueblo people to life. With further input from Pueblo people and improvements in technology, I think we can re-create many of the non-esoteric activities and better delineate indigenous history for the public.

Anthropologists and archaeologists have amassed volumes of information about the indigenous peoples of the Southwest, but they have had a tough time putting this information together to convey meaning. Several factors impede these efforts—not the least of which is the fact that contemporary archaeologists were not there to see the living past. Archaeology focuses on what is left in the archaeological record, whereas cultural anthropologists try to extrapolate information from the descendants of past civilizations. Often times, this research is published without consideration of who owns this information.

Intellectual property rights are complicated. But, in my view, most cultural information collected is the sovereign property of indigenous peoples. The Zuni people used to live with the perspective that culture and cultural materials are alive and must be continuous. Museums, collectors, educators, governmental entities, and people across the world believe that cultures, cultural materials, and traditional cultural properties are either inanimate or figments of our imagination. So, why do these people or entities co-opt indigenous culture for personal or national profit? Because it is a billion-plus dollar industry—but with no real returns to the Native Peoples who are currently at risk of losing more of their culture.

My concerns as expressed above notwithstanding, this project can help achieve a partial understanding of the past while protecting esoteric aspects that are private and exclusive, similar to medical or religious confidentiality. The overall concept and the technological design of this project are achieving what we hoped for—the re-creation of an ancient landscape and lifeway. This re-creation of life is three-dimensional, so the mind must think in three-dimensional terms. The input Native people can offer here is critical in conveying meaning.

There is a greater potential for change, and I hope that this project can ultimately benefit all involved. Native people of the Southwest have been searching for a way to create an equitable means of sharing their part of world with the dominant society. A change in the paradigm must occur for cultural science to remain a science rather turning the science into a trade. People must be informed about the future of their own cultural continuance and put an end to the exploitation. Globally, all cultures should be interested in fortifying their own cultural values. Our values that came from the past—which is still a major part of our genetic memory and functions as our cultural continuance—must remain contextually alive. This project can bring about that progress by raising awareness and understanding of cultural continuance, as opposed to mere historic preservation.

Earl Morris: Local Boy Done Good

KATE SARTHER GANN
ARCHAEOLOGY SOUTHWEST

Under his father's tutelage, Earl Halstead Morris (1889–1956) became an eager pothunter at three-and-a-half years old. The facts of Morris's early life and times make this more understandable, however, and in adulthood, he became an esteemed figure in Southwestern archaeology. Although he worked in many places, including the greater San Juan Basin, Morris is most closely associated with Aztec Ruins. In many ways, the story of Morris and Aztec seems like an archaeological fairy tale, or perhaps a fable.

Morris was born in Chama, New Mexico, and his itinerant family spent much of his young life leaving and returning to Farmington. Morris's father Scott took to pothunting at sites that would soon become famous, amassing collections, and then selling them to institutions and individuals. Earl was his companion in these endeavors—including a visit to Aztec in 1895, when Earl was six—until Scott's murder in 1904. Bitterly affected by Scott's death, Morris found solace in continuing their unfortunate pastime. (Indeed, he hunted for pots even after he became a professional archaeologist, although he donated or traded rather than sold them, most notably to the University of Colorado. Morris justified these excursions by documenting his finds and asserting that he was thus keeping them out of the hands of looters.)

A good student, Morris attended the University of Colorado at Boulder to major in psychology. His curiosity about the past led to acquaintances with people who helped him find his path in legitimate archaeology, including Edgar L. Hewett, whom he met on a train in 1911, and his eventual mentor, Nels C. Nelson of the American Museum of Natural History (AMNH), to whom he apprenticed in 1915. Nelson's stratigraphic methods were—pardon the pun—truly groundbreaking at the time. With this, Morris entered a cohort of the early twentieth century's most important American archaeologists.

In 1916, on Nelson's recommendation, Morris was chosen to direct excavations at Aztec Ruins on behalf of AMNH. In addition to his unorthodox and more rigorous field training, a young lifetime of observing the region's ancient pottery gave Earl keen insight into chronological and cultural patterns. His contemporaries considered his excavation and restoration efforts at Aztec to be "painstaking." Although he had submitted some of Aztec's timbers for A. E. Douglass's examination in 1918, it was a year later, upon listening to Douglass more or less talking to himself while on a visit to Aztec, that Morris became committed to the dendrochronology endeavor. He continued collecting tree-ring samples at many sites and was proud of his contribution to building the Southwestern chronology.

Earl Morris (front center, hat in hand, white shirt) and work crew at Aztec. Upon learning that he was to direct excavations at Aztec Ruins, Morris wrote to his superiors, "To excavate the Aztec Ruin is a dream which has endured from my boyhood, and I wish to express my appreciation of the fact that you see fit to give me a part in it." After his death, his ashes were scattered within the pueblo. PHOTO: ©UNIVERSITY OF COLORADO MUSEUM OF NATURAL HISTORY

By 1920, Earl was living at Aztec and serving as AMNH's onsite "agent." When President Harding declared Aztec Ruins a National Monument in 1923, Morris became its custodian. He had continued work at Aztec, with only limited funding and

his own passion, as best he could until about this time, giving many tours and ensuring that a highway was routed to the site. After 1923, he spent many of the next ten years on other projects of significance, not the least of which was work that contributed to the declaration of Canyon de Chelly National Monument in 1931.

By 1928, enough tourists were visiting Aztec that a fulltime government employee filled the supervisory post, and Morris began consulting on repair work. He advocated that the ruins should stay as they were, with no new excavation, to give visitors an idea of what he and his teams had done and to preserve information for future archaeologists. His final contribution to Aztec came in 1934 when, commissioned by the National Park Service, he directed reconstruction of Aztec's Great Kiva. Although not immune to criticism, the Kiva still stands, providing visitors with a humbling and memorable experience, as Earl intended.

Morris's career spanned another twenty years, first with AMNH and then the Carnegie Institution, and he remained associated with the University of Colorado. In addition to scholarly articles and reports, he wrote several accounts for general audiences. In 1953, he was the second recipient of the Alfred Vincent Kidder medal, named for the famed archaeologist who had long since become Earl's dear friend. Morris passed away in the summer of 1956, and on August 31, 1957, his ashes were scattered within Aztec Ruin. In 1959, his oldest daughter, Elizabeth A. Morris (1932–2012), completed a dissertation in which she restudied artifacts her father had excavated in northeastern Arizona. She became an important archaeologist and teacher in her own right.

Beyond his misguided youth, Morris was committed to interpretation, preservation, and place. His formal obituary, penned by Kidder, remarked on Morris's "gentleness, true humility, unfailing readiness to help, utter sincerity, innate appreciation of quality in people and things."

To learn more about Morris's life, read *Earl Morris & Southwestern Archaeology* (1968) by Florence C. Lister and Robert H. Lister, from which this essay was drawn.

Cynthia Irwin-Williams

As with the relationship of Earl Morris to the Aztec Community, any telling of Salmon Pueblo's story would be incomplete without acknowledging the incomparable Cynthia Irwin-Williams. With her already-distinguished career preceding her, Irwin-Williams came to Salmon Ruins in 1969, to lead what would become one of the largest archaeological projects in the United States. She raised more than $5 million to excavate Salmon, analyze the artifacts and architecture, and produce a final report.

Archaeologist Cynthia Irwin-Williams (1936–1990) directed excavations at Salmon Ruins from 1970 to 1978. Local community members were integral to unearthing the story of this great house, established by Chacoan immigrants in 1090. PHOTO: COURTESY OF SALMON RUINS MUSEUM

For Cynthia, the Salmon excavations were much more than a scientific enterprise, however. She found fulfillment in working with enthusiastic local residents to develop the site and to help build the San Juan County Museum and Library facility, thereby ensuring that efforts at Salmon would provide a foundation for many years of public education and research. Irwin-Williams's work at Salmon and on much earlier sites made a lasting impact on Southwestern archaeology. To read previously published *Archaeology Southwest Magazine* articles about her life and her work at Salmon, visit archaeologysouthwest.org/asw28-1.

Eastern New Mexico University's Anthropology Department and Mu Alpha Nu Anthropology Club produced a short documentary on Irwin-Williams's accomplishments. Visit www.youtube.com and search on "Cynthia Irwin-Williams," or find a link to the video in our online highlights for this issue at archaeologysouthwest.org/asw28-1.

— Paul F. Reed

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On page 7 we ask the question: What was it about Chaco? For most people, the answer is simple: The Architectural Monuments. Edgar Lee Hewett—the renowned archaeologist who crafted the Antiquities Act of 1906, America's foundational piece of historic preservation legislation—divided archaeological sites into two classes. Monuments deserved long-term preservation and interpretation for the public. All other sites deserved short-term preservation until they could be excavated. Today, as Preservation Archaeologists, we see the world differently.

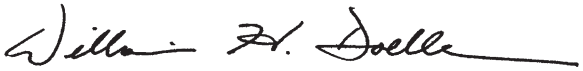
Great houses—Pueblo Bonito or Chetro Ketl in Chaco Canyon, or Salmon and Aztec in the Middle San Juan—are unquestionably monuments. That monumentality captivated their original investigators. Now, we recognize that monuments cannot be understood on their own. We must examine the full range of sites in order to understand how they once were part of a cultural landscape. We must also work to preserve that diversity for future exploration.

This image of Salmon Pueblo, taken in October 1874, helps convey the monumentality of the architecture. The third story of the pueblo collapsed soon thereafter and is only documented in very early photographs. PHOTO: TIMOTHY H. O'SULLIVAN, COURTESY OF THE NATIONAL ARCHIVES AND RECORDS ADMINISTRATION, WASHINGTON D.C.

Archaeology Southwest began our partnership with Salmon Ruins Museum in 2001. Initially, we planned to tell the story of one monument—Salmon Pueblo—which Cynthia Irwin-Williams had excavated in the 1970s, but never fully reported. Our 2006 publication focused on the Salmon great house, but we also realized that Irwin-Williams viewed Salmon as an important place in a larger landscape.

Thus, upon completion of that project, we sought to place this one monument in a larger context. Including Aztec Pueblo, Salmon's impressive neighbor less than ten miles to the north, was essential. But we also had to consider the settlement pattern of the three local drainages. Paul Reed and collaborators have since completed two National Science Foundation grants. The first was a research grant, and the second funded Doug Gann's 3D modeling efforts.

Doug's work moves well beyond the long-standing bias toward monuments. He incorporates time, an extensive landscape, and more than 100 small sites. Furthermore, he highlights that the Chacoan monuments have complex histories. They did not start as monuments. Doug employs state-of-the-art technology, which is still young. Given the pace of technological progress, the potential for sharing ever-more-nuanced landscapes and histories is exciting—and challenging. Expanding beyond a simple focus on monumental architecture is a significant step forward in conveying the complexity of the past.



back sight (băk sīt) n. 1. a reading used by surveyors to check the accuracy of their work. 2. an opportunity to reflect on and evaluate Archaeology Southwest's mission.