THE TEWA COMMUNITY AT TSAMA PUEBLO (LA 908): ARTIFACTS FROM THE 1970 EXCAVATIONS

By

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Chapter 1

INTRODUCTION AND OBJECTIVES

Background, Organization, and Use of This Report

This report presents summary analysis and contextual information for the artifact assemblage from Tsama Pueblo (LA 908), an ancestral Tewa community in the Northern Rio Grande region of New Mexico. The assemblage derives from excavations in 1970, directed by Florence Hawley Ellis as part of a University of New Mexico archaeological field school. Tom Windes and Peter McKenna, who participated in these excavations, present field tabulations of the encountered artifacts in a 2006 publication (Windes and McKenna 2006). However, the collection itself remained in its original field packaging from 1970 until 2008, when Crow Canyon Archaeological Center received the collection on loan from the Maxwell Museum of Anthropology, University of New Mexico for additional study. Between 2008 and 2010 the collection was repackaged in archival quality materials, cataloged, analyzed, and databased by Crow Canyon laboratory staff, interns, and volunteers, using the Crow Canyon Laboratory's standard procedures (Ortman et al. 2005). An explicit goal of this work was to collect artifact assemblage data from a Northern Rio Grande site in such a way that it could be compared directly with artifact assemblages from Northern San Juan sites previously excavated by Crow Canyon.

By the end of 2010, the entire collection had been repackaged and cataloged and analysis of stone artifacts had been completed. A portion of the pottery assemblage had also been analyzed and presented in Scott Ortman's dissertation and subsequent book (Ortman 2009, 2012). The remainder of the pottery assemblage was analyzed by Ortman and a group of volunteers working at the Santa Fe National Forest offices in Santa Fe between 2011 and 2013, after which the collection was returned to the Maxwell Museum.

This report thus covers work conducted between 2008 and 2013. It presents background information on Tsama Pueblo, tabular summaries of the artifact data organized by type and location, and comparisons with other sites in the Northern Rio Grande and Northern San Juan. The report is intended to make information from Tsama more widely available, to contribute new data for regional comparisons, and to consider the artifact assemblage in light of current archaeological interpretations of ancestral sites in the Northern Rio Grande.

Culture-Historical Background

Tsama Pueblo (in Tewa, Tsámaˀówîngeh) is in the northwestern Tewa Basin, in what is known today as the Chama Valley (Duwe 2020) of northern New Mexico (Figure 1). Tsama is one of many ancestral Tewa villages in the valley; others include Poshuouinge (Poshúˀúk'âyḏiˀ-owîngeh), (Jeançon 1923), Howiri (Howíḏíˀówîngeh) (Fallon and Wening 1987) and Te'ewi (Tayˀâyˀówîngeh) (Wendorf 1953).

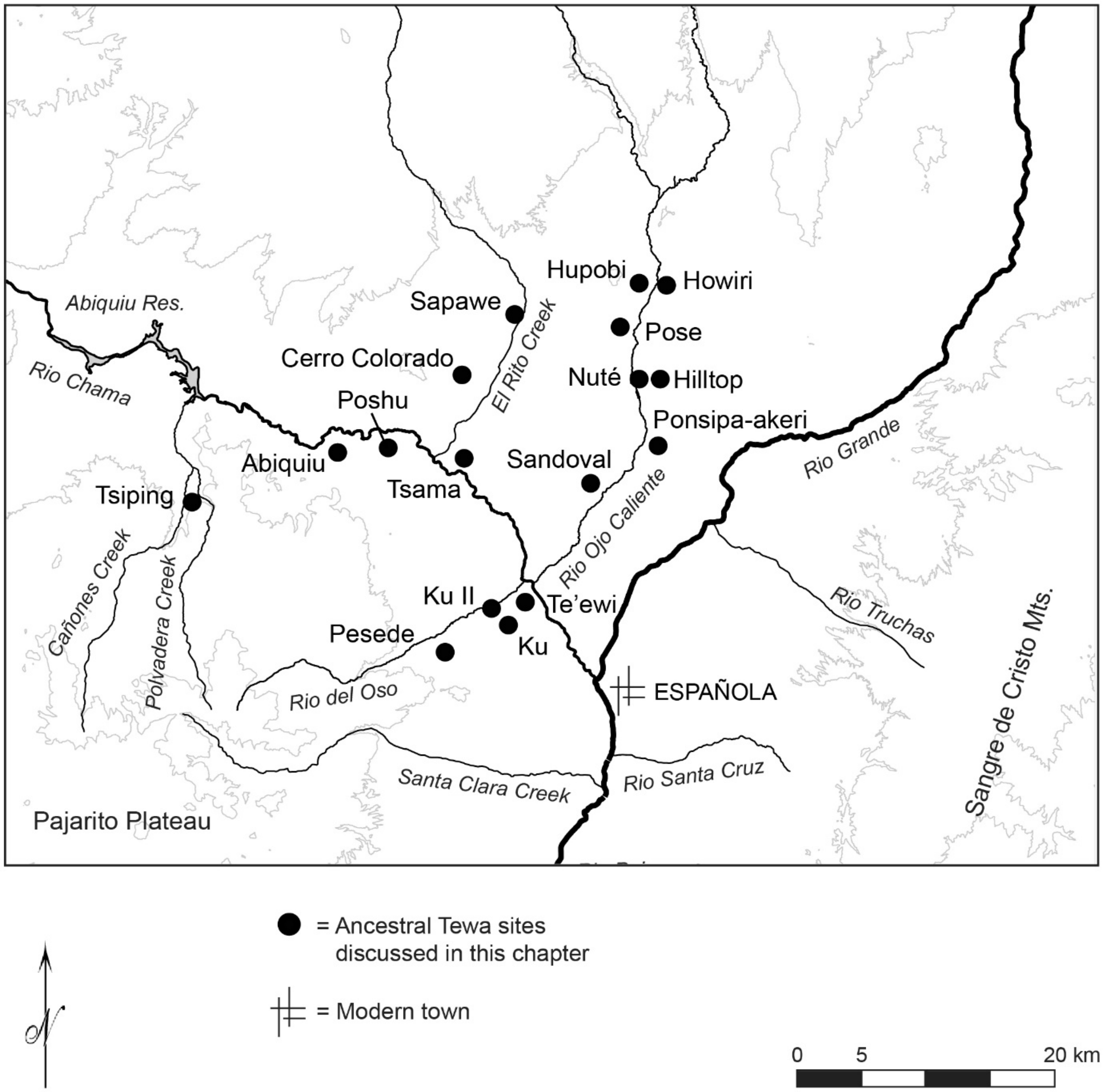

Figure 1. Location of Tsama Pueblo in the Chama Valley. Map courtesy of Samuel Duwe.

The closest adjacent sites to Tsama are Leaf Water (Kaap'oe^{ʔ}ówîngeh) about 6 km to the southeast (Luebben 1953), Poshuouinge about 5.5 km to the west (Jeançon 1923), the Cerro Colorado site about 5.5 km to the north (Cruz and Ortman 2019), and Sapawe about 10 km to the north (Windes and McKenna 2018).

The communities that occupied Tsama and other sites in the Chama Valley spoke the Tewa language. This is documented by oral traditions that recount events that occurred in these sites, by early Spanish documents that refer to their occupation by Tewa people, and by the persistence of traditional Tewa names for nearly every major archaeological site in the valley (Duwe 2020;

Harrington 1916). The Tewa name for Tsama is Tsáma^{ʔ}ówîngeh, "Wrestling Pueblo Village Ruin," and the site appears to be the source of today's name for the Chama River (Harrington 1916:147 [5:7]). The Tewa name for the Chama River is P'op'įgeh, "River-red-place," which emphasizes its reddish color. At some point the Tewa name for the ancestral site was transferred to the river by Spanish and later English speakers.

Although the Tewa Basin has been home to Pueblo people since at least AD 900 (McNutt 1969; Smiley, et al. 1953; Wendorf and Reed 1955), Pueblo occupation of the Chama Valley began in the mid-1200s when several small villages, including Tsama, were established (Hibben 1937; Peckham 1981; Windes and McKenna 2006). Over the next three centuries the Chama valley population increased substantially and coalesced into fewer, larger settlements. Demographic and pottery sourcing studies suggest that this population growth was due primarily to immigration of Tewa people from adjacent regions (Duwe 2019; Ortman 2016b). In the late 1500s environmental downturns, European-introduced diseases, and encroachment by nomadic peoples led to the movement of Chama Valley residents downstream to the Rio Grande Valley, such that few villages were still inhabited when the first Spanish colonial capital was established at San Gabriel del Yunque in 1598 (Ramenofsky and Feathers 2002). Although the Chama Valley was no longer a place of full-time Tewa residence in the 1600s, it continued to be used by Tewa people for herding and resource collection (Kemrer 1992) and continues to be part of the Tewa world today (Duwe 2020). Indeed, there are reports of shrines around Tsama that are still visited and fed by Tewa people (Windes and McKenna 2006:233). For recent overviews of Chama Valley archaeology see Beal (1987), Anschuetz (1998) and Duwe (2020).

Examining The Tewa Community at Tsama

Tsama (LA 908) is on a bluff on the north bank of the lower Rio Chama, near its confluence with El Rito Creek. Today the property on which the ancestral site sits is owned and managed by the Archaeological Conservancy. The ancestral settlement consists of three plaza areas: the West Plaza, an area of low mounds of melted adobe; the Middle Plaza, two detached but taller adobe mounds with some embedded cobbles; and the East Plaza, a massive quadrangle of melted, multistory adobe architecture with outlines of cobble wall foundations still visible on top of the mound. Because surface pottery of the West Plaza appears somewhat older than surface pottery of the Middle and East Plazas, Mera (1934) separated out the West Plaza in his initial records for Tsama, giving it a different site number (LA 909) than the Middle and East Plazas (LA 908). Due in part to evidence for early occupation beneath the East Plaza, presented in this report, we consider Tsama to be a single site and associate it with a single number, LA 908.

Figure 2 is the map prepared by Windes and McKenna (2006) that combines Greenlee's (1933) ground plan with excavation and shovel stripping results from the 1970 field school. Figure 3 fits these same features to a digital elevation model derived from a 2017 lidar survey of northern New Mexico, allowing more accurate determinations of the sizes, orientations, and locations of features on the Windes and McKenna map.

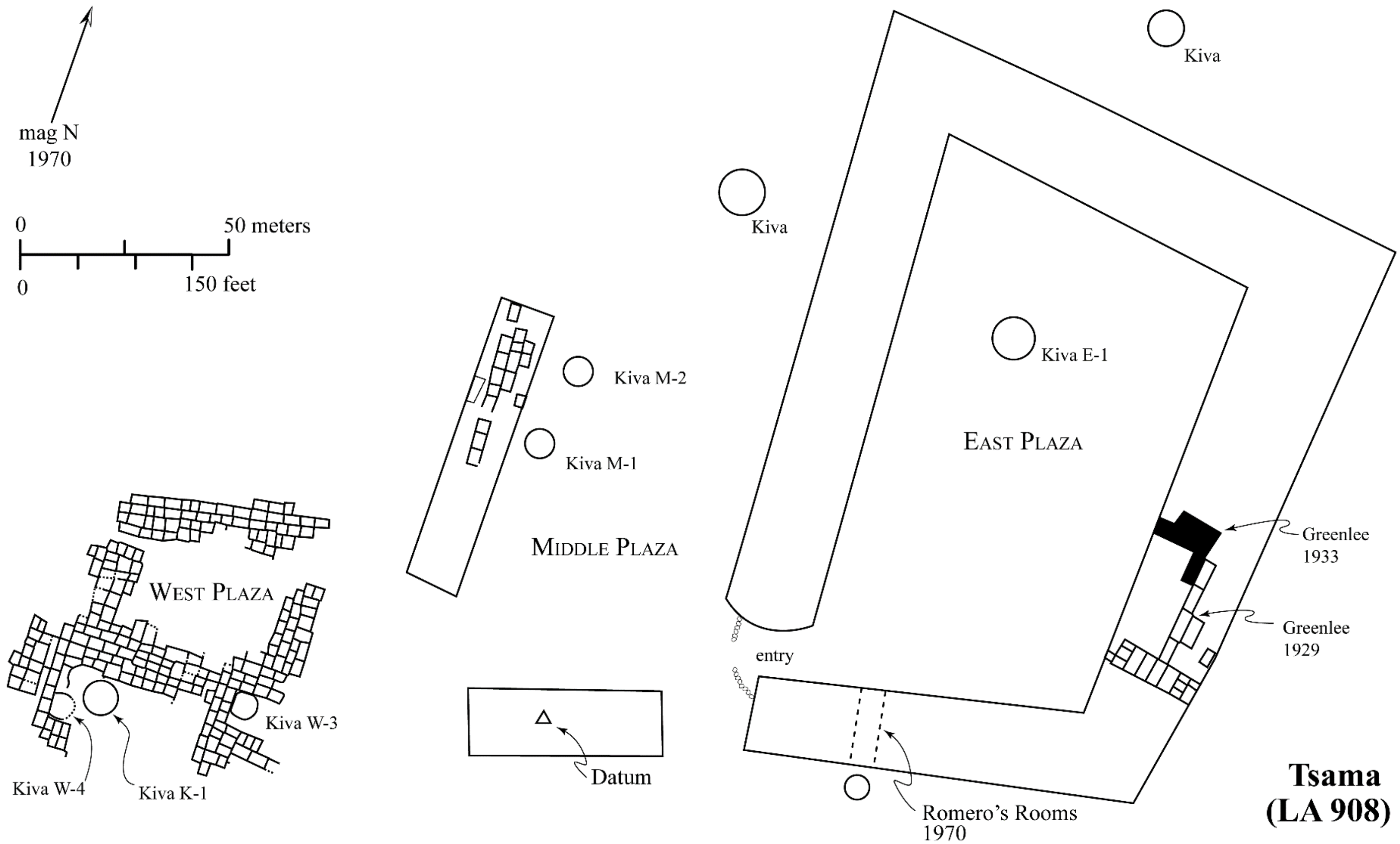

Figure 2. Map of Tsama Pueblo, showing excavated features. Source: Windes and McKenna 2006, Figure 1; used by permission.

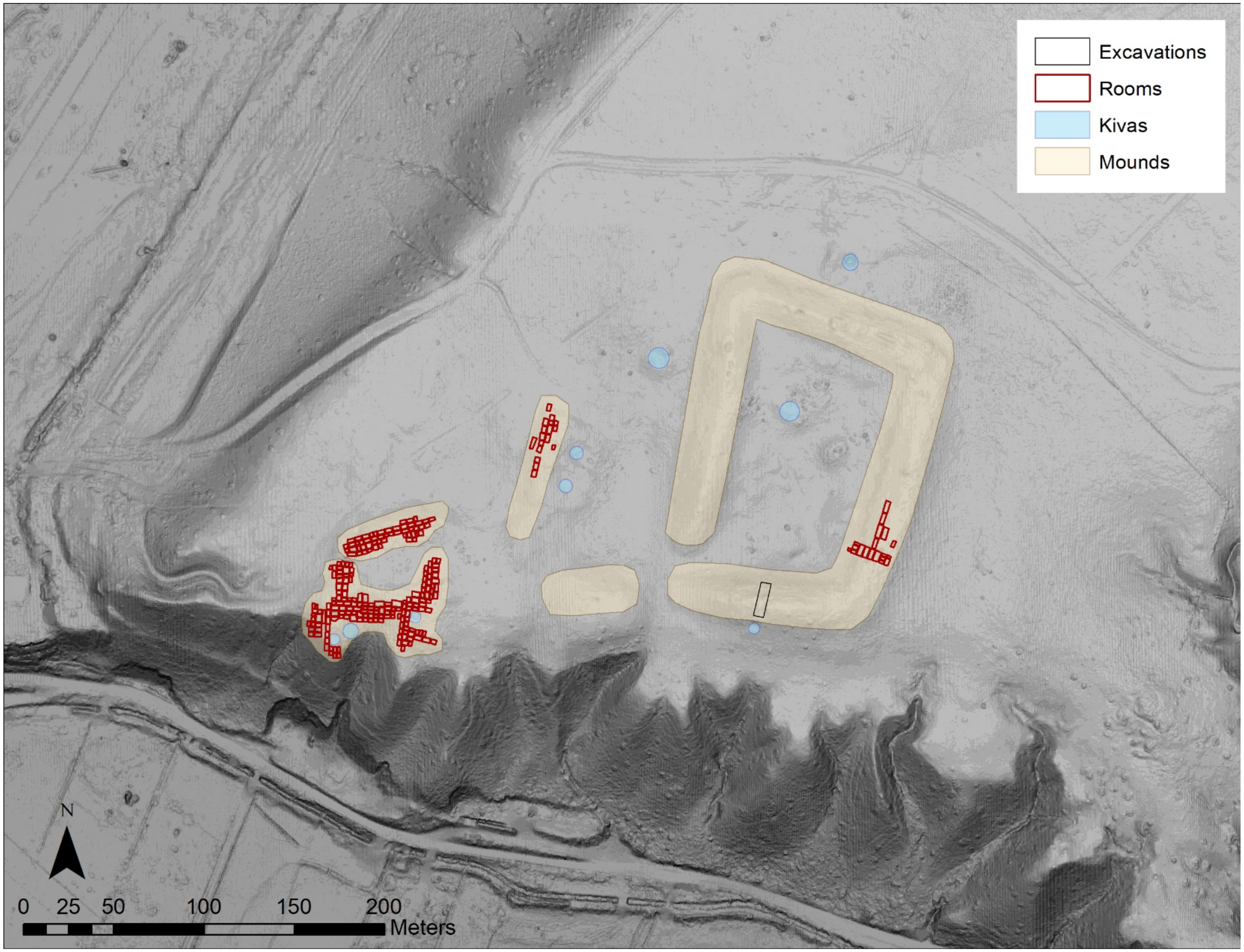

Figure 3. Lidar-based map of Tsama Pueblo. Lidar image source: https://viewer.nationalmap.gov/basic/.

Duwe's 2008 map of Tsama presents a somewhat different interpretation of the morphology of the Middle Plaza, and of the number and locations of kivas in the Middle and East Plazas. The most notable difference is that Duwe interpreted the topography around the two kivas in the Middle Plaza as extensions of the house mound in this area. We interpret this topography as courtyards, platforms, or the results of excavation, and maintain Greenlee's interpretation of the house mound. We do this because the Greenlee base map matches the lidar data closely, other than slight differences in orientation, and was created before any excavation work. We have also left out the two possible kivas identified by Duwe in the East Plaza because Greenlee did not identify them and because they are not clearly expressed in the lidar imagery.

In this report we focus on three topics that the Tsama archaeological record is especially well-suited to address: (1) the historical and social processes of Tewa origins; (2) economic change over time; and (3) the evolution and expression of Tewa community organization. In the following sections we introduce each of these topics as they relate to different aspects of the site.

The West Plaza and Migration

During the 1970 field school, students shovel-stripped the entire West Plaza area to reveal a village of about 120 ground floor rooms with an enclosed plaza of about 860 square meters (Windes and McKenna 2006). Wall abutments suggest that small suites of four to six rooms were the modal unit of construction, and most of the excavated rooms rest on sterile soil, suggesting that the West Plaza grew rapidly. The combination of rare floor features and collapsed fire pits in the upper fills of excavated rooms suggest that the West Plaza had a second story of rooms that were terraced back from the ground floor footprint (Windes and McKenna 2006:236). The rule typically used by Northern Rio Grande archaeologists to estimate upper story rooms is to divide the ground floor room count in half. Based on this rule, the estimated number of rooms in the West Plaza is 180. This is very close to the estimate of 188 rooms derived from the volume of adobe in these same mounds (Duwe et al. 2016). Bernstein and Ortman (2020) report a similarly close correspondence between room count estimates derived from the visible rooms and estimated stories versus mound volume methods at Cuyamungue. These correspondences suggest that both methods produce consistent and reasonably accurate estimates.

One of the field school's most important findings was Kiva W-4, a burned, trash-filled, D-shaped ceremonial room in the southwest corner of the West Plaza (Figure 4). This room was built using a combination of coursed adobe and refuse, the latter supported by a jacal framework covered with plaster. It was oriented to the east; the floor included a subrectangular adobe-rimmed fire pit-deflector-ash pit complex on the floor, with a vent tunnel opening to the east (Windes and McKenna 2006:247–249). It also had a small foot drum in the northeast quadrant of the floor. A cutting date of 1231r and a non-cutting date of 1249vv suggest that Kiva W-4 was built in the middle decades of the AD 1200s, during the Coalition period (A.D. 1175–1350) of the Northern Rio Grande archaeological sequence. (Unfortunately, none of the samples collected from other excavated structures was datable [Windes and McKenna 2006: Table 2]). Currently, Kiva W-4 and the associated West Plaza represent the earliest known tree-ring-dated occupation in the Chama District.

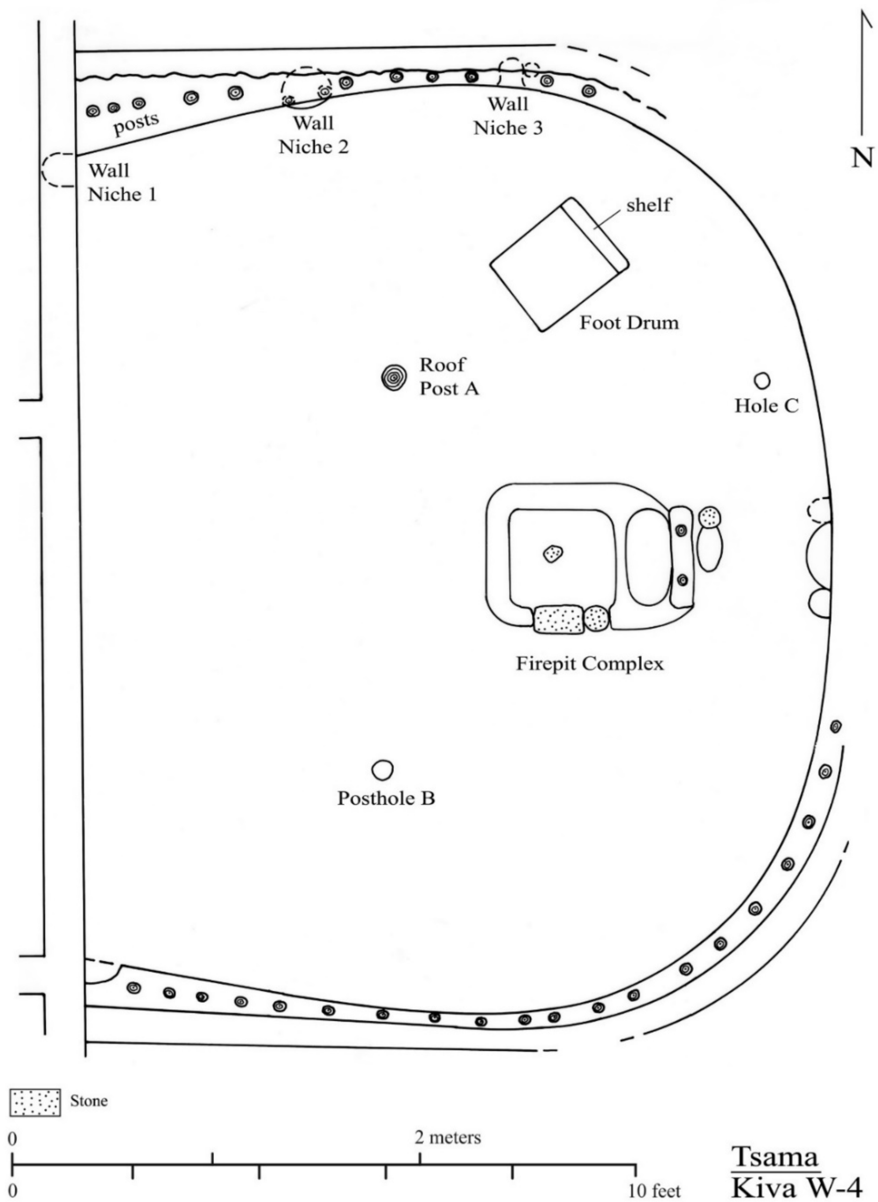

Figure 4. Floor plan of Kiva W-4. Source: Windes and McKenna 2006, Figure 9; used by permission.

Ortman examined the painted designs on pottery from Kiva W-4 and demonstrated that they exhibit strong parallels with Mesa Verde Black-on-white, despite being executed on vessels made of local raw materials (Ortman 2012, Chapter 13). However, the architecture of Kiva W-4 and the West Plaza do not exhibit such parallels and are more typical of other Late Coalition period villages to the south, including Pindi (Stubbs and Stallings 1953), Forked Lightning (Kidder 1958:5–46), and Cuyamungue (Bernstein and Ortman 2020). The sources of the founding population of Tsama and other Late Coalition period settlements in the Tewa Basin has been debated for many decades. We will address these questions at various points using data from the Tsama Pueblo assemblage.

The Middle and East Plazas and Economic Change

The Middle and East Plazas together define a much larger community inhabited primarily during the Classic period (A.D. 1350–1600). The East Plaza encloses a plaza of 1.1 hectares. The field school excavated a trench, one room wide, across the south bank of the East Plaza, resulting in the definition of six rooms, thought to be a suite in the style that Ellis observed at Sapawe. Greenlee's earlier (1933) excavations suggest that the east bank of rooms in the East Plaza was eight rooms wide. The Greenlee map suggests that these rooms were built using ladder-type construction, which involves building walls along the long axis of the room block in a single construction event and then inserting cross-walls at regular intervals, creating a regular grid of apartment-style dwellings. If so, the scale of construction was clearly larger in the East Plaza than it was in the West Plaza. As in the West Plaza, the absence of floor features combined with collapsed fire pits and mealing bins in room fills suggest at least two-story architecture (Greenlee 1933).

Duwe et al. (2016) estimate that collectively the Middle and East Plaza mounds encompass 1,330 rooms, based on the volume of adobe. Thus, at its peak, the Tsama community was several times larger than it was at the time of its founding. In addition, the East Plaza rooms were generally larger than the West Plaza rooms. This is shown in Figure 5, which summarizes the distribution of measured floor areas reported by McKenna (1970) for the West Plaza, Greenlee (1933) for the East Plaza, and Shure (1973) for the West and Middle Plazas.

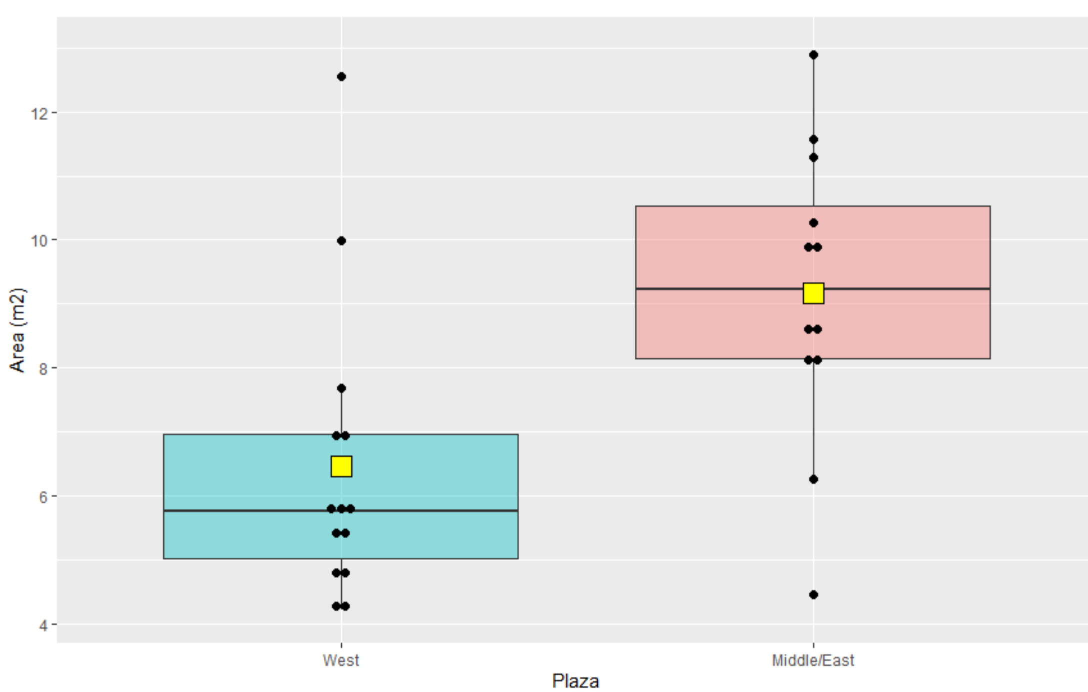

Figure 5. Box/dot plots of excavated room areas. Yellow boxes represent group means.

The distributions show that the average room size increased from about 6 1/2 square meters to about 9 square meters from the Late Coalition period to the Classic period. In turn, this suggests that Classic period households had more personal possessions and food stores, an indication of improved material living standards over time (Ortman and Davis 2019; Ortman and Lobo 2020). We highlight several aspects of the artifact assemblage that reinforce this interpretation in this report.

The large size and prosperity of the Classic period Tsama community can be attributed at least in part to its advantageous location for farming (Figure 6). Tsama was established on a terrace immediately above the Rio Chama floodplain, at that river's confluence with El Rito creek. This confluence created a wide floodplain that could be irrigated from the El Rito or the Chama. Although no direct evidence of Iberian-style irrigation has been identified in the Northern Rio Grande to date, Spanish explorers' accounts regularly mention irrigation ditches and irrigated fields at villages they visited along the Rio Grande (Ford 2021; Vlasich 2005), and pre-Hispanic ditch irrigation systems have been identified in other regions of the upland southwest (Friedman et al. 2003; Simms et al. 2020). We conclude that the inhabitants of Tsama and other ancestral Tewa villages were able to irrigate these floodplains to some degree. Eiselt (2019) suggests the territory controlled by Tsama extended about 3.5 kilometers from the site, based on the sizes of and distances to adjacent sites along the river. Figure 6 illustrates this catchment, which contains 578 hectares of irrigable land (shown in blue). In the early 1900s each hectare of irrigated Pueblo farmland could support about two people (Eiselt 2019; Vlasich 2005). If this were true during the Classic period as well, the floodplain adjacent to Tsama could have supported about 1,150 people.

This estimated carrying capacity is important for several reasons. First, the typical practice in recent demographic studies has been to estimate the maximum populations of Northern Rio Grande sites using a conversion of one person per room (Duwe et al. 2016; Eiselt 2019; Ortman 2016b). Application of this rule to the architectural remains at Tsama suggests a maximum population of about 1300 persons. The close correspondence between this population estimate and the one derived from the estimated floodplain area suggests that at its peak the Tsama community was about as large as it could realistically be, given its economy and the local environment.

Second, the benches above the Rio Chama floodplain in the vicinity of Tsama have abundant Quaternary period gravel deposits that were used by ancestral Tewa farmers as mulch for precipitation-based garden plots (Camilli et al. 2019; Ford and Swentzell 2015; Lightfoot and Eddy 1994, 1995; Maxwell and Anschuetz 1992). These fields are still highly visible, and Figure 6 illustrates their locations in the vicinity of Tsama based on analysis and ground-truthing of Google Earth Pro imagery (based on Eiselt et al. 2017). The results allow us to estimate that the 3.5 km catchment surrounding Tsama includes about 12.6 hectares of gravel mulch fields (Ortman 2022). This is a much smaller area than the floodplain, and it could not have supported many people (see Eiselt 2019). In addition, accumulating evidence indicates that gravel mulch fields were used for growing cotton rather than food (Camilli et al. 2019; Kessler 2020). This fact reinforces the idea that the floodplain was the primary farming zone.

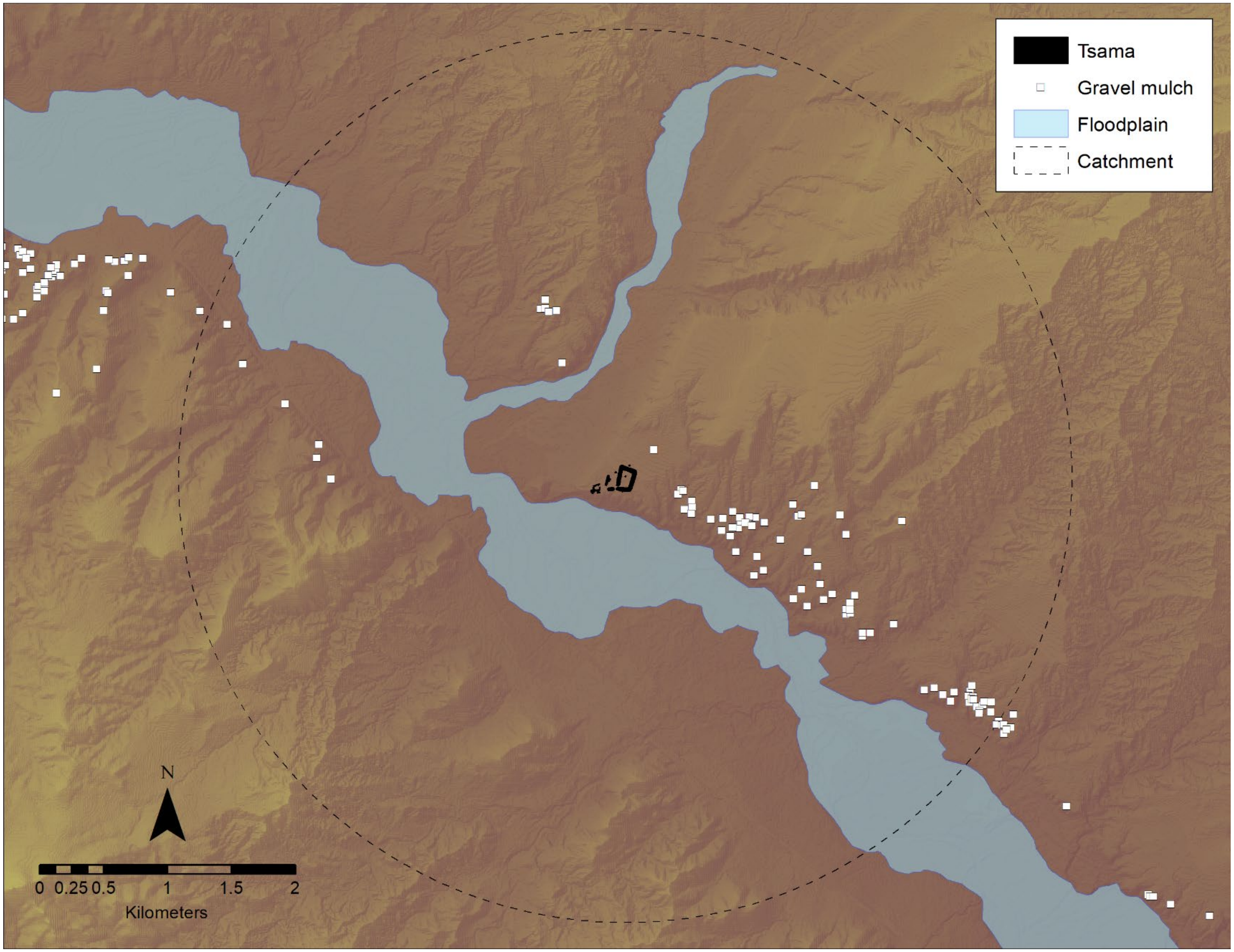

Figure 6. Potential farming areas within 3.5 km of Tsama Pueblo.

Third, the close correspondence between the village's architectural footprint and the associated floodplain is reassuring: so long as Classic period agricultural productivity was similar to that of the early 1900s, Tsama's catchment area would have been adequate to support a fully inhabited pueblo. Moreover, assuming a fully-inhabited architectural footprint, Tsama's East Plaza includes about 8 square meters of plaza space per resident (Cruz and Ortman 2019). This generous amount of space suggests that the plaza was designed to provide enough space for visitors from adjacent communities, in addition to residents, during dances. This is consistent with the Classic period emphasis on inter-village congregation, with increased plaza space facilitating these gatherings (Ortman and Coffey 2019). If, however, the Classic period architectural footprint was only 50 percent inhabited at any given time, the East Plaza would have encompassed more than sixteen square meters (172 square feet) per resident. This would have been far more than was needed, even considering visitor use, and the population would have been more spread out than was necessary or practical. As a point of comparison, the West Plaza includes only about 4.5 square meters of plaza space per room. The size and shape of the East Plaza would be difficult to explain if it was not intended to be fully inhabited when it was built.

In sum, several lines of evidence are consistent with our interpretation that during at least part of the Classic period, the entire architectural footprint of the Middle and East Plazas was inhabited. In turn, the population of Tsama must have increased several fold over the course of the Late Coalition and Classic periods, and that the site was home to at least 1,000 people for at least two centuries. We reconstruct the demographic history of Tsama in greater detail later in this report, but we emphasize this point here because it suggests that artifacts from Classic period contexts in the Middle and East Plazas derive from a community that was several times larger than the Coalition period community. Also, increased visitation during ceremonies is suggested by the changing ratio of plaza area to population. This history of demographic and architectural change in a fixed location presents an opportunity to examine the economic and environmental effects of community size and length of occupation, as reflected in the artifact assemblage. This is a second focus of the report.

Tewa Community Organization at Tsama

The final topic we consider in detail is the evolution of Tewa community organization as reflected in the archaeological record at Tsama Pueblo, and as it articulates with Tewa traditional history. In introducing this topic, the best place to begin is Tewa origin narratives. Well-known and widely shared among Tewa people, the narratives state that their ancestors originally lived beneath the surface of a lake in the distant north (Ortiz 1969; Parsons 1994[1926]). The institutions and offices of traditional Tewa government were established in this ancestral homeland, including a Summer Chief and a Winter Chief who were entrusted with leading and caring for the people during their respective seasons. Several additional institutions, including the clowns who play such an important role in dances today, were also established. The leaders of these organizations are referred to collectively as the "made people," and today are considered to be the people spiritually closest to the lake of emergence, the point of contact between the world of the living and the world of ancestral spirits.

When Tewa ancestors left their homeland, they moved southward in two groups, the Winter Chief leading his people downstream along the east side of a river and the Summer Chief leading his people downstream along the west side. During the migration process each group initially formed its own village, but eventually the two groups came together to form a single village containing both groups.

Today, Tewa villages are still governed by earthly representatives of these primordial leaders, with the Winter Chief presiding over the community during the winter, the Summer Chief presiding during the summer, and everyone being under the supervision of the made people. Tewa communities are also divided into moieties known as the Summer People and the Winter People, each of which is headed by its respective chief. Etymological evidence enshrined in the kin terms of Tanoan languages suggests that ancestral Tanoan moieties were once matrilineal and exogamous (Cruz and Ortman 2021; Ortman 2018). Today, they no longer regulate marriage, and although moiety membership is initially inherited through the father's line, a person's affiliation can change for a number of reasons. This is why John Ware (2014) has emphasized that Tewa moieties are more properly referred to as dual tribal sodalities. Moieties are not clans but balanced, complementary social groups that work together to make a complete community.

There are several potential links between traditional Tewa community organization and the archaeological record. For example, in some Tewa communities each moiety has its own meeting room, and sometimes its own kiva, but in others there is a "big kiva" that is shared by the moieties and the made people. In addition, there are directional associations for the summer and winter people. For example, the equinox, marked by the time of year when the sun rises due east, is viewed as the triggering event for the change of leadership (Curtis 1926; Harrington 1916; Hill 1982:203). It thus follows that the winter sunrise in the southeast is associated with the Winter People, and the summer sunrise in the northeast with the Summer People. This fact, combined with evidence in migration traditions, leads to an association of the south and east with the Winter People and the north and west with the Summer People. Maps of early 20th century Tewa communities also suggest that moiety members tend to cluster on opposite sides of villages' central plazas, with the Summer People on the north and west sides and the Winter People on the south and east sides (Parsons 1929:310).

Finally, it is important to emphasize that the concept of the middle also plays an important role in traditional Tewa community organization. The societies of made people established in the ancestral homeland are not generally associated with summer or winter, but are instead referred to as being *tepíngéh*, 'in the middle of the structure,' meaning that they occupy a liminal position between the summer and winter people and mediate between them in ceremonial (and political) contexts (Ortiz 1969). The first part of this term is related to the Tewa word for kiva (*te'e* 'house-special'), and the second part is related to the Tewa word for plaza, (*bupíngéh* 'low roundish middle place'). This suggests that the made people can be associated with kivas within plazas, and with the directions of equinox sunrises.

Duwe has studied the emergence of ethnographically described Tewa community organization in the Chama Valley, concluding that it most likely emerged during the Classic period (Duwe 2020, Chapter 5). The main lines of evidence Duwe uses in making this argument include: (1) the appearance of shrine systems that define cultural landscapes similar to those of 20th century Tewa villages, (2) the occurrence of large as well as small kivas in Classic period ancestral Tewa sites, and (3) the occurrence of paired villages in a few locations. Duwe identified the first two patterns at Tsama. Along the west edge of the terrace on which the Pueblo sits, he mapped a series of upright stones and boulders covered in pecked cupules that address the view to the west (Duwe 2011, Figure 6.8). Such stones are set up in auspicious locations around Tewa communities today, where they are cared for and communicated with (Duwe 2016; Ortiz 1969). The most commonly offered explanation for the cupules is that they are the result of making rock flour, an ingredient in medicine water that encourages strength in men and fertility in women. We would add that at Tsama the view from this location is toward Cerro Pedernal or Tsip'ing ("flaking stone mountain"), a prominent flat-topped peak that is an important landmark in Tewa cosmology and the source of Pedernal chert (Figure 7).

Figure 7. View through the southwest opening of the East Plaza at Tsama. Looking west through the West Plaza toward Tsip'ing. Photograph by Scott Ortman.

Duwe also mapped a concentration of stones on a slight hill at the southeast edge of the terrace, apparently an eroded "world-quarter" shrine. These are rings of piled-up stone, about 10 to 12 m in diameter, with openings to the east, in some cases with additional stone alignments radiating outward (Duwe 2011, Chapter 6; Jeançon 1923). A world-quarter shrine occurs at nearly every Classic period ancestral Tewa village. Although the example at Tsama is too eroded to determine its morphology, its location takes in a grand view to the southeast toward Truchas Peak, or K'uusehnp'ing ("stone horns mountain"), the cardinal mountain of the East in Tewa cosmology.

Duwe further notes that the kivas at Tsama come in two distinct sizes, which he associates with the existence of moieties and the various organizations of the made people. Two Classic period kivas that Ellis excavated at Tsama provide an opportunity to consider the role of big and small kivas in an ancestral Tewa community (Figures 8 and 9). Below, we show that these kivas support Duwe's model, but in a different way than he suggested.

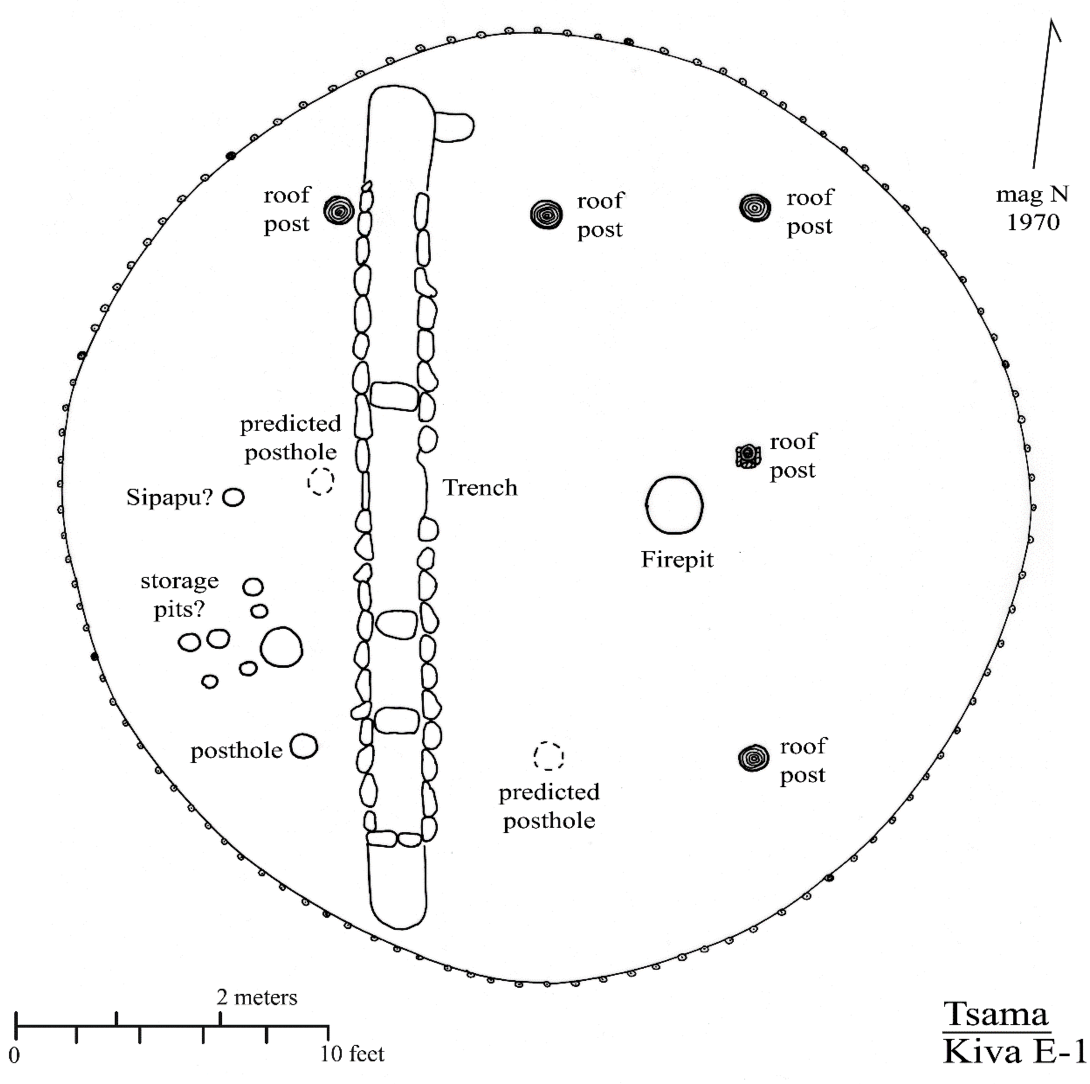

Figure 8. Floor plan of Kiva E-1. Source: Windes and McKenna 206, Figure 3; used by permission.

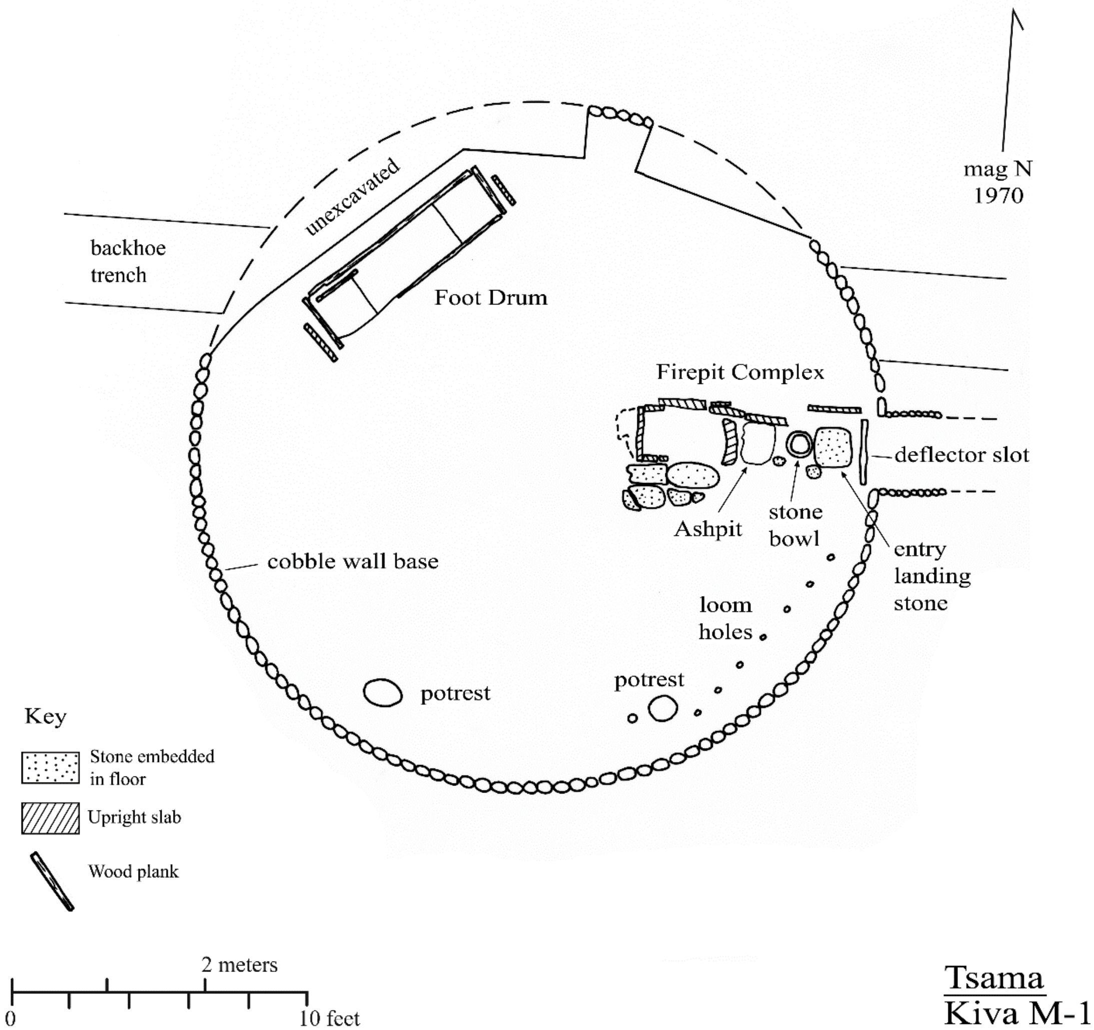

Figure 9. Floor plan of Kiva M-1. Source: Windes and McKenna 2006, Figure 5; used by permission.

Kiva E-1 lies in the center of the East Plaza. It has a floor area of about 90 square meters, a hearth that is off-center to the east, and a 9.4 m long, stone-lined trench extending north-south in the western part of the chamber. This feature appears to have been a plank-covered foot drum on which dancers could generate a booming sound by stomping their feet. The row of dancers playing this drum would have faced east toward the equinox sunrise. The existing documentation does not mention a ventilation shaft but Windes and McKenna (2006:242) note that there may be additional features that were not cleared or recorded. Figure 8 derives from the field map in a teaching assistant's report, which mentions that additional notes for Kiva E-1 are in a notebook that is missing.

Kiva M-1 is the southern of two kivas in the Middle Plaza. It has a floor area of only 37 square meters. A hearth and deflector system is also off-center to the east. A foot drum was placed along the northwest wall, opposite a row of loom anchors along the southeast wall. Because this structure burned, evidence of the planking was preserved and noted by the excavators. In this case, a row of dancers playing the foot drum would have faced toward the loom, toward K'uusehnp'ing, and toward the mid-winter sunrise to the southeast (Figure 10). Several Biscuit B bowls left on the floor demonstrate that Kiva M-1 was used at the same time as the East Plaza. In addition to showing that the inhabitants of Tsama produced textiles from the cotton grown in nearby gravel mulch fields, the loom in Kiva M-1 suggest a symbolic role for cotton, looms and weaving in the Tsama community. This is reinforced by the lyrics of a Tewa song documented by Spinden (1933:94) which refers to the image of sunshine on falling rain in the distance as a "garment of brightness" (see also Ortman 2012:240), and by the fact that white cotton clothing is prominent in the attire of male dancers representing clouds in Tewa dances today (Sweet 2004).

Figure 10. View of the midwinter sunrise from Kiva M-1, facing southeast. The illuminated ridges in the foreground are the crests of the East Plaza room blocks. The horned peak to the north of the sun is K'uusehnp'ing, the Tewa east mountain. Photograph by Scott Ortman.

To summarize, these two structures represent a big kiva in the center of the main village plaza, with a due east (equinox sunrise) orientation, and a pair of small kivas located outside and to the west of the East Plaza, the southern of which was contemporary with and half the size of the big kiva and had a southeast (midwinter sunrise) orientation. These patterns are consistent with an association of the big kiva in the East Plaza with the made people in the middle of the structure, and the southern small kiva with the Winter People. This further suggests that the northern of the two small kivas was associated with the Summer People. Such an arrangement would seem to suggest that both winter people and summer people lived in the East Plaza, and that the annual cycle of community activities was linked to relationships between the land, the buildings, and cycles in the sky. All of this is consistent with the existence of traditional Tewa community organization during the Classic period. We discuss additional material expressions of this organization and its evolution from the Late Coalition period to the Classic period throughout this report.

Tsama in the Spanish Contact Era

Tsama was inhabited through the end of the Classic period, and there is evidence of activity at Tsama during the Spanish Contact period (AD 1600–1700) as well. Ellis (1975:20) reported that "a metal piece that once may have been the clasp from an old Spanish book was found deep in one of the Tsama rooms," suggesting that occupation continued into the Contact period. Barrett (2002:47) also suggests that Tsama was occupied into the Contact period, based on documentary evidence: Oñate included "Tzooma" in his list of pueblos to which he assigned a priest in 1598, and "Sama" appears on the Enrico Martinez map of New Mexico, which was drawn on the basis of information provided by one of Oñate's soldiers in 1602 (Barrett 2002:7).

Duwe (2020:214–215) adduces several lines of evidence for 17th century activity at the site. He notes that the cobble foundations visible on the top of the East Plaza mounds rest on several meters of melted adobe, and a few sherds of Kapo Black, Tewa Red, and Glaze F, types characteristic of the 1600s, occur in the assemblage from the East Plaza. He also notes an oral tradition at Ohkay Owingeh that indicates that Tsama was one of several villages reoccupied during the Pueblo Revolt era. Finally, an alternative explanation for the eroded appearance of the world-quarter shrine at Tsama is that it was intentionally dismantled. Since these features are intact at ancestral Tewa sites that are not mentioned in early Spanish documents, the world-quarter shrine may have been dismantled at the insistence of the resident Spanish priests. All of these suggest on-going activity at Tsama during the initial century of Spanish colonization. Nevertheless, based on the recovered pottery the artifact assemblage discussed in this report pertains almost exclusively to the Coalition and Classic periods.

Chapter 2

PREVIOUS WORK

The 1970 excavations at Tsama took place as part of a University of New Mexico archaeological field school under the direction of Florence Hawley Ellis (Windes and McKenna 2006:233). About 7 percent of the site was excavated, including 36 rooms, six kivas, and an exploratory trench (Windes and McKenna 2006:233). All excavations were in arbitrary 6 inch (15 cm) levels, starting from the shovel-stripped ground surface. Field notes from the excavations are incomplete. The teaching assistant placed in charge of each excavation area wrote a preliminary report containing detailed information on the excavated structures and features, but we have only been able to access three of these: Windes' report on the architecture of the West Plaza west rooms and West Plaza Kiva-W4 (Windes 1970); McKenna's report on the architecture of the north portion of the West Plaza (McKenna 1970); and Shure's (1973) report on the rooms he excavated in the east wing of the West Plaza and the Middle Plaza, including Kiva M-1. For the other areas, the only documentation for the context of recovered materials we had access to, at the time of the Crow Canyon re-analysis project, was on the field bags themselves. Fortunately, this information was adequate to establish basic proveniences.

A methodological detail to keep in mind when considering our results is that the excavated deposits were not screened. Instead, students excavated with hand tools and collected all artifacts they noticed. It is likely that this practice led to the under-representation of small artifacts that would normally be caught in a quarter-inch (6 mm) mesh screen. This likely reduced the total count of recovered artifacts per cubic meter of fill, but probably had a more modest effect on the total weight of artifacts (since larger artifacts weigh more than smaller ones). The key question is whether the absence of screening affected the ratios of recovered artifact types relative to screened deposits. We believe that the relative frequencies of pottery types were unaffected, because small sherds are rarely classifiable to specific categories and there is no reason to suspect that the level of fragmentation varies across types. It is more likely that the absence of screening has reduced the recovery of small fragments of chipped stone, broken shell, and faunal remains of small animals. This should be kept in mind when comparing the Tsama collection with screened collections.

Information from the 1970 excavations has appeared in a few publications. Windes and McKenna published a synopsis of the excavations and some of their key findings in 2006. Ortman (2012, Chapter 13) presents pottery assemblage data for Kiva W-4 and the surface assemblages from each plaza, as well as an analysis of the painted designs on whiteware bowls from these contexts. In addition, Davis and Ortman (2015) compared the artifact assemblages from Tsama and Sand Canyon Pueblo in a 2015 presentation. Samantha Linford (2018) collected design style data from the Tsama collection for her study of paired village communities. Samuel Duwe included sherds from Tsama in a regional study of Tewa Basin pottery exchange (Duwe 2019). Duwe also presents archival information from Ellis' excavations as part of his research on Chama valley archaeology (Duwe 2011, 2020).

Regional studies that incorporated data from Tsama include H.P. Mera's (1934) survey of the biscuit ware area of the Northern Rio Grande, Greenlee's (1933) unpublished manuscript titled "Archaeological Sites in the Chama Valley, and Report on Excavations at Tsama, 1929–1933," John Beal's (1987) synthesis of the Rio Chama archaeological record, and Severin Fowles' (2004) study in Adams and Duff's (2004) summary of Pueblo IV period archaeology. Samuel Duwe has conducted long term, regional scale research in the Chama Valley, and a variety of maps and data derived from surface survey at Tsama appear in his work (Duwe 2008, 2011, 2020; Duwe et al. 2016).

Today, the collection from Ellis' 1970 excavations at Tsama is curated at the Maxwell Museum of Anthropology, University of New Mexico. The collection is organized according to the numbering system set up by the Crow Canyon laboratory during the re-analysis project, and the collections have been removed from the original field bags and repackaged in archival quality materials. A copy of the artifact database, as of the date of the collection's return to the Maxwell is on file at the museum, and the raw data summarized in this report are also available through the Crow Canyon Archaeological Center Research Database. Because we have continued to work with a copy of that database in preparing this report and corrected a few minor errors we encountered, there will likely be some minor discrepancies between the data as summarized here and other interpretations based on the same database.

Chapter 3

RESEARCH METHODOLOGY

Definition of Analytic Categories

All objects were classified into various stone, bone, pottery, vegetal, and other categories defined in the Crow Canyon Archaeological Center Laboratory Manual (Ortman et al. 2005), and pottery was classified following Wilson's (2006) guide to identification of Northern Rio Grande pottery types. As part of this work, the Crow Canyon laboratory removed the excavated materials from their original field bags, used the information recorded on the bags to determine the proveniences of materials to the extent possible, and repackaged the collection in archival materials. As the collection was repackaged, handwritten labels on the paper field bags were cut out, placed within a polyethylene bag, and included with the field bag contents in the new packaging. The laboratory crew also re-numbered the collection and documented correspondences between the original field documentation and the new database. Table 1 presents these correspondences.

Definition of Components

In this report we summarize the artifact data across a series of groups we defined based on spatial location, vertical position, and ceramic chronology. These divisions allow us to make temporal and spatial comparisons, including similarities and differences between Coalition period assemblages in the west village versus the east village and between the Coalition and Classic period occupations.

We grouped the artifact assemblages into four components: (1) the Coalition period occupation (the West Plaza); (2) the Coalition period East occupation (a smaller occupation revealed in the lower levels of excavated rooms in the East Plaza); (3) the Classic period occupation (which includes all other deposits in the East Plaza); and (4) a "general site" component for materials that either lack provenience information or were labeled as general site collections on the original field bags. In defining these components, we did not distinguish between surface and subsurface contexts. For an analysis of the surface assemblage by plaza, see Ortman (2012, Chapter 13).

Proveniences from the West Plaza were placed in the Coalition Period component due to architectural, tree-ring, and ceramic evidence indicating that this part of the settlement dates primarily from about AD 1250 to 1400. Materials from the Middle Plaza and East Plaza were assigned to the Classic Period component (AD 1400–1600), except for materials from the lower levels of excavation in "Romero's rooms" in the East Plaza, which we assign to a "Coalition East" component. This distinction is based on stratigraphic and ceramic evidence. In his excavation report, Greenlee (1933:63–65) noted stratigraphic evidence for a long use history in the East Plaza, and he also noted that the south bank of rooms was taller than the rest of the mound.

Table 1. Study Units and Correlations with 1970 Proveniences.

Plaza	Study Unit Type	Study Unit No.	Study Unit Description	Exact Location Known?	Notes
East	Structure	134	Non-masonry (adobe) surface room	No	East Plaza South Bank Room 1. Excavated in 10 levels. There were no features and no subfloor testing.
East	Structure	135	Non-masonry (adobe) surface room	No	East Plaza South Bank Room 2. Excavated in 10 levels. There were no features and no subfloor testing.
East	Structure	136	Non-masonry (adobe) surface room	No	East Plaza South Bank Room 4. Excavated in 9 levels, including the floor level. There were no features and no subfloor testing.
East	Structure	137	Non-masonry (adobe) surface room	No	East Plaza South Bank Room 5. Excavated in 6 levels including a floor level.
East	Structure	138	Non-masonry (adobe) surface room	No	East Plaza South Bank Room 6. The room was excavated in 8 levels. A floor feature (ash pit) was excavated.
East	Structure	139	Non-masonry (adobe) surface room	No	East Plaza South Bank Room 7. Excavated in 8 levels. There were no features. A test pit was excavated near the bottom of the room.
East	Non-structure	301	Extramural surface	Yes	"East Plaza." See Windes and McKenna (2006).
East	Structure	302	Subterranean kiva	Yes	Labeled Kiva E-1 (Great Kiva) in Windes and McKenna (2006). On the map this structure is in the north half of the East Plaza rooms.
East	Structure	303	Kiva, type unknown	Yes	K-1, which we believe is the same as the kiva south of the East Plaza south bank rooms.
East	Structure	304	Kiva, type unknown	No	Labeled "little kiva" on the artifact bags. We are not sure whether this kiva is south or north of the East Plaza.
General	Non-structure	0	Not further specified	N/A	Study Unit was created to deal with artifacts that have no provenience or are listed as coming from the whole site.
Middle	Non-structure	201	Extramural surface	Yes	"Middle Plaza." See Windes and McKenna (2006).
Middle	Structure	202	Subterranean kiva	Yes	Kiva M-1 in Windes and McKenna (2006); in the middle part of the Middle Plaza.
Middle	Structure	203	Subterranean kiva	Yes	Kiva M-2, in the northern part of the Middle Plaza. Windes and McKenna (2006) do not provide many details and there is no map.

Table 1. Study Units and Correlations with 1970 Proveniences.

Plaza	Study Unit Type	Study Unit No.	Study Unit Description	Exact Location Known?	Notes
Middle	Structure	204	Kiva, type unknown	No	Kiva M-3, in the north end of the Middle Plaza. This provenience was created from the labels on several artifact bags, which also say "great kiva." We are not sure whether this is a mistake and the collections are instead from Kiva E-1, the great kiva.
West	Non-structure	101	Extramural surface	Yes	"West Plaza." Extensive shovel stripping was done in the "western plaza" (same as the western mound?) to find wall alignments for abutment studies and mapping. No screening done.
West	Structure	102	Aboveground kiva	Yes	Kiva W-3, in the southeast portion of the room block. Several rooms were partly removed to excavate this structure.
West	Structure	103	Subterranean kiva	Yes	Originally designated Kiva W-4, this structure was in the southwest portion of the western room block. Thirteen features were noted in the kiva: 3 wall niches, fire pit, 2 ash pits, deflector, ventilator, sipapu, 2 postholes, foot drum and small round pit.
West	Structure	104	Non-masonry (adobe) surface room	No	West Plaza West Bank Room 1.
West	Structure	105	Kiva, type unknown	No	Kiva W-1 is documented on several bag labels, but we are not sure where it was. One bag is from a test trench; the level is unknown.
West	Structure	106	Non-masonry (adobe) surface room	No	West Plaza West Bank Room 2.
West	Structure	107	Non-masonry (adobe) surface room	No	West Plaza West Bank Room 3. Excavation included at least 10 levels and subfloor excavation. Several floors and a floor pit were found.
West	Structure	108	Non-masonry (adobe) surface room	No	West Plaza West Bank Room 4. Excavation included 8 levels and a subfloor test pit. Apparently, no floor features were found.
West	Structure	109	Non-masonry (adobe) surface room	No	West Plaza West Bank Room 5. Excavated in 9 levels, the last representing the floor contact level.
West	Structure	110	Non-masonry (adobe) surface room	No	West Plaza West Bank Room 6. Excavated in 8 levels plus a floor level. No features and no subfloor testing.
West	Structure	111	Non-masonry (adobe) surface room	No	West Plaza West Bank Room 7. Excavated in 7 levels; apparently no features or subfloor testing.
West	Structure	112	Non-masonry (adobe) surface room	No	West Plaza West Bank Room 10. Excavated in 9 levels plus a floor level and a test pit. We believe the test pit was a subfloor excavation.

Table 1. Study Units and Correlations with 1970 Proveniences.

Plaza	Study Unit Type	Study Unit No.	Study Unit Description	Exact Location Known?	Notes
West	Structure	113	Non-masonry (adobe) surface room	No	West Plaza North Bank Room 1.
West	Structure	114	Non-masonry (adobe) surface room	No	In the West Plaza North Bank. Excavation included 7 levels (the 7th level included the floor) and a subfloor trench.
West	Structure	115	Non-masonry (adobe) surface room	No	West Plaza North Bank Room 3. Excavated in 6 levels. No subfloor testing was done and no floor features were found.
West	Structure	116	Non-masonry (adobe) surface room	No	In the West Plaza North Bank. Excavated in 5 levels plus a floor level. There were no features and no subfloor testing.
West	Structure	117	Non-masonry (adobe) surface room	No	West Plaza North Bank Room 7. Excavated in 8 levels; Level 8 was the floor level. A test pit was excavated below the floor. No features were excavated.
West	Structure	118	Non-masonry (adobe) surface room	No	West Plaza North Bank Room 11. Excavated in 6 levels. No features or subfloor test pits were excavated.
West	Structure	119	Non-masonry (adobe) surface room	No	West Plaza North Bank Room 16. The room was excavated in 8 levels, with some subfloor excavations.
West	Structure	120	Non-masonry (adobe) surface room	No	West Plaza North Bank Room 17. It was excavated in 8 levels plus the floor level. A fire pit was found. No subfloor testing was done.
West	Structure	121	Non-masonry (adobe) surface room	No	West Plaza North Bank Room 18. Excavated in 8 levels, including the floor level. A subfloor test pit was excavated.
West	Structure	122	Non-masonry (adobe) surface room	No	West Plaza North Bank Room 26. Excavated in 7 levels. A test pit was excavated below the floor.
West	Structure	123	Non-masonry (adobe) surface room	No	West Plaza North Bank Room 27. Excavated in 7 levels and a subfloor test.
West	Structure	124	Non-masonry (adobe) surface room	No	West Plaza North Bank Room 28. Excavated in 5 levels plus the floor level. There were no features and no subfloor testing.
West	Structure	125	Non-masonry (adobe) surface room	No	West Plaza North Bank Room 29. Excavated in 7 levels plus the floor level. There were no features and no subfloor testing.
West	Structure	126	Non-masonry (adobe) surface room	No	West Plaza North Bank Room 30. Excavated in 6 levels plus the floor level. There were no features and no subfloor testing.
West	Structure	127	Non-masonry (adobe) surface room	No	West Plaza North Bank Room 31, non-masonry surface room.. It was excavated in 6 levels and one subfloor test pit.

Table 1. Study Units and Correlations with 1970 Proveniences.

Plaza	Study Unit Type	Study Unit No.	Study Unit Description	Exact Location Known?	Notes
West	Structure	128	Non-masonry (adobe) surface room	No	West Plaza North Bank Room 33. Excavated in 4 levels plus the floor level and a subfloor test pit.
West	Structure	129	Non-masonry (adobe) surface room	No	West Plaza North Bank Room 34. Excavated in 4 levels plus a subfloor level.
West	Structure	130	Non-masonry (adobe) surface room	No	West Plaza East Bank Room 1. Excavated in 5 levels plus the floor level. There were no features and no subfloor testing.
West	Structure	131	Non-masonry (adobe) surface room	No	West Plaza East Bank Room 5. Excavated in 6 levels. There were no features or subfloor testing.
West	Structure	132	Non-masonry (adobe) surface room	No	West Plaza East Bank Room 6. Excavated in 6 levels. No features were found and no subfloor testing was done.
West	Structure	133	Non-masonry (adobe) surface room	No	West Plaza East Bank Room 7. Excavated in 5 levels, plus subfloor testing.

The attributes noted by Greenlee may be why Ellis decided to excavate a series of rooms along the south bank of the East Plaza in 1970. Although the field notes for these excavations are missing, the information on the field bags, combined with the artifact content of each excavation level, was adequate to determine that, indeed, a Late Coalition Period village underlies the Classic period East Plaza construction. The stratigraphic evidence is summarized in Table 2. Windes and McKenna (2006) note that the excavations took place in 6 inch (15 cm) arbitrary levels, so excavations in the East Plaza rooms reached a depth of five feet (1.5 m; 10 levels) in some cases. A floor level was noted in two of the six excavated rooms in the East Plaza; in a third room the excavators appear to have inferred that a floor was present, based on the identification of a floor feature. The excavated rooms adjoined one other, but the identified floors were found at depths varying from 2.5 to 3 feet (0.8–0.9 m) to 4.5 to 5 feet (1.4–1.5 m). There is no documentation of the absolute elevations of these floors and in three of the six rooms, no floors were identified or inferred. It appears that floors were difficult to identify and that cultural deposits continued below the floor levels of the Classic period structures.

Table 2. Numbers of Excavation Levels in East Plaza Rooms Assigned to the Coalition East Component.

Structure	Number of Levels	Notes	No. of Levels in Coalition East component
134	10	No floor or features noted.	7 to 10
135	10	No floor or features noted.	8 to 10
136	9	Floor level was defined.	None
137	6	Floor level was defined.	None
138	8	A floor feature (ash pit) was excavated.	7 to 8
139	8	No floor defined but a test pit was excavated.	6 to 8

The ceramic evidence is summarized in Table 3, which compares the relative amounts of common, chronologically diagnostic pottery types in levels assigned to the Classic versus Coalition East component for each excavated East Plaza room. Although the assemblages are not unmixed, there is strong evidence of vertical stratification: Coalition and Early Classic period types (Santa Fe Black-on-white, Wiyo Black-on-white, Biscuit A, and Smeared Indented) are more common in the lower levels assigned to the Coalition East component, and Middle to Late Classic period types (Biscuit B, Potsuwi'i Incised, Tsankawi Black-on-cream, and Sapawe Micaceous Washboard) are more common in the upper levels assigned to the Classic Period component. This vertical sorting of deposits in the East Plaza rooms is significant because it indicates a previously unknown Late Coalition Period occupation of the East Plaza. In turn, this finding raises the possibility that during the Late Coalition period the Tewa community at Tsama consisted of paired east and west villages, and over time these two villages coalesced into a single village in the East Plaza area. We consider this hypothesis in greater detail below.

Table 3. Pottery Assemblages from Excavation Levels in East Plaza Rooms Assigned to the Classic vs. Coalition East Components.

Study Unit*	Santa Fe Black-on-white	Santa Fe/Wiyo Black-on-white	Wiyo Black-on-white	Biscuit A	Biscuit B	Potsuwi'i Incised	Tsankawi Black-on-cream	Smeared Indented	Sapawe Micaceous Washboard	Total
Count										
134		4	4	71	134	17	61	16	92	399
134.1	1		14	117	43		22	85		282
135	1		7	73	186	22	49	29	746	1113
135.1	6	10	19	72	7			132	12	258
136	8		9	45	183	8	69	39	230	591
137	2	6	3	93	90	13	4	33	231	475
138	20	7	11	115	328	57	62	51	372	1023
138.1	85	2	2	48	7	2	1	257	6	410
139		2	12	75	112	52	5	82	41	381
139.1	4	18	16	23	21	2		8	3	95
Row Percent										
134	0.0	1.0	1.0	17.8	33.6	4.3	15.3	4.0	23.1	100
134.1	0.4	0.0	5.0	41.5	15.2	0.0	7.8	30.1	0.0	100
135	0.1	0.0	0.6	6.6	16.7	2.0	4.4	2.6	67.0	100
135.1	2.3	3.9	7.4	27.9	2.7	0.0	0.0	51.2	4.7	100
136	1.4	0.0	1.5	7.6	31.0	1.4	11.7	6.6	38.9	100
137	0.4	1.3	0.6	19.6	18.9	2.7	0.8	6.9	48.6	100
138	2.0	0.7	1.1	11.2	32.1	5.6	6.1	5.0	36.4	100
138.1	20.7	0.5	0.5	11.7	1.7	0.5	0.2	62.7	1.5	100
139	0.0	0.5	3.1	19.7	29.4	13.6	1.3	21.5	10.8	100
139.1	4.2	18.9	16.8	24.2	22.1	2.1	0.0	8.4	3.2	100

*Study units with a decimal point represent the Coalition East levels of a given room. Study units without the decimal point represent the Classic period components.

The size of the assemblage associated with each component at Tsama varies substantially. To facilitate comparisons of the relative abundances of artifact types across components, we used the total weight of grayware sherds from a given component to calculate the "density" of a given artifact category per kilogram of grayware pottery. The use of grayware pottery as a benchmark against which to compare the relative abundances of artifact types is supported by previous research suggesting that utility wares accumulate at consistent rates per person year of occupation and do not vary as a result of socioeconomic development (Jongman 2014; Ortman and Davis 2019; Ortman and Lobo 2020; Till and Ortman 2007; Varien and Ortman 2005). The primary reason for this is the common use of grayware pots for daily cooking. Residents needed to cook a consistent volume of food per person per day, leading to a relatively rapid degradation of the vessels used and a regular rate of deposition of sherds from worn-out cooking pots in the archaeological record. Grayware pots were also used for storage, but this activity was not nearly as taxing on vessel use-life. As a result, most grayware sherds in an assemblage resulted from the use of grayware pots for cooking.

The total weight of bulk sherds, by ware and component, is presented in Table 4. This table illustrates the value of using cooking pottery, a low income-elasticity good (which is to say, a good for which demand, and thus consumption rates, are consistent per person year, regardless of changes in living standards), as a standard against which to compare assemblages.

Table 4. Weight, in Grams, of Bulk Sherds by Ware and Component.

	Component			
Ware	Coalition	Coalition East	Classic	General
Nonlocal	1.6	0.0	2.3	0.0
Rio Grande Gray	97667.1	7225.1	58374.1	642.3
Rio Grande Glaze	64.0	0.0	2022.0	3.0
Rio Grande White	56889.6	8151.9	107937.7	1524.9
Unknown	12.5	0.0	0.0	0.0
Total	154634.8	15377.0	168336.1	2170.2

The most notable result in Table 4 is a shift in the ratio of white ware to gray ware, which increases from 0.58:1 to 1.85:1 over time. This shift suggests a substantial change in the relative accumulation rates of the two wares, presumably resulting from an increase in household inventories of whiteware vessels due to increased socializing involving food, and corresponding increases in the per capita consumption rate of these vessels (Ortman and Davis 2019). This is one of many lines of evidence we will adduce in this report to suggest that material living standards increased substantially over time at Tsama. The table also shows that gray ware is underrepresented in the "general site" component, in that the ratio of white ware to gray ware is almost 3 to 1 for those contexts. To the extent that the general site sample is biased, it has limited interpretive potential beyond allowing one to translate the information in these tables into totals for the entire collection. Also, the Coalition East component is only about one-tenth the size of the Coalition and Classic Components, limiting comparisons that can be made reliably.

Comparisons to Other Pueblos

When possible, we compare artifact assemblage information from Tsama with data from other excavated ancestral Puebloan sites, including Sand Canyon Pueblo (Till and Ortman 2007), Howiri (Fallon and Wening 1987), Burnt Mesa Pueblo (Kohler 2004), and Arroyo Hondo Pueblo (Creamer 1993; Habicht-Mauche 1993). Comparisons with Sand Canyon Pueblo, a 13th century village in the Northern San Juan region, are intended to capture differences in environment, settlement, and economy between Northern San Juan and Northern Rio Grande communities. Previous studies have suggested that Pueblo society and economy changed in substantial ways as the center of gravity of the Pueblo world shifted from the San Juan drainage to the Rio Grande drainage during the 1200s (Ortman 2016a; Ortman and Davis 2019); we will investigate the degree to which these changes are reflected in bulk artifact assemblages. In addition, comparisons with Howiri allow us to examine inter-site differences within the Chama Valley during the Classic period; comparisons with Burnt Mesa Pueblo allow us to assess differences in materials between the Chama Valley and the Pajarito Plateau during the Coalition Period; and comparisons with Arroyo Hondo Pueblo allow us to examine changes in the Chama valley and the Santa Fe area over time.

Chapter 4

POTTERY

Unmodified Sherds

Tables 5 and 6 list the amounts of all types of unmodified sherds recovered at the site. The type distributions support the overall dating of the site from the Late Coalition period through the Classic period. The data in Tables 5 and 6 also suggest that the West Plaza was inhabited into the Early Classic period, based on the large amounts of Wiyo Black-on-white and Biscuit A. The absence of pottery that predates Santa Fe Black-on-White suggests Tsama was founded during the AD 1200s. Also, the substantial amount of Tsankawi Black-on-cream, with only trace amounts of Kapo Black and Tewa Red, establishes an end date for the occupation of about AD 1600. Trade wares such as Galisteo Black-on-white, Taos Black-on-white, and Jemez Black-on-white are rare. Glaze wares, which were produced primarily in the Galisteo Basin some 80 kilometers to the south (Cordell and Habicht-Mauche 2012), are also rare, but later glaze types are more frequent than earlier ones. Overall, the ratio of glaze ware to gray ware by weight (Table 4) increases from 0.0006:1 in the Coalition Component to 0.0346:1 in the Classic Component. Part of this increase is because glaze-painted pottery only began to be produced about AD 1315, but the magnitude of the increase, combined with the higher relative frequency of later glazes in Tables 5 and 6, indicates that the per capita rate of glazeware importation increased over time.

By count, utility ware is 65 percent of the Coalition assemblage at Tsama. This is comparable to the percentage at Sand Canyon Pueblo (Till and Ortman 2007, Table 5), but lower than at Burnt Mesa Pueblo (84 percent) (Kohler and Root 2004:162). This pattern reinforces the significance of the even lower percentage of utility ware in the Classic Period component at Tsama. Also, compared to Howiri, Tsama has a greater diversity of ceramic types and a higher percentage of glaze ware (about 2 percent at Tsama by count, versus 0.7 percent at Howiri) (Fallon and Wening 1987:43). We suspect that the social network of Tsama was somewhat more extensive than that of Howiri.

Demographic Analysis

Demographic interpretation of pottery assemblages proceeds from the notion that the relative frequencies of pottery types in an assemblage reflect variation in the overall accumulation of these types, which is governed by the length of time over which each type was produced and the number of people who consumed pottery over time (Ortman 2016b). The most important consideration is the extent to which a pottery assemblage constitutes a representative sample. The excavation areas were selected judgmentally, so there is no reason to presume that the materials recovered from each plaza represents a simple random sample of the pottery from that area. The use of surface pottery assemblages is a possible alternative, but would ignore the stratification of pottery types in the East Plaza excavation units. Due to these complications, it is not feasible to select a subset of contexts that can be treated as a simple random sample.

Table 5. Pottery Type Counts by Component.

Pottery Type	Component							
	Coalition		Coalition E		Classic		General	
	No.	%	No.	%	No.	%	No.	%
Rio Grande White Ware								
Kwahe'e Black-on-white	0	0.0	0	0.00	1	0.01	0	0.0
Santa Fe Black-on-white	2148	11.7	96	5.2	393	2.5	0	0.0
Wiyo Black-on-white	1289	7.1	51	2.7	381	2.4	22	12.9
Santa Fe/Wiyo Black-on-white	492	2.7	30	1.6	151	1.0	0	0.0
Pindi Black-on-white	326	1.8	0	0.0	22	0.1	0	0.0
Poge Black-on-white	0	0.0	0	0.0	1	0.01	0	0.0
Galisteo Black-on-white	27	0.2	0	0.0	3	0.02	0	0.0
Whiteware, not Biscuit	128	0.7	1	0.1	148	0.9	3	1.8
Biscuit A	770	4.2	260	14.0	1582	10.1	21	12.4
Biscuit B	359	2.0	78	4.2	4144	26.4	24	14.1
Biscuit, not further specified	289	1.6	108	5.8	1529	9.8	4	2.4
Potsuwi'i Incised	16	0.1	4	0.2	478	3.1	5	2.9
Tsankawi Black-on-Cream	80	0.4	23	1.2	674	4.3	0	0.0
Kapo Black	0	0.0	0	0.0	13	0.1	0	0.0
Tewa Red	0	0.0	0	0.0	1	0.01	0	0.0
Rio Grande White Ware	115	0.6	19	1.0	201	1.3	4	2.4
Vallecitos Black-on-white	13	0.1	0	0.0	3	0.02	0	0.0
Vadito Black-on-white	16	0.1	0	0.0	1	0.01	0	0.0
Chupadero Black-on-white	0	0.0	0	0.0	2	0.01	0	0.0
Taos Black-on-white	2	0.01	0	0.0		0.0	0	0.0
Jemez Black-on-white	4	0.02	0	0.0		0.0	0	0.0
Rio Grande Gray Ware								
Rio Grande Plain Gray	332	1.8	37	2.0	564	3.6	10	5.9
Plain Corrugated	129	0.7	6	0.3	23	0.2	1	0.6
Clapboard Corrugated	225	1.2	36	1.9	34	0.2	0	0.0
Indented Corrugated	605	3.3	12	0.7	13	0.1	0	0.0
Taos Incised	0	0.0	1	0.1	1	0.01	0	0.0
Incised Gray, NFS	0	0.0	0	0.0	2	0.01	0	0.0
Smeared Corrugated	2907	15.9	0	0.0	123	0.8	0	0.0
Smeared Indented	7766	42.5	482	25.9	636	4.1	68	40.0
Washboard Corrugated	28	0.2	0	0.0	27	0.2	0	0.0
Cordova Micaceous Ribbed	6	0.03	7	0.4	42	0.3	0	0.0
Cundiyo Micaceous Slipped	151	0.8	544	29.3	1520	9.7	2	1.2
Sapawe Micaceous Washboard	21	0.1	21	1.1	1862	11.9	4	2.4
Micaceous Slipped	8	0.04	41	2.20	687	4.4	1	0.6

Table 5. Pottery Type Counts by Component.

Pottery Type	Component							
	Coalition		Coalition E		Classic		General	
	No.	%	No.	%	No.	%	No.	%
Micaceous Tempered	32	0.2	3	0.16	139	0.9	0	0.0
Rio Grande Glaze Ware								
Glaze A, undifferentiated	0	0.0	0	0.0	5	0.03	0	0.0
Glaze B, undifferentiated	0	0.0	0	0.0	2	0.01	0	0.0
Glaze C, undifferentiated	1	0.01	0	0.0	29	0.2	0	0.0
Glaze D, undifferentiated	0	0.0	0	0.0	1	0.01	0	0.0
Glaze E, undifferentiated	0	0.0	0	0.0	18	0.1	0	0.0
Glaze F, undifferentiated	0	0.0	0	0.0	7	0.04	0	0.0
Glaze-on-red	4	0.02	0	0.0	150	1.0	0	0.0
Glaze-on-yellow	2	0.01	0	0.0	12	0.1	0	0.0
Glaze polychrome	0	0.0	0	0.0	24	0.2	1	0.6
Glaze ware, undifferentiated	1	0.01	0	0.0	23	0.2	0	0.0
Los Padillas Glaze Polychrome	1	0.01	0	0.0	0	0.0	0	0.0
Nonlocal								
Other Red Nonlocal	1	0.01	0	0.0	0	0.0	0	0.0
Polychrome	0	0.0	0	0.0	1	0.01	0	0.0
Unknown								
Unknown	2	0.01	0	0.0	0	0.0	0	0.0

An important factor to consider is the overall intensity of excavation; the West Plaza was investigated much more intensively than the Middle or East Plazas. Because demographic analysis relies on the relative frequencies of pottery types, considering the entire pottery assemblage at once would likely bias the result in favor of the Coalition period occupation of the West plaza. Also, given the evidence for a Coalition Period occupation of the East Plaza, estimating the population histories of the West and East plazas separately would be helpful for assessing the social organization of the Tsama community early in its history. Given these considerations, we have chosen to examine the population history of the West Plaza separately from the combined Middle Plaza and East Plaza area, and we include the entire pottery assemblage from each of these areas in the analysis.

Table 7 presents the entire pottery assemblage (surface and subsurface contexts, and excavated rooms and kivas) for the West Plaza, and for the combined Middle and East Plaza, by count. These samples exclude a few pottery types whose production spans are vague or extremely long (such as Rio Grande Plain Gray).

Table 6. Pottery Type Weights by Component.

Pottery Type	Site Component							
	Coalition		Coalition E		Classic		General	
	Wt. (g)	%	Wt. (g)	%	Wt. (g)	%	Wt. (g)	%
Rio Grande White Ware								
Kwahe'e Black-on-white	0	0.0	0	0.0	3.2	0.0	0	0.0
Santa Fe Black-on-white	21501.2	13.9	931.2	6.1	2920.0	1.7	0	0.0
Wiyo Black-on-white	10776.7	7.0	291.2	1.9	2674.7	1.6	124.9	5.8
Santa Fe/Wiyo Black-on-white	4961.5	3.2	297.5	1.9	926.0	0.6	0	0.0
Pindi Black-on-white	3383.7	2.2	0	0.0	235.7	0.1	0	0.0
Poge Black-on-white	0	0.0	0	0.0	3.1	0.0	0	0.0
Galisteo Black-on-white	273.8	0.2	0	0.0	41.2	0.02	0	0.0
Whiteware, not Biscuit	1101.9	0.7	25.8	0.2	1994.8	1.2	411.1	18.9
Biscuit A	5498.2	3.6	3220.8	21.0	14652.6	8.7	300.3	13.8
Biscuit B	5071.6	3.3	2054.7	13.4	57674.0	34.3	465.8	21.5
Biscuit, not further specified	2412.5	1.6	993.2	6.5	16811.1	10.0	50.5	2.3
Potsuwi'i Incised	66.6	0.04	17.6	0.1	2839.1	1.7	120.9	5.6
Tsankawi Black-on-Cream	532.8	0.3	156.9	1.0	5606.0	3.3	0	0.0
Kapo Black	0	0.0	0	0.0	113.1	0.1	0	0.0
Tewa Red	0	0.0	0	0.0	5.9	0.0	0	0.0
Rio Grande Whiteware	1101.8	0.7	163.0	1.1	1393.8	0.8	51.4	2.4
Vallecitos Black-on-white	87.1	0.1	0	0.0	25.0	0.01	0	0.0
Vadito Black-on-white	69.8	0.1	0	0.0	7.2	0.0	0	0.0
Chupadero Black-on-white	0	0.0	0	0.0	11.2	0.01	0	0.0
Taos Black-on-white	13.6	0.01	0	0.0	0	0.0	0	0.0
Jemez Black-on-white	36.8	0.02	0	0.0	0	0.0	0	0.0

Table 6. Pottery Type Weights by Component.

Pottery Type	Site Component							
	Coalition		Coalition E		Classic		General	
	Wt. (g)	%	Wt. (g)	%	Wt. (g)	%	Wt. (g)	%
Rio Grande Gray Ware								
Rio Grande Plain Gray	1677.6	1.1	210.1	1.4	4786.3	2.8	82.6	3.8
Plain Corrugated	920.5	0.6	44.0	0.3	125.0	0.1	2.9	0.1
Clapboard Corrugated	1865.9	1.2	324.4	2.1	263.6	0.2	0	0.0
Indented Corrugated	6478.4	4.2	65.9	0.4	89.0	0.1	0	0.0
Taos Incised	0	0.0	10.9	0.1	10.7	0.01	0	0.0
Incised Gray, not further specified	0	0.0	0	0.0	14.4	0.01	0	0.0
Smeared Corrugated	23855.6	15.4	0	0.0	511.1	0.3	0	0.0
Smeared Indented	60455.2	39.1	2904.9	18.9	4957.4	2.9	472.5	21.8
Washboard Corrugated	248.5	0.2	0	0.0	78.8	0.1	0	0.0
Cordova Micaceous Ribbed	83.9	0.1	78.8	0.5	407.2	0.2	0	0.0
Cundiyo Micaceous Slipped	1603.5	1.0	3112.1	20.2	14712.4	8.7	23.2	1.1
Sapawe Micaceous Washboard	206.7	0.1	203.5	1.3	25652.3	15.2	51.7	2.4
Micaceous Slipped	38.4	0.02	260.7	1.7	6174.6	3.7	9.4	0.4
Micaceous Tempered	233.0	0.2	9.8	0.1	591.3	0.4	0	0.0
Rio Grande Glaze Ware								
Glaze A, undifferentiated	0	0.0	0	0.0	25.9	0.02	0	0.0
Glaze B, undifferentiated	0	0.0	0	0.0	26.5	0.02	0	0.0
Glaze C, undifferentiated	9.5	0.01	0	0.0	368.5	0.2	0	0.0
Glaze D, undifferentiated	0	0.0	0	0.0	4.8	0.0	0	0.0
Glaze E, undifferentiated	0	0.0	0	0.0	384.7	0.2	0	0.0
Glaze F, undifferentiated	0	0.0	0	0.0	136.4	0.1	0	0.0
Glaze-on-red	23.7	0.02	0	0.0	729.6	0.4	0	0.0
Glaze-on-yellow	5.9	0.0	0	0.0	40.2	0.02	0	0.0
Glaze polychrome	0	0.0	0	0.0	174.2	0.1	3	0.1

Table 6. Pottery Type Weights by Component.

Pottery Type	Site Component							
	Coalition		Coalition E		Classic		General	
	Wt. (g)	%	Wt. (g)	%	Wt. (g)	%	Wt. (g)	%
Glazeware, undifferentiated	2.5	0.0	0	0.0	131.2	0.1	0	0.0
Los Padillas Glaze Polychrome	22.4	0.01	0	0.0	0	0.0	0	0.0
Nonlocal								
Other red nonlocal	1.6	0.0	0	0.0	0	0.0	0	0.0
Polychrome	0	0.0	0	0.0	2.3	0.0	0	0.0
Unknown								
Unknown Pottery	12.5	0.01	0	0.0	0	0.0	0	0.0

Table 7. Samples Used for Demographic Analysis.

Ware	Type	Begin Date	End Date	West Plaza		Middle and East Plaza	
				No.	%	No.	%
White	Chupadero Black-on-white	1150	1550	0	0.0	2	0.01
White	Jemez Black-on-white	1300	1700	4	0.03	0	0.0
White	Vallecitos Black-on-white	1250	1400	16	0.1	1	0.01
White	Kwahe'e Black-on-white	1050	1200	0	0.0	1	0.01
White	Taos Black-on-white	1150	1250	2	0.01	0	0.0
White	Santa Fe Black-on-white	1150	1350	2148	14.8	489	3.4
White	Pindi Black-on-white	1250	1350	326	2.3	22	0.2
White	Wiyo Black-on-white	1300	1400	1289	8.9	432	3.0
White	Santa Fe/Wiyo Black-on-white	1250	1400	492	3.4	181	1.3
White	Poge/Rowe Black-on-white	1300	1425	0	0.0	1	0.01
White	Galisteo Black-on-white	1300	1400	27	0.2	3	0.02
White	Biscuit A	1350	1450	770	5.3	1842	12.9
White	Biscuit B	1400	1550	359	2.5	4222	29.6
White	Tsankawi Black-on-cream	1500	1650	80	0.6	697	4.9
Gray	Taos Incised	900	1100	0	0.0	2	0.01
Gray	Incised Gray, NFS	900	1100	0	0.0	2	0.01
Gray	Clapboard Corrugated	900	1100	225	1.6	70	0.5
Gray	Plain Corrugated	950	1150	129	0.9	29	0.2
Gray	Indented Corrugated	1150	1300	605	4.2	25	0.2
Gray	Smeared Indented Corrugated	1250	1425	7766	53.6	1118	7.8
Gray	Cundiyo Micaceous Slipped	1300	1400	151	1.0	2064	14.5
Gray	Cordova Micaceous Ribbed	1300	1400	6	0.04	49	0.3
Gray	Washboard Corrugated	1400	1600	28	0.2	27	0.2
Gray	Sapawe Micaceous Washboard	1400	1600	21	0.1	1883	13.2
Gray	Micaceous Tempered	1400	1700	32	0.2	142	1.0
Gray	Micaceous Slipped	1400	1700	8	0.1	728	5.1
Glaze	Los Padillas Glaze Polychrome	1175	1300	1	0.01	0	0.0
Glaze	Glaze A, undifferentiated	1315	1425	0	0.0	5	0.04
Glaze	Glaze B, undifferentiated	1400	1450	0	0.0	2	0.01
Glaze	Glaze C, undifferentiated	1425	1500	1	0.01	29	0.2
Glaze	Glaze D, undifferentiated	1450	1515	0	0.0	1	0.01
Glaze	Glaze E, undifferentiated	1515	1650	0	0.0	18	0.1
Glaze	Glaze F, undifferentiated	1625	1700	0	0.0	7	0.1
Glaze	Glaze-on-red	1315	1700	4	0.03	150	1.1
Glaze	Glaze-on-yellow	1315	1700	2	0.01	12	0.1
Glaze	Rio Grande Glaze Ware, Undiff.	1315	1700	1	0.01	23	0.2
Total				14493	100.00	14279	100.00

We subjected these assemblages to uniform probability density analysis, as developed by Ortman (2016b) and implemented in the Cyber Southwest research tool (https://cybersw.org/cybersw/). This analysis produces a summed probability density distribution for a pottery assemblage based on the assumption that deposition of a sherd of a given type has a uniform probability across its production span. The analysis adjusts the shape of the resultant curve based on the conditional probability of obtaining the observed proportions of types if the site were inhabited during each pottery period. The posterior probability density is then integrated with the room count for a site to estimate the number of occupied rooms during each pottery period, on the assumption that the entire architectural footprint of the site was inhabited during the most probable period.

Figure 11 summarizes the analysis results for the data in Table 7. The analyses reinforce the inference that Tsama was founded in the second half of the 13th century and inhabited continuously until about AD 1600. The results also suggest that the entire architectural footprint of Tsama was occupied during the second half of the 14th century, when the posterior distributions peaked for both the West Plaza area and the Middle and East Plaza areas.

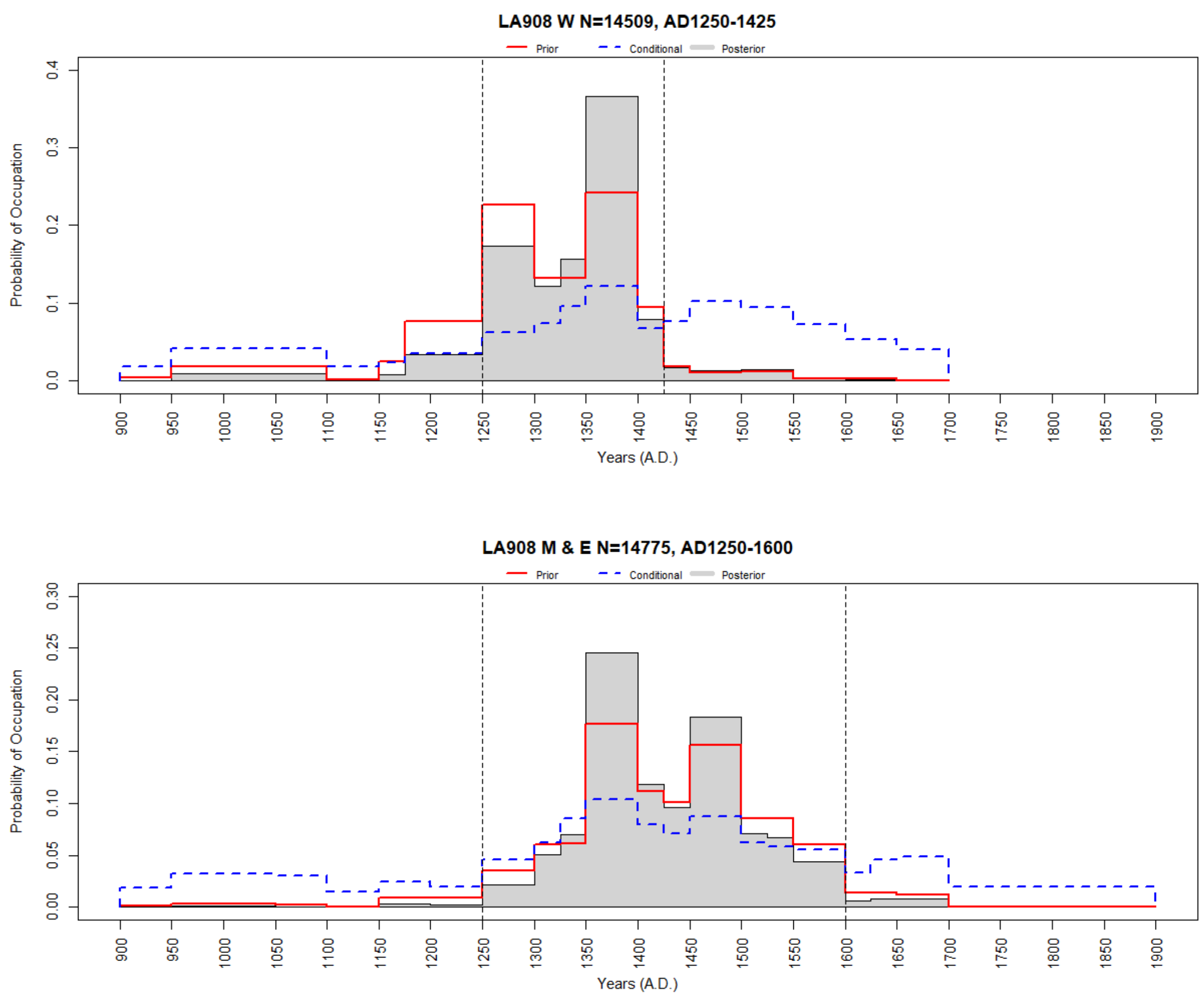

Figure 11. Probability density analysis. *Top,* West Plaza. *Bottom,* Middle and East Plazas.

The populations of both areas seem to have fluctuated in roughly fifty year cycles, with the West Plaza experiencing a dip in occupation between 1300 and 1350 and the Middle and East Plazas experiencing a dip between 1400 and 1450. This potential dynamism of the community population is consistent with suggestions by Anschuetz (2007) and Duwe (2020) that the populations of ancestral Tewa sites fluctuated substantially on relatively short time scales, as people shifted on the landscape in response to climate fluctuations and local environmental impacts.

Figure 12 presents the demographic models that follow from integrating the posterior distribution for each area with its estimated room counts. These reconstructions reinforce the suggestion that the Tsama community began as two adjacent, similarly sized villages. The estimated population of the West Plaza, and the Middle and East plazas, were each about 100 persons between 1250 and 1300. Population in both areas increased between 1300 and 1400, but the increase was much larger in the Middle and East Plaza areas. This result is consistent with our reconstruction of Tsama as a paired village community during the Late Coalition Period.

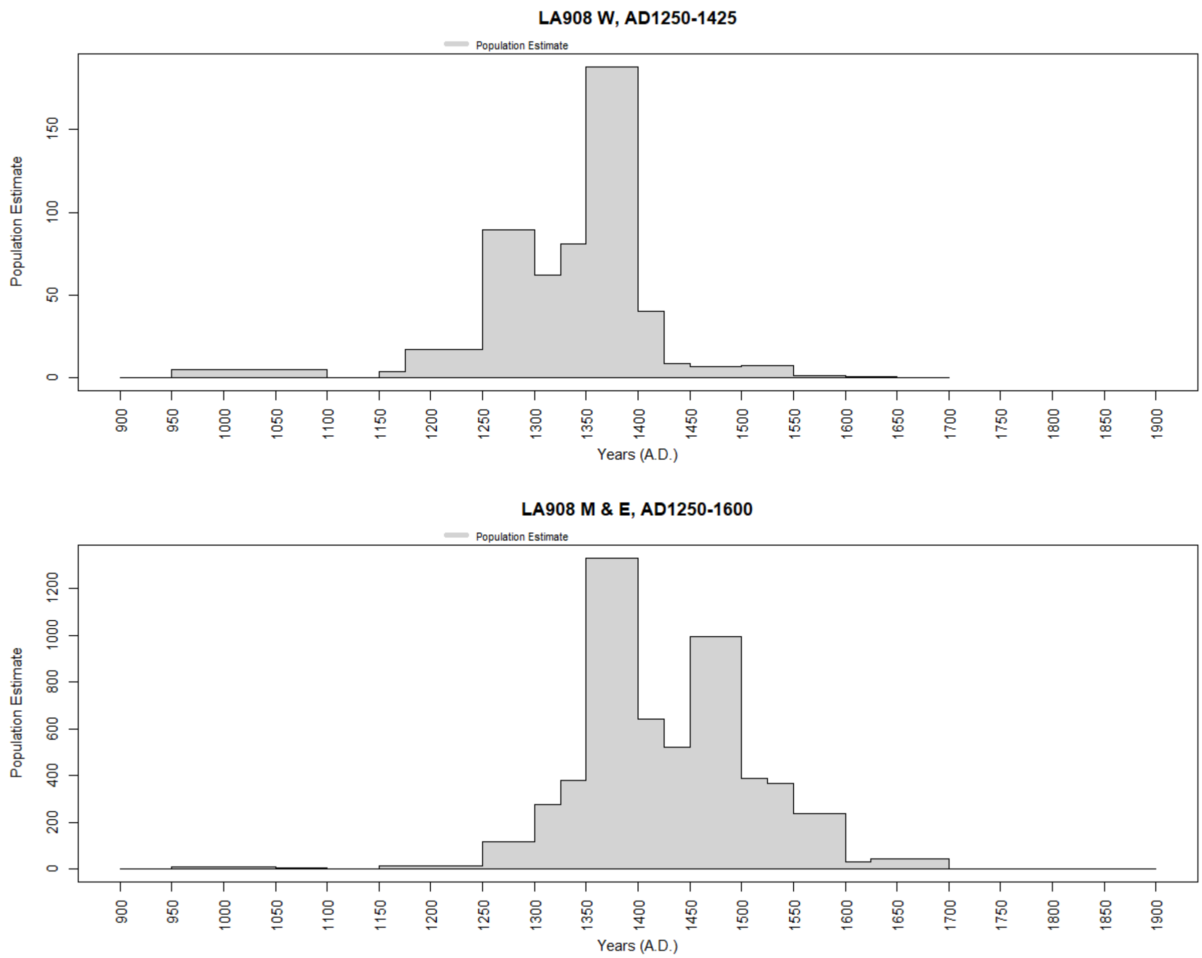

Figure 12. Demographic reconstructions. *Top,* West Plaza. *Bottom,* Middle and East Plazas.

Ceramic Differences Between the Late Coalition Villages

The pottery assemblages suggest that during the Late Coalition Period the Tsama community consisted of villages of similar size, separated by about 150 meters. Based on Tewa oral traditions related to more recent paired village communities, such as Ohkayˀówînge and Yûngeˀówîngeh (Ortiz 1979) and Howíd̠íˀówîngeh and Hų́ųpóviˀówîngeh (Harrington 1916), this settlement pattern may reflect a form of community organization where Summer People lived in the western village and Winter People in the eastern village (Bernstein and Ortman 2020; Cruz and Ortman 2019; Ortiz 1969). Although the layout of the eastern Late Coalition period village is obscured, the West Plaza was built with an opening in the northeast corner that faces toward the midsummer sunrise (see Figure 3). The fact that a village in the western part of the site includes a view to the northeastern horizon supports its identification as a Summer People's village.

In paired village communities such as Tsama, one might see subtle differences in material culture that reflect an association of the eastern village with winter and the western village with summer. Our samples represent pottery consumed in the western versus the eastern Late Coalition period villages, based on where broken vessels accumulated as opposed to where the vessels were produced. However, even if potters in each village produced completely distinct pottery, one would not expect the pattern to be perfectly preserved in archaeological assemblages unless there was no pottery exchange between the two villages. This seems highly unlikely; the two Late Coalition period villages were built next to each other, on the same terrace, and were part of a single community. Nonetheless, we may expect residents' social networks to have been biased in favor of their own village. If certain pottery attributes did signal village affiliation, one can expect biases in social networks to result in identifiable differences in the relative frequencies of vessel types.

We therefore note two significant differences in the relative frequencies of certain pottery types in the western and eastern Late Coalition period villages at Tsama. First, among the gray wares, the ratio of smeared indented-corrugated to Cundiyo Micaceous Slipped (a variety of smeared indented-corrugated with an added mica slip on the exterior surface) is higher in the West Plaza than in the Middle and East Plazas. Second, among the white wares, the ratio of Santa Fe Black-on-white to Pindi Black-on-white (a variety of Santa Fe Black-on-white with distinctive crushed pumice temper) is lower in the West Plaza than in the Middle and East Plazas.

Due to mixing of Coalition and Classic Period deposits in the East Plaza, the patterns are most evident when one compares the ratios of Smeared Indented Corrugated to Cundiyo Micaceous Slipped, and of Santa Fe Black-on-white to Pindi Black-on-white, across all contexts from the West versus Middle and East Plazas (Table 8). Adopting the null hypothesis that the samples from each plaza derive from a population where the underlying frequencies of these types are the same, in each instance the probability of obtaining these differences is five percent or less (Chi-square $P < 0.0000$ for the gray wares, $P = 0.05$ for the white wares). In sum, the two Coalition Period villages at Tsama exhibit statistically significant differences in their pottery assemblages.

Table 8. Distribution of Selected Pottery Types in Coalition Period Villages.

Coalition Period Village	Smeared Indented	Cundiyo Micaceous	Total
West	7766	151	7917
East	1118	2064	3182
Total	8884	2215	11099
	Santa Fe B/W	**Pindi B/W**	
West	2148	326	2474
East	489	22	511
Total	2637	348	2985

These differences have directional associations. Micaceous raw materials generally occur in the Sangre de Cristo Mountains east of the Rio Grande, while pumice and vitreous tuff occur primarily in the consolidated ash deposits of the Pajarito Plateau west of the Rio Grande (though at Tsama this area is to the south). Duwe (2019) determined the chemical composition of 11 Santa Fe and Wiyo Black-on-white sherds from Tsama and the downstream village of Kapo, and found that nine were made of raw materials found on the Pajarito Plateau (where pumice occurs). Thus, raw material associated with the mountains on the east side of the Tewa Basin is relatively more common in pottery found at the eastern Late Coalition period village, while raw material associated with the mountains on the west side of the Tewa Basin is relatively more common in pottery consumed in the western Late Coalition period village. As we mentioned in Chapter 1, these directions have seasonal and social implications in Tewa culture, the east being associated with winter and the Winter People and the west being associated with summer and the Summer People. In sum, based on various lines of evidence, it is plausible to suggest that Tsama had a paired village community organization during the Coalition Period—just as Bernstein and Ortman (2020) argue for Cuyamungue.

Total Inventory by Ware, Form, and Site Component

Table 9 presents counts, percentages, and densities of sherds by ware and form, and Table 10 presents the corresponding data by weight. The density calculations in Table Sections 9C (counts divided by grams of grayware pottery in that component) and 10C (weights divided by grams of grayware pottery in that component) provide information about the relative accumulation rates of wares and forms, relative to gray ware, providing information about changing accumulation rates through time. The data show substantial changes in the relative accumulation rates of whiteware bowls and jars over time. (Forms other than bowls and jars are rare in the collection.) The increase in whiteware consumption, relative to grayware consumption, between the Coalition and Classic periods at Tsama also occurred at Arroyo Hondo Pueblo (Habicht-Mauche 1993:16, 21), indicating that this is a general trend in Northern Rio Grande sites.

Table 9. Bulk Sherd Counts by Ware, Form, and Component.

Ware and Form	Site Component			
	Coalition	Coalition E	Classic	General
9A. Count				
Nonlocal				
Bowl	1	0	1	0
Gray Ware				
Bowl	2	1	7	6
Jar	12201	1189	5656	80
Ladle	1	0	0	0
Unknown	6	0	10	0
Glaze Ware				
Bowl	8	0	196	1
Jar	0	0	67	0
Other	0	0	7	0
Unknown	1	0	1	0
White Ware				
Bowl	5797	567	7762	71
Canteen	3	1	0	0
Jar	242	87	1802	12
Ladle	6	1	3	0
Mug	1	0	0	0
Other	0	0	2	0
Unknown	25	14	159	0
9B. Percentage				
Nonlocal				
Bowl	0.01	0.0	0.01	0.0
Gray Ware				
Bowl	0.01	0.1	0.04	3.5
Jar	66.7	63.9	36.1	47.1
Ladle	0.01	0.0	0.0	0.0
Unknown	0.03	0.0	0.1	0.0
Glaze Ware				
Bowl	0.04	0.0	1.3	0.6
Jar	0.0	0.0	0.4	0.0
Other	0.0	0.0	0.04	0.0
Unknown	0.01	0.0	0.01	0.0
White Ware				
Bowl	31.7	30.5	49.5	41.8
Canteen	0.02	0.1	0.0	0.0
Jar	1.3	4.7	11.5	7.1
Ladle	0.03	0.1	0.02	0.0
Mug	0.01	0.0	0.0	0.0
Other	0.0	0.0	0.01	0.0
Unknown	0.1	0.8	1.0	0.0

Table 9. Bulk Sherd Counts by Ware, Form, and Component.

Ware and Form	Site Component			
	Coalition	Coalition E	Classic	General
9C. Density (Count/Kg of Gray Ware)				
Nonlocal				
Bowl	0.01	0.0	0.02	0.0
Gray Ware				
Bowl	0.02	0.1	0.1	9.3
Jar	124.9	164.6	96.9	124.6
Ladle	0.01	0.0	0.0	0.0
Unknown	0.1	0.0	0.2	0.0
Glaze Ware				
Bowl	0.1	0.0	3.4	1.6
Jar	0.0	0.0	1.2	0.0
Other	0.0	0.0	0.1	0.0
Unknown	0.01	0.0	0.02	0.0
White Ware				
Bowl	59.4	78.5	133.0	110.5
Canteen	0.03	0.1	0.0	0.0
Jar	2.5	12.0	30.9	18.7
Ladle	0.1	0.1	0.1	0.0
Mug	0.01	0.0	0.0	0.0
Other	0.0	0.0	0.03	0.0
Unknown	0.3	1.9	2.7	0.0

Table 10. Bulk Sherd Weights by Ware, Form, and Component.

Ware and Form	Site Component			
	Coalition	Coalition E	Classic	General
10A. Weight (g)				
Nonlocal				
Bowl	1.6	0.0	2.3	0.0
Gray Ware				
Bowl	16.7	10.2	91.0	38.0
Jar	97582.8	7214.9	58247.9	604.3
Ladle	42.3	0.0	0.0	0.0
Unknown	25.3	0.0	35.2	0.0
Glaze Ware				
Bowl	56.7	0.0	1426.6	3.0
Jar	0.0	0.0	352.2	0.0
Other	0.0	0.0	241.4	0.0
Unknown	7.3	0.0	1.8	0.0
White Ware				
Bowl	54272.9	7337.8	87960.1	919.5
Canteen	48.5	12.7	0.0	0.0
Jar	2095.8	686.5	19093.6	605.4
Ladle	139.3	8.5	39.5	0.0
Mug	7.6	0.0	0.0	0.0
Other	0.0	0.0	28.9	0.0
Unknown	325.5	106.4	815.6	0.0
10B. Percentage				
Nonlocal				
Bowl	0.0	0.0	0.0	0.0
Gray Ware				
Bowl	0.01	0.1	0.1	1.8
Jar	63.1	46.9	34.6	27.9
Ladle	0.03	0.0	0.0	0.0
Unknown	0.02	0.0	0.02	0.0
Glaze Ware				
Bowl	0.04	0.0	0.9	0.1
Jar	0.0	0.0	0.2	0.0
Other	0.0	0.0	0.1	0.0
Unknown	0.0	0.0	0.0	0.0
White Ware				
Bowl	35.1	47.7	52.3	42.4
Canteen	0.03	0.1	0.0	0.0
Jar	1.4	4.5	11.3	27.9
Ladle	0.1	0.1	0.02	0.0
Mug	0.0	0.0	0.0	0.0
Other	0.0	0.0	0.02	0.0
Unknown	0.2	0.7	0.5	0.0

Table 10. Bulk Sherd Weights by Ware, Form, and Component.

Ware and Form	Site Component			
	Coalition	Coalition E	Classic	General
10C. Density (Count/Kg of Gray Ware)				
Nonlocal				
Bowl	0.02	0.00	0.04	0.0
Gray Ware				
Bowl	0.2	1.4	1.6	59.2
Jar	999.1	998.6	997.8	940.8
Ladle	0.4	0.0	0.0	0.0
Unknown	0.3	0.0	0.6	0.0
Glaze Ware				
Bowl	0.6	0.0	24.4	4.7
Jar	0.0	0.0	6.0	0.0
Other	0.0	0.0	4.1	0.0
Unknown	0.1	0.0	0.03	0.0
White Ware				
Bowl	555.69	1015.6	1506.8	1431.6
Canteen	0.50	1.8	0.0	0.0
Jar	21.46	95.0	327.1	942.6
Ladle	1.43	1.2	0.7	0.0
Mug	0.08	0.0	0.0	0.0
Other	0.00	0.0	0.5	0.0
Unknown	3.33	14.7	14.0	0.0

Rim Sherds

Total Inventory by ware, form, and component

It is difficult to estimate the relative numbers of functional vessel forms from a sherd assemblage because vessel forms vary in size and fragment into differing numbers of sherds per vessel. Although rim-arc analysis is the most reliable method for quantifying relative numbers of vessel forms, another way to partly overcome this problem is to examine counts of rim sherds of various wares and forms (Pierce and Varien 1999). Although whiteware bowls have larger rim diameters than grayware jars, a single vessel of each form will usually fragment into a closer ratio of rim sherds than of all sherds. If, however, the dimensions of vessel forms changed over time, either approach will be biased in different ways.

Keeping this in mind, Tables 11 and 12 summarize vessel wares and forms for rim sherds only, by component. These data show that the relative abundance of grayware jars and whiteware bowls varies depending on whether rim sherds or all sherds are used as the measure of abundance. When only rims are used, the ratio of grayware jars to whiteware bowls is about 1:2 in the Coalition component and 1:3 in the Classic component, but when all sherds are used the ratios are about 2:1 for the Coalition component versus 1:1.5 for the Classic component (Tables 9 and 10).

Table 11. Rim Sherd Counts by Ware, Form, and Component.

Ware and Form	Site Component			
	Coalition	Coalition E	Classic	General
11A. Count				
Gray Ware				
Bowl	1	1	6	0
Jar	634	57	459	3
Ladle	1	0	0	0
Unknown	0	0	2	0
Glaze Ware				
Bowl	1	0	45	0
Jar	0	0	7	0
Other	0	0	7	0
White Ware				
Bowl	1081	103	1379	19
Canteen	3	1	0	0
Jar	10	3	116	1
Ladle	2	0	1	0
Mug	1	0	0	0
Other	0	0	1	0
Unknown	1	0	3	0
11B. Percentage				
Gray Ware				
Bowl	0.1	0.6	0.3	0.0
Jar	36.5	34.6	22.7	13.0
Ladle	0.1	0.0	0.0	0.0
Unknown	0.0	0.0	0.1	0.0
Glaze Ware				
Bowl	0.1	0.0	2.2	0.0
Jar	0.0	0.0	70.4	0.0
Other	0.0	0.0	70.4	0.0
White Ware				
Bowl	62.3	62.4	68.1	82.6
Canteen	0.2	0.6	0.0	0.0
Jar	0.6	1.82	5.7	4.4
Ladle	0.1	0.0	0.1	0.0
Mug	0.1	0.0	0.0	0.0
Other	0.0	0.0	0.1	0.0
Unknown	0.1	0.0	0.2	0.0
11C. Density (Count/Kg of Gray Ware)				
Gray Ware				
Bowl	0.01	0.1	0.1	0.0
Jar	6.5	7.9	7.9	4.7
Ladle	0.01	0.0	0.0	0.0
Unknown	0.0	0.0	0.03	0.0

Table 11. Rim Sherd Counts by Ware, Form, and Component.

Ware and Form	Site Component			
	Coalition	Coalition E	Classic	General
Glaze Ware				
Bowl	0.01	0.0	0.8	0.0
Jar	0.0	0.0	0.1	0.0
Other	0.0	0.0	0.1	0.0
White Ware				
Bowl	11.1	14.3	23.6	29.6
Canteen	0.03	0.1	0.0	0.0
Jar	0.1	0.4	2.0	1.6
Ladle	0.02	0.0	0.02	0.0
Mug	0.01	0.0	0.0	0.0
Other	0.0	0.0	0.02	0.0
Unknown	0.01	0.0	0.1	0.0

Table 12. Rim Sherd Weights by Ware, Form, and Component.

Ware and Form	Site Component			
	Coalition	Coalition E	Classic	General
12A. Weight (g)				
Gray Ware				
Bowl	12.4	10.2	83.0	0.0
Jar	8330.1	436.0	7680.4	37.4
Ladle	42.3	0.0	0.0	0.0
Unknown	0.0	0.0	5.1	0.0
Glaze Ware				
Bowl	9.5	0.0	427.9	0.0
Jar	0.0	0.0	77.4	0.0
Other	0.0	0.0	241.4	0.0
White Ware				
Bowl	16301.3	1905.7	17872.6	365.7
Canteen	48.5	12.7	0.0	0.0
Jar	84.6	31.7	1653.5	402.3
Ladle	17.6	0.0	19.9	0.0
Mug	7.6	0.0	0.0	0.0
Other	0.0	0.0	26.4	0.0
Unknown	10.3	0.0	15.4	0.0
12B. Percentage				
Gray Ware				
Bowl	0.05	0.43	0.30	0.00
Jar	33.50	18.19	27.33	4.64
Ladle	0.17	0.00	0.00	0.00
Unknown	0.00	0.00	0.02	0.00

Table 12. Rim Sherd Weights by Ware, Form, and Component.

Ware and Form	Site Component			
	Coalition	Coalition E	Classic	General
Glaze Ware				
Bowl	0.04	0.00	1.52	0.00
Jar	0.00	0.00	0.28	0.00
Other	0.00	0.00	0.86	0.00
White Ware				
Bowl	65.56	79.53	63.60	45.41
Canteen	0.20	0.53	0.00	0.00
Jar	0.34	1.32	5.88	49.95
Ladle	0.07	0.00	0.07	0.00
Mug	0.03	0.00	0.00	0.00
Other	0.00	0.00	0.09	0.00
Unknown	0.04	0.00	0.05	0.00
12C. Density (Count/Kg of Gray Ware)				
Gray Ware				
Bowl	0.1	1.4	1.4	0.0
Jar	85.3	60.4	131.6	58.2
Ladle	0.4	0.0	0.0	0.0
Unknown	0.0	0.0	0.1	0.0
Glaze Ware				
Bowl	0.1	0.0	7.3	0.0
Jar	0.0	0.0	1.3	0.0
Other	0.0	0.0	4.1	0.0
White Ware				
Bowl	166.9	263.8	306.2	569.4
Canteen	0.5	1.8	0.0	0.0
Jar	0.9	4.4	28.3	626.3
Ladle	0.2	0.0	0.3	0.0
Mug	0.1	0.0	0.0	0.0
Other	0.0	0.0	0.5	0.0
Unknown	0.1	0.0	0.3	0.0

Part of the explanation for this pattern is that the fraction of sherds from a given vessel form that are rims also changed over time. This is shown in Table 13, which calculates the fractions of sherds of common vessel forms that are rims for the Coalition and Classic components, based on the data in Tables 9 and 11. As expected, the fraction of whiteware bowl sherds that are rims is higher than for grayware and whiteware jars. Table 13 also shows that the fraction of whiteware bowl sherds that are rims was stable through time, but that the fraction of grayware jar sherds that are rims nearly doubled. The ratio of rim diameter to vessel volume for grayware jars must have changed over time, affecting ratios of grayware jar rims to whiteware bowl rims irrespective of changes in the relative frequencies of these two vessel forms.

Table 13. Fraction of Sherds of Selected Vessel Forms that are Rims, by Component.

Ware and Form	Component	Rims	All Sherds	Fraction
Grayware jars	Coalition	634	12201	0.052
Grayware jars	Classic	459	5656	0.081
Whiteware bowls	Coalition	1081	5797	0.186
Whiteware bowls	Classic	1379	7762	0.178
Whiteware jars	Coalition	10	242	0.041
Whiteware jars	Classic	116	1802	0.064

Painted Decoration on Whiteware Bowl Rims

Ortman (2012, Chapter 13) analyzed design attribute data on bowl rim sherds from Kiva W-4 and from the surface collections across the three plaza areas at Tsama. The data were collected using a protocol derived from a previous study of weaving imagery in Mesa Verde region painted pottery, so that potential continuities in pottery styles between the Northern Rio Grande and a likely source area of the ancestral Tewa population could be assessed. The results showed strong continuities in the expression of weaving imagery among Late Coalition Period potters in the West Plaza at Tsama, suggesting that the initial inhabitants of this village continued the stylistic tradition expressed on Mesa Verde Black-on-white. In this study, provenience was used as the basis for chronological control, based on Windes and McKenna's (2006) conclusion that the occupation of Tsama shifted gradually from west to east over time. It is possible that this use of provenience biased the assessments of stylistic continuity, given the long and overlapping occupations of the three plazas and the fact that certain attributes of the Mesa Verde style are relatively frequent on Biscuit wares. It may be worthwhile to revisit this analysis using pottery types rather than provenience as the basis for chronological control.

Table 14 presents percentages and sample sizes for design attributes on the exteriors, rims, interior margins, and interiors of whiteware bowl rims of local types in the Tsama collection. This table also contains data for a sample of Mesa Verde Black-on-white bowl rims. The data for Tsama were collected by Ortman and Arakawa in 2009; the data for Mesa Verde Black-on-white are carried forward from Ortman (2000, Table 6). In the table, pottery types included in the analysis are listed in chronological order from left to right. We have combined Pindi and Santa Fe Black-on-white, and Wiyo and Santa Fe/Wiyo Black-on-white, to even out sample sizes relative to the passage of time. Sample sizes vary across design fields because of differential preservation of these fields across sherds; on some sherds the exterior surface is preserved but not the interior, and so on. As a result, proportions are calculated relative to the number of sherds on which a particular design field is observable, rather than relative to the number of analyzed sherds. This maximizes the information return from the analysis and improves assessments of the relative abundance of design attributes on different design fields.

Table 14. Design Attribute Percentages by Type.

Design attribute	Mesa Verde B/W	Pindi and Santa Fe B/W	Wiyo and Santa Fe/ Wiyo B/W	Biscuit A	Biscuit B	Tsankawi B/C
Corrugated or basket-impressed exterior	0.3	0.4	0.0	0.0	0.0	0.0
Exterior band design	11.1	3.7	5.5	1.2	73.9	55.1
Observable exteriors	**n.a.**	**272**	**163**	**165**	**371**	**78**
Rim line	0.1	1.7	0.0	1.2	0.3	0.0
Rim ticks	42.3	30.6	32.9	51.8	59.1	56.6
Patterned ticks	8.2	1.3	1.3	0.6	0.5	0.0
Xs and zigzags on rim	8.0	2.1	3.2	15.1	22.3	10.8
Ticks and zigzags on rim	0.0	0.0	0.6	7.2	13.9	7.2
Other rim decoration	0.7	0.0	0.0	2.4	5.2	6.0
Observable rims	**n.a.**	**235**	**158**	**166**	**367**	**83**
Multiple thin framing lines	6.1	1.1	0.6	4.1	0.4	0.0
Thick and thin framing lines	34.2	25.5	24.7	24.0	9.2	9.0
Ticks between framing lines	4.2	2.3	1.9	4.1	1.2	0.0
Other framing pattern	2.1	0.0	0.0	0.0	0.0	0.0
Observable interior margins	**n.a.**	**263**	**154**	**146**	**249**	**67**
Plain-weave band	2.1	7.4	4.4	0.0	1.6	0.0
Coiled basket design	5.5	19.0	20.0	2.9	1.6	0.0
Coiled basketry texture	9.0	3.3	2.2	8.6	0.0	0.0
Narrow loom band	1.4	19.0	8.9	11.4	1.6	16.7
Plain tapestry band	5.8	6.6	8.9	17.1	0.0	0.0
Twill tapestry band	26.5	27.3	17.8	8.6	1.6	8.3
Twill-plaited texture pattern	1.1	1.7	8.9	2.9	0.0	0.0
Twill-plaited color pattern	8.7	6.6	4.4	2.9	1.6	0.0
Background hachure	18.1	19.0	15.6	11.4	0.0	0.0
Angled band design	2.8	0.0	0.0	0.0	0.0	0.0
Non-weaving-based pattern	4.3	5.0	8.9	20.0	34.4	41.7
Classifiable interior designs	**n.a.**	**121**	**45**	**35**	**64**	**12**
Indeterminate interior designs	**n.a.**	**166**	**133**	**147**	**353**	**78**
Number of Sherds Scored	**1671**	**287**	**178**	**182**	**417**	**90**

The design attributes are independently recorded and non-mutually-exclusive categories, so the attribute frequencies for each design field need not add up to one hundred percent. Attribute names for the exterior, rim, and interior margin design fields are descriptive and self-evident, but names for interior design attributes relate to the type of weaving that inspired such patterns. We infer that past speakers of the Tewa language thought of pottery vessels as clay versions of woven containers, which is supported by etymological evidence. The word for pottery in Tewa, nat'ú, is a compound of the words for earth and for basket, indicating that at the time this term was coined, Tewa speakers recognized an equivalence (see Ortman 2012, Chapter 10 for additional discussion and evidence). Descriptions of the categories used in Table 14 are as follows:

- *Plain-weave band:* band designs consisting of a checkerboard reflecting a one-over-one under weaving process.
- *Coiled basket design:* geometric motifs arranged with respect to the rim, and with a true unpainted background.
- *Coiled basketry texture:* designs consisting solely of a band of framing lines and embellishments.
- *Narrow loom band:* geometric band designs that are divided vertically into panels.
- *Plain tapestry band:* flowing geometric band designs with structural lines that are horizontal and vertical relative to the rim, with unpainted areas as liminal space.
- *Twill tapestry band:* flowing geometric band designs with structural lines that are diagonal to the rim, and with unpainted areas as liminal space.
- *Twill-plaited texture pattern*: all-over designs consisting of step-fret patterns executed with hachure-filled lines, where the hatched and unpainted areas have reciprocal shapes.
- *Twill-plaited color pattern:* all-over designs consisting of step-fret patterns executed with thick lines, where the painted and unpainted areas have reciprocal shapes.
- *Background hachure*: all-over designs consisting of geometric solids with liminal spaces, and with the remaining space being filled with hachure.
- *Angled band design*: plain or twill tapestry bands extracted and used as diagonal panels in an all-over design.
- *Non-weaving-based pattern:* a design that is either curvilinear or does not express weaving imagery in a consistent way.

The percentages in Table 14 summarize the evolution of exterior, rim and framing decoration between the time of Tsama's founding and the coming of the Spanish. Figure 13 presents the time series for selected design attributes in the form of a line chart. These results include several notable patterns. First, rim ticking is common throughout the sequence, and elaborations on the basic ticking pattern increase in frequency over time. Second, framing patterns consisting of thick and thin framing lines are also common throughout, and elaborations such as tick marks between framing lines occur in low but consistent frequencies throughout as well. Third, the frequencies of many design attributes among Mesa Verde Black-on-white and Santa Fe/Pindi Black-on-white sherds correspond closely, suggesting overall continuity in design style between these two types. Finally, interior designs on Santa Fe/Pindi Black-on-white sherds exhibit the same range of weaving imagery seen in Mesa Verde Black-on-white, but the percentage of designs that express this imagery decreased over time, much more so than frequencies of rim ticking and framing patterns.

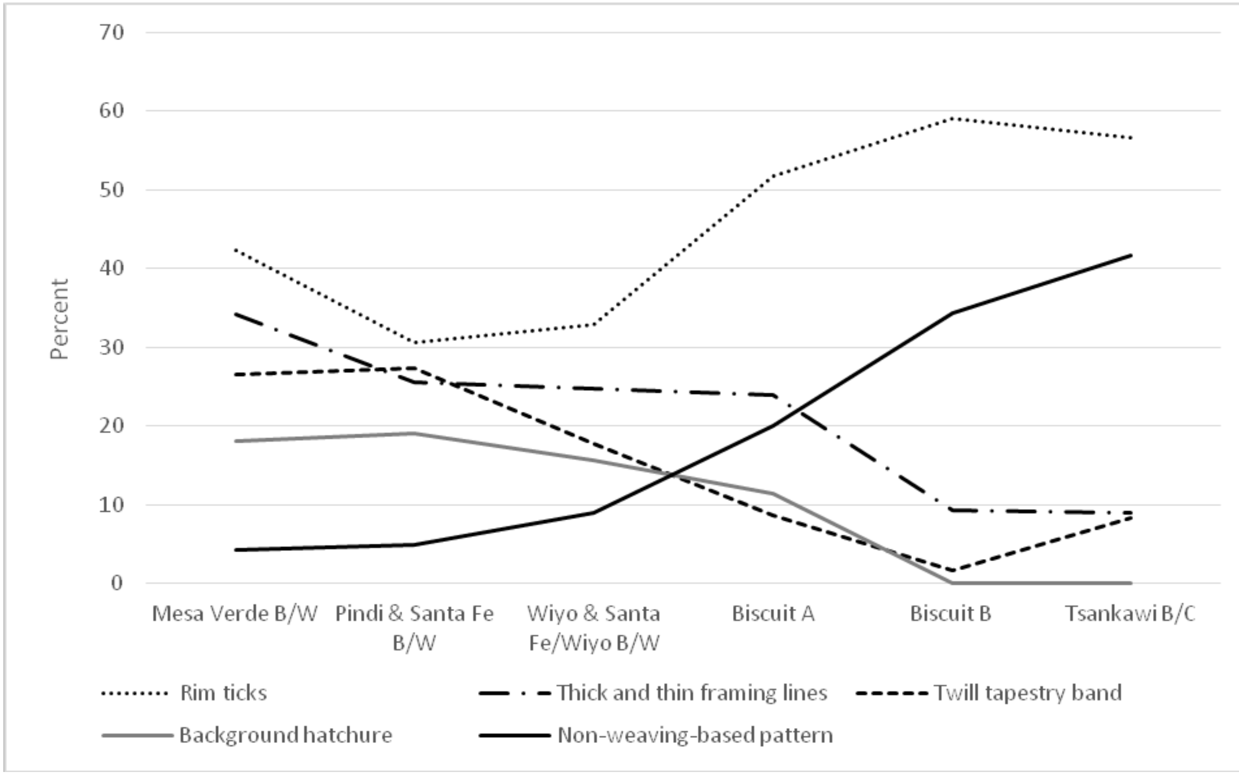

Figure 1. Percentages of selected pottery design attributes over time.

These results replicate patterns observed in Ortman's (2012) study and reinforce his conclusions that (1) the initial inhabitants of Tsama Pueblo painted pottery in the Mesa Verde style; (2) over time, certain embellishments of this style were maintained, or even reinvigorated; (3) the notion of designs as actual woven patterns gradually faded from use and was replaced by a more generalized, semi-geometric approach and a greater use of representational and iconographic imagery. These findings are consistent with a range of evidence from archaeology and traditional knowledge that suggest that most of the ancestral Tewa population, including the initial population of Tsama Pueblo, originated in the Mesa Verde region (Bernstein and Ortman 2020; Kemp et al. 2017; Ortman 2010, 2012, 2016b, 2018, 2020).

Photographs of Designs on Whiteware Sherds

As analysts classified the Tsama Pueblo pottery collection, they photographed painted whiteware sherds from selected proveniences. This was done informally so the camera used, resolution, lighting, and background vary across images. Appendix A includes images of sherds that exhibit the typical raw materials and surface treatments of Santa Fe and Wiyo Black-on-white but that also exhibit design characteristics of Mesa Verde Black-on-white, the latter including thick and thin framing lines, background hachure, exterior band designs, active backgrounds, bifold rotation, and complex rim decorations. Although the execution of these designs varies and is often less precise than is typical of Mesa Verde Black-on-white, the content of the designs is very similar, as was shown above. The sherds thus appear to represent a continuation of the Mesa

Verde design style using local raw materials and technology. Similar interpretations have been advanced for other pottery traditions throughout the US Southwest, including for Maverick Mountain Polychrome, which represents Kayenta-style pottery made in the Point of Pines area (Haury 1994[1958]), and for Loma Fria Black-on-white, which represents Mesa Verde-style pottery made along the Rio Puerco of the East (Baker and Durand 2003).

Modified and Shaped Sherds and Other Ceramic Artifacts

Tables 15 and 16 summarize counts and weights of modified and shaped sherds and other ceramic artifacts, by site component. Modified sherds represent fragments of broken vessels that were repurposed as scrapers, pukis, gardening tools, or sherd containers. Shaped sherds represent fragments of broken vessels that were turned into pendants or gaming pieces. Other ceramic artifacts represent a variety of fired clay artifacts that do not derive from vessels. These data suggest an increased use of broken vessels for a variety of purposes during the Classic period. Table 16 shows that this pattern of increased use is even more pronounced when comparing weights rather than counts. Not only were more sherds being used as tools through time, larger pieces were being used as well.

Appendix B lists the proveniences and associated notes for other ceramic artifacts in the Tsama collection. Thirteen of the 20 artifacts in this list are complete or partial clay pipes or "cloud-blowers." The remaining objects represent a variety of artifact types. One of the more interesting of these is a fired clay bell (PD 48 FS 4), which is illustrated in Figure 14.

Table 15. Modified/Shaped Sherd and Other Ceramic Artifact Counts by Component.

Artifact Type	Site Component			
	Coalition	Coalition E	Classic	General
15A. Count				
Modified sherd	9	0	53	0
Other ceramic artifact	20	10	6	1
Shaped sherd	5	0	40	4
15B. Percentage				
Modified sherd	26.5	0.0	53.5	0.0
Other ceramic artifact	58.8	0.0	6.1	100.0
Shaped sherd	14.7	100.0	40.4	0.0
15C. Density (Count/Kg of Gray Ware)				
Modified sherd	0.1	0.0	0.9	0.0
Other ceramic artifact	0.2	1.4	0.1	1.6
Shaped sherd	0.1	0.0	0.7	6.2

Table 16. Modified/Shaped Sherd and Other Ceramic Artifact Weights by Component.

Artifact Type	Site Component			
	Coalition	Coalition E	Classic	General
16A. Weight (g)				
Modified sherd	79.9	0	911.1	0
Other ceramic artifact	260	19	167.2	12.2
Shaped sherd	16.1	0	260	74.9
16B. Percentage				
Modified sherd	22.4	0.0	68.1	0.0
Other ceramic artifact	73.0	100.0	12.5	14.0
Shaped sherd	4.5	0.0	19.4	86.0
16C. Density (Count/Kg of Gray ware)				
Modified sherd	0.8	0.0	15.6	0.0
Other ceramic artifact	2.7	2.6	2.9	19.0
Shaped sherd	0.2	0.0	4.5	116.6

Figure 14. Fired clay bell.

Chapter 5

STONE TOOLS

Chipped Stone Tools and Cores

Tables 17 and 18 summarize the distribution of chipped stone tools and cores by count and weight. Table 17 shows that the number (and density) of chipped stone tools, including projectile points, declined through time, while the number (and density) of cores was more or less consistent. Table 18 shows that these patterns are also apparent when the abundance estimate is based on the total weights of tools and cores.

The density of cores (per Kg of grayware pottery) in the Tsama assemblage (Table 18C) is similar to that of Sand Canyon Pueblo (where the overall density of cores is 0.4/Kg grayware pottery; Till and Ortman 2007, Table 47). This is somewhat surprising in that the Sand Canyon Pueblo deposits were screened and would be expected to yield more small grayware sherds. The similarity suggests that screening affects sherd counts to a greater extent than aggregate weights, and that the inhabitants of Tsama and Sand Canyon Pueblo created cores during chipped stone tool production at similar rates per capita.

Table 17. Counts of Chipped Stone Tools and Cores by Type and Component.

Artifact Type	Component			
	Coalition	Coalition E	Classic	General
17A. Counts				
Tool (excluding points)	10	1	2	0
Projectile point	18	1	5	1
Core	20	1	18	1
Modified core	0	1	0	0
17B. Percentage				
Tool (excluding points)	20.8	25.0	8.0	0.0
Projectile point	37.5	25.0	20.0	50.0
Core	41.7	25.0	72.0	50.0
Modified core	0.0	25.0	0.0	0.0
17C. Density (Count/Kg of Gray Ware)				
Tool (excluding points)	0.1	0.1	0.03	0.0
Projectile point	0.2	0.1	0.1	1.6
Core	0.2	0.1	0.3	1.6
Modified core	0.0	0.1	0.0	0.0

Table 18. Weights of Chipped Stone Tools and Cores by Type and Component.

Artifact Type	Component			
	Coalition	Coalition E	Classic	General
18A. Weight (g)				
Tool (excluding points)	293.3	22.5	30.5	0
Projectile point	40.1	0.5	12.3	1.3
Core	2651	100.6	1482.7	41.6
Modified core	0	366.6	0	0
18B. Percentage				
Tool (excluding points)	9.8	4.6	2.0	0.0
Projectile point	1.3	0.1	0.8	3.0
Core	88.8	20.5	97.2	97.0
Modified core	0.0	74.8	0.0	0.0
18C. Density (Count/Kg of Gray ware)				
Tool (excluding points)	3.0	3.1	0.5	0.0
Projectile point	0.4	0.1	0.2	2.0
Core	27.1	13.9	25.4	64.8
Modified core	0.0	50.7	0.0	0.0

Projectile Points and Bifaces

Table 19 summarizes the bifacially flaked stone tools in the Tsama collection. Relatively few such tools were found in the Tsama Pueblo excavations. In addition, such tools were less frequent in Classic Period deposits than in Coalition Period deposits, suggesting that activities involving bifaces and projectile points declined through time. There are at least two possible explanations for this trend. Residents of Tsama may have hunted less frequently over time. If so, one might expect an increasing fraction of the animal protein consumed by residents to have derived from domestic turkeys. The faunal remains (Chapter 7) do not support this conclusion. Instead, the decline in bifacially flaked tools seems more likely to reflect a decline in inter-personal and inter-community violence over time, as several recent studies have suggested (Kohler et al. 2014; Ortman 2016a; Schneider 2019). Figure 15 illustrates a few bifacially flaked tools in the collection.

The density of projectile points in the Sand Canyon Pueblo assemblage is 0.123 per kilogram of cooking pottery (Till and Ortman 2007, Table 56). This density falls between that of the Coalition Component and that of the Classic Component at Tsama (Table 18C).

Table 19. Bifacially Flaked Tools by Type and Component.

Biface Type	Component			
	Coalition	Coalition E	Classic	General
19A. Count				
Biface, not further specified	22	0	9	4
Cottonwood Triangular (PII–Historic)	1	0	0	0
Desert Side-notched	2	0	0	0
Drill, not further specified	3	0	1	0
Large corner-notched (BMII)	1	0	2	0
Large side-notched (Archaic)	1	0	0	0
Medium side-notched	0	0	2	0
Projectile point, not further specified	3	0	0	0
Small side-notched, concave base (Late PII)	1	0	1	1
Small side-notched, straight base (PIII)	22	1	1	0
White Dog Basketmaker (Basketmaker II)	1	0	0	0
Total	**57**	**1**	**16**	**5**
19B. Percentage				
Biface, not further specified	38.6	0.0	56.3	80.0
Cottonwood Triangular (PII–Historic)	1.8	0.0	0.0	0.0
Desert Side-notched	3.5	0.0	0.0	0.0
Drill, not further specified	5.3	0.0	6.3	0.0
Large corner-notched (BMII)	1.8	0.0	12.5	0.0
Large side-notched (Archaic)	1.8	0.0	0.0	0.0
Medium side-notched	0.0	0.0	12.5	0.0
Projectile point, not further specified	5.3	0.0	0.0	0.0
Small side-notched, concave base (Late PII)	1.8	0.0	6.3	20.0
Small side-notched, straight base (PIII)	38.6	100.0	6.3	0.0
White Dog Basketmaker (Basketmaker II)	1.8	0.0	0.0	0.0
19C. Density (Count/Kg of Gray Ware)				
Biface, not further specified	0.23	0.00	0.15	6.23
Cottonwood Triangular (PII–Historic)	0.01	0.00	0.00	0.00
Desert Side-notched	0.02	0.00	0.00	0.00
Drill, not further specified	0.03	0.00	0.02	0.00
Large corner-notched (BMII)	0.01	0.00	0.03	0.00
Large side-notched (Archaic)	0.01	0.00	0.00	0.00
Medium side-notched	0.00	0.00	0.03	0.00
Projectile point, not further specified	0.03	0.00	0.00	0.00
Small side-notched, concave base (Late PII)	0.01	0.00	0.02	1.56
Small side-notched, straight base (PIII)	0.23	0.14	0.02	0.00
White Dog Basketmaker (Basketmaker II)	0.01	0.00	0.00	0.00
Total	**0.59**	**0.14**	**0.27**	**7.79**

Figure 15. Selected bifacially flaked tools from Tsama Pueblo.

Debitage, Flakes, and Modified Flakes

Inventory by Functional Type

Tables 20 and 21 summarize the assemblage of debitage, flakes, and modified flakes by count and weight. Stone debitage and flakes result from the manufacture and maintenance of chipped stone tools, so their abundance in an assemblage, relative to cooking potsherds, reflects the rate of chipped stone tool production relative to cooking. From this perspective, the densities in Tables 20 and 21 suggest that the rate of chipped stone tool production increased at Tsama over time, even as the consumption rate of bifacially flaked tools declined. Debitage also appears to be much more frequent in the general site assemblage, but this is likely due to the under-representation of grayware potsherds from that provenience (Chapter 4).

The density of debitage in the Tsama assemblage is strikingly lower than in the Sand Canyon Pueblo assemblage, where 27 pieces of debitage occur per kilogram of grayware pottery (Till and Ortman 2007, Table 47). The inhabitants of Sand Canyon Pueblo appear to have produced two to three times more chipped-stone debris per person-year of occupation than did the inhabitants of Tsama. This difference is partly attributable to differences in the kinds of stone tools that were made in each community (see below), but it may also be an effect of the larger size of the Tsama community, where a larger number of neighbors would have reduced the per capita need for chipped-stone tools due to increases in the division of labor in the community (see Ortman and Lobo 2020 for a full presentation of this argument). A portion of the pattern could also be attributable to the Tsama field school not screening and not prioritizing chipped-stone debitage collection.

Table 20. Counts of Chipped Stone Debris by Component.

Artifact Type	Component			
	Coalition	Coalition E	Classic	General
20A. Count				
Debitage	893	103	1078	21
Modified flake	8	0	13	1
Unmodified flake	18	2	13	2
20B. Percentage				
Debitage	97.2	98.1	97.6	87.5
Modified flake	0.9	0.0	1.2	4.2
Unmodified flake	2.0	1.9	1.2	8.3
20C. Density (Count/Kg of Gray Ware)				
Debitage	9.1	14.3	18.5	32.7
Modified flake	0.1	0.0	0.2	1.6
Unmodified flake	0.2	0.3	0.2	3.1

Table 21. Weights of Chipped Stone Debris by Component.

Artifact Type	Component			
	Coalition	Coalition E	Classic	General
21A. Weight (g)				
Debitage	7750.6	1051.5	9728.76	222.6
Modified flake	103.3	0	159.5	68.7
Unmodified flake	219.3	11.5	199.1	18.1
21B. Percentage				
Debitage	96.0	98.9	96.5	72.0
Modified flake	1.3	0.0	1.6	22.2
Unmodified flake	2.7	1.1	2.0	5.9
21C. Density (Count/Kg of Gray Ware)				
Debitage	79.4	145.5	166.7	346.6
Modified flake	1.1	0.0	2.7	107.0
Unmodified flake	2.3	1.6	3.4	28.2

The ratios of finished tools to debitage show interesting patterns across Northern Rio Grande sites. For example, Tsama, Howiri, and Burnt Mesa Pueblo all have similar core to debitage ratios, of about 0.02:1 (40:2,095, 136:6,954, and 35:1599, respectively) (Kohler and Root 2004; Wening 1987:166–167). Arroyo Hondo's Component II (Classic period component) ratio is also similar (0.029:1; 84 cores and 2,895 unused flakes) (Phagan 1993:218). However, ratios of chipped stone tool to debitage vary substantially, from a low of 0.038 (9:2,095) at Tsama to 0.067:1 (463:6,954) at Howiri (Wening 1987:61), 0.095:1 (535 flaked-stone tools to 5,651 unused flakes) in Arroyo Hondo Component I, and 0.12:1 (337 flaked-stone tools to 2,895 unused flakes) in Arroyo Hondo Component II (Phagan 1993:218). These patterns suggest that stone tool manufacturing varied across Northern Rio Grande communities, possibly due to trade or diversification or specialization in activities.

Bulk Chipped Stone Raw Materials by Component

Table 22 summarizes the bulk chipped stone (defined as including flakes, angular debris, and utilized flakes) by component. The most common materials are varieties of Jemez Mountain obsidian (El Rechuelos obsidian was distinguished visually from other Jemez obsidian) and Pedernal Chert. These high-quality materials outcrop within the Jemez Mountains, across the Chama River to the south and west, at some distance from Tsama, so most likely were obtained through trips to the raw material sources or via exchange. Regardless of the mechanism, it is apparent that access to obsidian increased slightly over time.

Table 22. Bulk Chipped Stone by Raw Material.

Raw Material	Coalition		Coalition E		Classic		General	
	Ct.	%	Ct.	%	Ct.	%	Ct.	%
Local Source								
El Rechuelos obsidian	17	1.0	4	3.8	40	3.6	2	8.3
Jemez obsidian, NFS	10	1.1	1	1.0	77	7.0	1	4.2
Pedernal chert	740	80.5	88	83.8	817	74.0	15	62.5
Heat-treated Pedernal chert	24	2.6		0.0	36	3.3		0.0
Gray chert	5	0.5		0.0	10	0.9		0.0
Quartz	12	1.3	2	1.9	14	1.3	1	4.2
Quartzite	23	2.5	2	1.9	20	1.8	1	4.2
Sandstone		0.0		0.0	1	0.1		0.0
Slate/shale	1	0.1		0.0		0.0		0.0
Agate/chalcedony		0.0		0.0	4	0.4		0.0
Igneous	9	1.0		0.0	3	0.3	1	4.2
Basalt	31	3.4		0.0	19	1.7		0.0
Metamorphic rock	3	0.3	1	1.0		0.0		0.0
Nonlocal Source								
Morrison chert		0.0	1	1.0		0.0		0.0
Morrison mudstone	1	0.1		0.0		0.0		0.0
Morrison silicified sandstone		0.0	1	1.0		0.0		0.0
Brushy Basin chert	1	0.1		0.0		0.0		0.0
Red jasper	1	0.1		0.0		0.0		0.0
Unknown Source								
Chert/siltstone	18	2.0	1	1.0	31	2.8	2	8.3
Silicified sandstone	23	2.5	4	3.8	31	2.8	1	4.2
Unknown stone		0.0		0.0	1	0.1		0.0
Total	**919**	**100.0**	**105**	**100.0**	**1104**	**100.0**	**24**	**100.0**

Nearly 70 percent of all debitage in the Sand Canyon Pueblo assemblage is local quartzite not suitable for making formal tools (Till and Ortman 2007, Table 48). In contrast, only a small percentage of the debitage in the Tsama assemblage is of comparable materials (including quartzite and basalt). A likely explanation for this pattern is that the inhabitants of Sand Canyon Pueblo needed large numbers of pecking stones of durable material to re-sharpen their maize grinding tools and to shape masonry blocks for construction, both of which were generally made of sandstone. The inhabitants of Tsama, in contrast, had ready access to vesicular basalt that worked well for manos and metates, and their walls were adobe. As a result, there are only a few objects in the Tsama assemblage that could have been used as pecking stones, there are few flakes of tough, coarse-grained material, and there are lower densities of chipped stone debris overall. These differences illustrate the effects of raw material availability and construction methods on the character of artifact assemblages in different regions.

Bulk Chipped Stone Raw Materials and Cortex

Table 23 examines differences in the procurement and use of selected bulk chipped stone raw materials by sorting the bulk chipped stone into size groups and distinguishing items that exhibit cortex from those that do not. The clearest pattern in the table is when such pieces of chipped stone exhibit cortex, they tend to be larger than pieces that do not exhibit cortex. In addition, between two-thirds and three-fourths of such chipped stone fragments lack cortex, regardless of raw material. We infer that chipped stone raw materials were procured as relatively unprocessed chunks as opposed to prepared cores or blanks, with the bulk of reduction taking place in the village itself.

Another important pattern revealed in Table 23 is that smaller pieces of chipped stone appear to be underrepresented relative to larger pieces. In unbiased assemblages of chipped stone debris, smaller pieces are typically much more common than larger pieces (Ahler 1989). In the Tsama collection the opposite is true. It appears that due to the lack of screening, small pieces of chipped stone debris were often overlooked by the excavators.

The relative abundance of bulk chipped stone with cortex suggests a change in the character of chipped stone raw material procurement over time at Tsama. These data are summarized in Table 24, which shows the total weight of chipped stone debris by raw material, whether cortex is present or absent, and the component for the two most commonly used raw materials: obsidian and Pedernal Chert. The table shows that the percentage of obsidian exhibiting cortex increases from about 15 percent in the Coalition component to 35 percent in the Classic component. In contrast, the amount of Pedernal Chert exhibiting cortex decreases, from about 50 percent in the Coalition component to about 40 percent in the Classic component. These shifts in opposite directions suggest changes in the ways the two materials entered Tsama: over time, obsidian was obtained in larger, less thoroughly reduced chunks, while Pedernal Chert was obtained in more thoroughly processed chunks.

Table 25 considers the raw materials used for various chipped, polished, and pecked stone tool types. Obsidian and Pedernal chert were used primarily to make bifaces and projectile points, and various igneous and metamorphic materials were used for hafted axes. It is also notable that Pedernal chert cores are much more common than obsidian cores. This suggests that regardless of the temporal trends indicated in Table 24, either obsidian was procured in smaller pieces or obsidian cores were more completely reduced compared to Pedernal chert.

Table 23. Bulk Chipped Stone: Material, Cortex, and Size

Group	Material	Cortex	1 inch (25 mm)		1/2 inch (13 mm)		1/4 inch (6 mm)		< 1/4 inch		Total	
			Ct.	%	Ct.	%	Ct.	%	Ct.	%	Ct.	% of Material
Local	El Rechuelos obsidian	Absent	2	4.4	35	76.1	9	19.6	0	0.0	46	73.0
		Present	3	17.7	13	76.5	1	5.9	0	0.0	17	27.0
Local	Jemez obsidian	Absent	5	7.4	32	47.1	31	45.6	0	0.0	68	76.4
		Present	0	0.0	15	71.4	6	28.6	0	0.0	21	23.6
Local	Pedernal chert	Absent	121	10.4	851	73.4	186	16.0	2	0.2	1160	69.9
		Present	108	21.6	358	71.6	34	6.8	0	0.0	500	30.1
Local	Heat-treated Pedernal chert	Absent	1	2.2	26	56.5	14	30.4	5	10.9	46	76.7
		Present	1	7.1	7	50.0	6	42.9	0	0.0	14	23.3
Local	Gray chert	Absent	3	25.0	9	75.0	0	0.0	0	0.0	12	80.0
		Present	3	100.0		0.0	0	0.0	0	0.0	3	20.0
Local	Quartz	Absent	1	4.8	14	66.7	6	28.6	0	0.0	21	72.4
		Present	4	50.0	3	37.5	1	12.5	0	0.0	8	27.6
Local	Quartzite	Absent	6	33.3	10	55.6	2	11.1	0	0.0	18	39.1
		Present	8	28.6	20	71.4	0	0.0	0	0.0	28	60.9
Local	Igneous	Absent	0	0.0	4	100.0	0	0.0	0	0.0	4	30.8
		Present	4	44.4	4	44.4	1	11.1	0	0.0	9	69.2
Local	Basalt	Absent	6	17.1	29	82.9	0	0.0	0	0.0	35	70.0
		Present	7	46.7	5	33.3	3	20.0	0	0.0	15	30.0
Local	Metamorphic rock	Absent	0	0.0	2	100.0	0	0.0	0	0.0	2	50.0
		Present	1	50.0	1	50.0	0	0.0	0	0.0	2	50.0
Unknown	Chert/siltstone	Absent	2	5.9	27	79.4	5	14.7	0	0.0	34	65.4
		Present	4	22.2	13	72.2	1	5.6	0	0.0	18	34.6
Unknown	Silicified sandstone	Absent	7	19.4	23	63.9	5	13.9	1	2.8	36	61.0
		Present	10	43.5	13	56.5	0	0.0	0	0.0	23	39.0
Total and percent by size:			307	14.4	1514	70.8	311	14.5	8	0.4	2140	100.0

Table 24. Bulk Chipped Stone: Abundance of Cortex by Raw Material and Component.

Material	Cortex	Component			
		Coalition	Coalition E	Classic	General
24A. Weight (g)					
Obsidian	Absent	126.3	10.3	282.4	7.7
Obsidian	Present	23.7	12.7	157.1	24.7
Pedernal Chert	Absent	3096.9	310.7	4558.66	102.4
Pedernal Chert	Present	3220.8	529	3386.35	55.5
24B. Percent within material					
Obsidian	Absent	84.2	44.8	64.3	23.8
Obsidian	Present	15.8	55.2	35.7	76.2
Pedernal Chert	Absent	49.0	37.0	57.4	64.9
Pedernal Chert	Present	51.0	63.0	42.6	35.1

Table 25. Chipped Stone Tools by Type and Raw Material.

Group	Material	Biface	Projectile point	Drill	Chipped Stone Tool	Core	Modified Core	Total
Local	Obsidian	6	9	0	0	2	0	17
Local	Pedernal chert	23	13	4	9	26	0	75
Local	Quartzite	0	0	0	0	1	0	1
Local	Igneous	1	0	0	0	2	0	3
Local	Basalt	1	1	0	1	0	0	3
Local	Petrified wood	0	0	0	0	1	1	2
Unknown	Chert/siltstone	2	1	0	2	7	0	12
Unknown	Silicified sandstone	1	0	0	0	1	0	2
Unknown	Unknown stone	0	1	0	1	0	0	2
Total		34	25	4	13	40	1	117

Ground Stone Tools

Inventory by Component

Tables 26 and 27 summarize the recovery of ground stone tools by functional category and component. No such tools were recovered from the Coalition East component and surprisingly few such tools were recovered from the Classic Period component. It appears that many pieces of ground stone either were not collected or were lost between 1970 and 2008. A tabulation by Windes and McKenna (2006, Table 1) suggests that 67 manos were found in contexts we assign to the Coalition component, and that nine were found in contexts we assign to the Classic component. The tabulation is reasonably close to our figure for the Coalition component, but not for the Classic component. Importantly, a footnote to Windes and McKenna's table indicates that their totals are from the field catalogue and TA summaries, which exclude the East Plaza excavations. It also indicates that many items were discarded in the field without being entered in the catalogue. It is also possible that the Maxwell Museum was unable to locate some of the ground stone objects at the time the collection was borrowed. Whatever the reason, it appears that ratios of ground stone tools to other artifact types in the collection do not reflect their ratios in the site deposits.

Table 26. Counts of Ground Stone Tools by Type and Component.

Artifact Type	Component		
	Coalition	Classic	General
26A. Count			
Griddle stone	11	1	0
Slab metate	2	0	0
Metate, not further specified	1	0	1
One-hand mano	2	0	0
Two-hand mano	60	2	0
Mano, not further specified	0	1	0
Indeterminate ground stone	5	3	0
26B. Percent			
Griddle stone	13.6	14.3	0.0
Slab metate	2.5	0.0	0.0
Metate, not further specified	1.2	0.0	100.0
One-hand mano	2.5	0.0	0.0
Two-hand mano	74.1	28.6	0.0
Mano, not further specified	0.0	14.3	0.0
Indeterminate ground stone	6.2	42.9	0.0
26C. Density (Count/Kg of Gray Ware)			
Griddle stone	0.1	0.02	0.0
Slab metate	0.02	0.0	0.0
Metate, not further specified	0.01	0.0	1.6
One-hand mano	0.02	0.0	0.0
Two-hand mano	0.6	0.03	0.0
Mano, not further specified	0.0	0.02	0.0
Indeterminate ground stone	0.1	0.1	0.0

Table 27. Weights of Ground Stone Tools by Type and Component.

Artifact Type	Component		
	Coalition	Classic	General
27A. Weight			
Griddle stone	26608	5000	0
Slab metate	7632.45	0	0
Metate, not further specified	4537.8	0	2145.5
One-hand mano	928.2	0	0
Two-hand mano	91111.9	4437.7	0
Mano, not further specified	0	57.2	0
Indeterminate ground stone	5024.3	167.7	0
27B. Percent			
Griddle stone	19.6	51.8	0.0
Slab metate	5.6	0.0	0.0
Metate, not further specified	3.3	0.0	100.0
One-hand mano	0.7	0.0	0.0
Two-hand mano	67.1	45.9	0.0
Mano, not further specified	0.0	0.6	0.0
Indeterminate ground stone	3.7	1.7	0.0
27C. Density (Count/Kg of Gray Ware)			
Griddle stone	272.4	85.7	0.0
Slab metate	78.2	0.0	0.0
Metate, not further specified	46.5	0.0	3340.3
One-hand mano	9.5	0.0	0.0
Two-hand mano	932.9	76.0	0.0
Mano, not further specified	0.0	1.0	0.0
Indeterminate ground stone	51.4	2.9	0.0

Further evidence for selective recovery of ground stone tools can be seen in the ratio of manos to metates. At Arroyo Hondo (Component I) this ratio is 3.7:1 (Phagan 1993:219) and at Howiri it is 5.32:1 (101:19) (Fallon and Wening 1987:72–73), but in the Coalition component at Tsama it is 18.75:1 (75:4). Indeed, the reanalysis project included only four metates, even though Windes and McKenna (2006, Table 1) suggest that 31 were encountered. This is strong evidence that metates were generally not collected.

Many ground, pecked, and polished stone objects were originally classified in the field. These assessments were written on field bags and presumably are reflected in Windes and McKenna's numbers (Windes and McKenna 2006, Table 1). During the reanalysis project some objects identified as manos in the field were identified as polishing stones in the lab, and vice versa. The main distinction was between manos and what we refer to as hide grinders (see below). Manos and hide grinders are of similar size and weight, but manos show evidence of being pressed against a metate at an angle as items are ground. This produced facets at an angle to the original surfaces of the stone. Such facets are on opposite sides of the mano when it was flipped during use, while pairs of angled facets occur on a single side when the mano was rotated during use. In contrast, the polished surfaces of hide grinders generally parallel the original stone face, indicating that the stone was used against a softer surface that caused less abrasion to the grinding stone (see Figure 16C, below). In addition, hide grinders often have chemical staining from use in tanning hides. Finally, stones with a wider variety of grits were selected for use as manos than was the case for hide grinders. In our database, we have preserved the field identifications in the notes for each object.

Raw Material Selection

Table 28 summarizes the raw materials used for ground stone tools. Although these tools were not collected systematically, there is no reason to suggest that the collections are biased in favor of certain raw materials or against others. Instead, the relative frequencies of raw materials are more likely to reflect preferences for, or the availability of, these materials (or both). The table suggests that ground stone tools were made from materials of varying hardness and grit, ranging from hard, fine-grained vesicular basalt to granite and other igneous materials, to schist and sandstone. Since all these materials are available locally in the Chama River Valley, the diversity suggests an intentional use of different materials, perhaps for use in sets as described in the Pueblo ethnographic literature (Kidder 1932; Mindeleff 1891).

Table 28. Ground Stone Tools by Type and Raw Material.

Raw Material	Griddle Stone	Slab Metate	Metate NFS	One-hand Mano	Two-hand Mano	Mano	Indeter-minate	Total
28A. Count								
Vesicular basalt	0	0	1	0	14	0	2	17
Conglomerate	0	0	0	0	1	0	0	1
Granite	2	0	0	2	6	1	0	11
Igneous	3	2	0	0	10	0	1	16
Morrison quartzite	0	0	0	0	1	0	0	1
Quartzite	2	0	0	0	1	0	1	4
Sandstone	5	0	0	0	9	0	4	18
Schist	0	0	0	0	15	0	0	15
Silicified sandstone	0	0	0	0	5	0	0	5
Unknown stone	0	0	1	0	0	0	0	1
Total	12	2	2	2	62	1	8	89
28B. Percent								
Vesicular basalt	0.0	0.0	50.0	0.0	22.6	0.0	25.0	19.1
Conglomerate	0.0	0.0	0.0	0.0	1.6	0.0	0.0	1.1
Granite	16.7	0.0	0.0	100.0	9.7	100.0	0.0	12.4
Igneous	25.0	100.0	0.0	0.0	16.1	0.0	12.5	18.0
Morrison quartzite	0.0	0.0	0.0	0.0	1.6	0.0	0.0	1.1
Quartzite	16.7	0.0	0.0	0.0	1.6	0.0	12.5	4.5
Sandstone	41.7	0.0	0.0	0.0	14.5	0.0	50.0	20.2
Schist	0.0	0.0	0.0	0.0	24.2	0.0	0.0	16.9
Silicified sandstone	0.0	0.0	0.0	0.0	8.1	0.0	0.0	5.6
Unknown stone	0.0	0.0	50.0	0.0	0.0	0.0	0.0	1.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

This diversity contrasts markedly with the assemblage from Sand Canyon Pueblo, where 78 percent of all ground stone tools were sandstone (Till and Ortman 2007: Table 67). The implied change over time suggests an improvement in corn grinding technology, which in turn suggests that the cornmeal consumed at Tsama was of higher quality than at Sand Canyon Pueblo.

Pecked and Polished Stone Tools

Inventory by Type and Component

Tables 29 and 30 summarize the distribution of various types of pecked and polished stone tools in the Tsama collection. The representation of these tools is more consistent across components than is the case for ground stone tools, and they do not appear to be as under-represented as ground stone tools. In addition, there is a large number of polishing stones in the assemblage.

A single-bitted axe was made of unspecified igneous material. Double-bitted axes were made of basalt (1), granite (2), and silicified sandstone (1). The remaining axes were made of Pedernal chert (1), unspecified igneous material (2), basalt (2), granite (3), and unknown stone (1). The axe/mauls were made of unspecified igneous material (3), basalt (2), and schist (1). Except for the silicified sandstone and unknown stone, from unknown locations, the materials being used were local.

Functional Classification of Polishing Stones

Polishing stones represent a fairly abundant and diverse artifact type in the Tsama collection. When the stones were arranged by weight and examined for residues, they fell naturally into three groups. Polishing stones weighing 50 grams or less are typically of a very fine-grained stone and appear to have been used for polishing pottery vessels during production. Polishing stones weighing between 100 and 650 grams often have residues and appear to have been used for polishing adobe floors or plaster as part of the construction and maintenance of buildings. Polishing stones weighing more than 750 grams often have a reddish chemical stain on one or more surfaces, suggesting their use in grinding hides during production of leather and clothing.

Figures 16–18 illustrate examples of polishing stones assigned to different functional categories. Appendix C lists the provenience, condition, raw material, and weight of each polishing stone, along with notes written on the corresponding field collection bag. In some cases our interpretation of a stone's function differs from that on the field collection bag, but we include those notes to convey the impressions of the field workers. Tables 31 and 32 summarize the polishing stones by functional category and component.

Table 29. Counts of Pecked and Polished Stone Tools by Type and Component.

Artifact Type	Component			
	Coalition	Coalition E	Classic	General
29A. Count				
Single-bitted axe	0	0	0	1
Double-bitted axe	2	0	2	0
Axe, not further specified	5	0	4	0
Axe/maul	6	0	0	0
Maul	4	1	1	0
Polishing stone	32	8	23	2
Polishing/hammerstone	4	0	0	1
Hammerstone	1	0	3	0
Abrader	10	0	5	1
Mortar	1	0	0	0
29B. Percentage				
Single-bitted axe	0.0	0.0	0.0	20.0
Double-bitted axe	3.1	0.0	5.3	0.0
Axe, not further specified	7.7	0.0	10.5	0.0
Axe/maul	9.2	0.0	0.0	0.0
Maul	6.2	11.1	2.6	0.0
Polishing stone	49.2	88.9	60.5	40.0
Polishing/hammerstone	6.2	0.0	0.0	20.0
Hammerstone	1.5	0.0	7.9	0.0
Abrader	15.4	0.0	13.2	20.0
Mortar	1.5	0.0	0.0	0.0
29C. Density (count/kg grayware)				
Single-bitted axe	0.00	0.00	0.00	1.56
Double-bitted axe	0.02	0.00	0.03	0.00
Axe, not further specified	0.05	0.00	0.07	0.00
Axe/maul	0.06	0.00	0.00	0.00
Maul	0.04	0.14	0.02	0.00
Polishing stone	0.33	1.11	0.39	3.11
Polishing/hammerstone	0.04	0.00	0.00	1.56
Hammerstone	0.01	0.00	0.05	0.00
Abrader	0.10	0.00	0.09	1.56
Mortar	0.01	0.00	0.00	0.00

Table 30. Weights of Pecked and Polished Stone Tools by Type and Component.

Artifact Type	Component			
	Coalition	Coalition E	Classic	General
30A. Weight (g)				
Single-bitted axe	0.0	0.0	0.0	584.5
Double-bitted axe	942.8	0.0	663.1	0.0
Axe, not further specified	912.68	0.0	1219.3	0.0
Axe/maul	2912.9	0.0	0.0	0.0
Maul	3706.8	373.4	1621.6	0.0
Polishing stone	28240.7	3181	5887.1	1112.1
Polishing/hammerstone	1918.6	0.0	0.0	264.4
Hammerstone	466.1	0.0	1476.2	0.0
Abrader	9618.7	0.0	1096.9	89.9
Mortar	296.1	0.0	0.0	0.0
30B. Percent				
Single-bitted axe	0.0	0.0	0.0	28.5
Double-bitted axe	1.9	0.0	5.5	0.
Axe, not further specified	1.9	0.0	10.2	0.0
Axe/maul	5.9	0.0	0.0	0.0
Maul	7.6	10.5	13.6	0.0
Polishing stone	57.6	89.5	49.2	54.2
Polishing/hammerstone	3.9	0.0	0.0	12.9
Hammerstone	1.0	0.0	12.3	0.0
Abrader	19.6	0.0	9.2	4.4
Mortar	0.6	0.0	0.0	0.0
30C. Density (Count/Kg of Gray Ware)				
Single-bitted axe	0.0	0.0	0.0	910.0
Double-bitted axe	9.7	0.0	11.4	0.0
Axe, not further specified	9.3	0.0	20.9	0.0
Axe/maul	29.8	0.0	0.0	0.0
Maul	38.0	51.7	27.8	0.0
Polishing stone	289.2	440.3	100.9	1731.4
Polishing/hammerstone	19.6	0.0	0.0	411.7
Hammerstone	4.8	0.0	25.3	0.0
Abrader	98.5	0.0	18.8	140.0
Mortar	3.0	0.0	0.0	0.0

Figure 16. Polishing stones: pot polishers.

Figure 17. Polishing stones: floor/plaster polishers.

Figure 18. Polishing stones: hide grinders.

Table 31. Polishing Stone Counts by Type and Component.

Artifact Type	Component			
	Coalition	**Coalition E**	**Classic**	**General**
31A. Count				
Pot polisher	6	1	9	0
Floor/plaster polisher	11	6	12	1
Hide grinder with pigment	15	1	2	1
31B. Percentage				
Pot polisher	18.8	0.0	39.1	0.0
Floor/plaster polisher	34.4	0.0	52.2	50.0
Hide grinder, with pigment	46.9	100.0	8.7	50.0
31C. Density (Count/Kg of Gray Ware)				
Pot polisher	0.1	0.1	0.2	0.0
Floor/plaster polisher	0.1	0.8	0.2	1.6
Hide grinder with pigment	0.2	0.1	0.03	1.6

Table 32. Polishing Stone Weights by Type and Component.

Artifact Type	Component			
	Coalition	Coalition E	Classic	General
32A. Weight (g)				
Pot polisher	355.7	41.4	450.2	0
Floor/plaster polisher	3888.5	1536.6	2775.6	199.9
Hide grinder with pigment	23996.5	1603	2661.3	912.2
32B. Percentage				
Pot polisher	1.3	0.0	7.7	0.0
Floor/plaster polisher	13.8	0.0	47.2	18.0
Hide grinder with pigment	85.0	100.0	45.2	82.0
C. Density (count/kg grayware)				
Pot polisher	3.6	5.7	7.7	0.0
Floor/plaster polisher	39.8	212.7	47.6	311.2
Hide grinder with pigment	245.7	221.9	45.6	1420.2

Changes in the density of each functional type suggests that pot polishers were used more frequently over time, while hide grinders were used less frequently. Both trends are reinforced by other patterns in the assemblage. For example, the increasing density of pot polishers over time is mirrored in the increasing density of polished whiteware sherds in the assemblage, both consistent with an increase in the per capita rate of whiteware pottery production during the Classic period. Also, the decreasing density of hide grinders over time is mirrored in the decreasing density of bone awls (see below), which suggests decreasing investment in hide production during the Classic period. This could be due to an increase in long-distance trade with hunter-gatherers (Spielmann 1983), an increasing substitution of cotton clothing for hide clothing (Camilli et al. 2019), or both. Given the second possibility, it is important to note that gravel mulch fields including those surrounding Tsama (see Figure 6) generally date to the Classic Period and are associated with growing cotton.

Other Stones and Minerals

Tables 33 and 34 summarize the miscellaneous minerals, stones, and pebbles in the Tsama collection, and Appendix D lists the proveniences, components, weights, and associated notes for such objects. Unlike the polishing stones, these stones are sufficiently varied that it was not productive to examine them in groups.

Table 33. Counts of Miscellaneous Stone Artifacts by Component.

Artifact Type	Component			
	Coalition	Coalition E	Classic	General
33A. Count				
Mineral/stone sample	190	0	28	0
Other modified stone/mineral	35	2	26	1
Pebble	2	0	2	0
33B. Percentage				
Mineral/stone sample	83.7	0.0	50.0	0.0
Other modified stone/mineral	15.4	0.0	46.4	100.0
Pebble	0.9	100.0	3.6	0.0
33C. Density (Count/Kg of Gray Ware)				
Mineral/stone sample	2.0	0.0	0.5	0.0
Other modified stone/mineral	0.4	0.3	0.5	1.6
Pebbles	0.02	0.0	0.03	0.0

Table 34. Weights of Miscellaneous Stone Artifacts by Component.

Artifact Type	Component			
	Coalition	Coalition E	Classic	General
34A. Weight (g)				
Mineral/stone sample	327.3	0	4221.4	0
Other modified stone/mineral	33998.3	1297.1	3663.1	148.7
Pebble	13.7	0	153.6	0
34B. Percentage				
Mineral/stone sample	1.0	0.0	52.5	0.0
Other modified stone/mineral	99.0	100.0	45.6	100.0
Pebble	0.04	0.0	1.9	0.0
34C. Density (Count/Kg of Gray Ware)				
Mineral/stone sample	3.4	0.0	72.3	0.0
Other modified stone/mineral	348.1	179.5	62.8	231.5
Pebbles	0.1	0.0	2.6	0.0

Chapter 6

OTHER ARTIFACTS, MISCELLANEOUS ITEMS, AND SAMPLES

Bone Tools

Table 35 summarizes the tools made of animal bone in the Tsama collection. Fourteen bone tubes are discussed separately, in the section on ornaments that follows. Faunal remains not modified into tools or ornaments are discussed in the next chapter.

The most significant observation based on Table 35 is the decrease in the frequency of bone awls from the Coalition period to the Classic period, which suggests that they were used and discarded less frequently per person year. The possible uses of bone awls include basket weaving and the making of hide clothing. The decrease in bone awl use could indicate that the residents of Tsama switched from producing their own baskets and clothing to trading for them. The fact that some activities increased at Tsama (such as pottery and ornament production), while others decreased, suggests increasing economic interdependency among villages during the Classic period (Ortman and Davis 2019).

Table 35. Bone Tools by Type and Component.

Artifact Type	Component			
	Coalition	**Coalition E**	**Classic**	**General**
35A. Count				
Antler tool	0	1	0	0
Awl	46	2	11	0
Needle	2	0	0	0
Drill	3	0	1	0
Other modified bone	3	0	2	1
B. Percent				
Antler tool	0.0	33.3	0.0	0.0
Bone awl	85.2	66.7	78.6	0.0
Needle	3.7	0.0	0.0	0.0
Drill	5.6	0.0	7.1	0.0
Other modified bone	5.6	0.0	14.3	100.0
C. Density (Count/Kg of Gray Ware)				
Antler tool	0.0	0.1	0.0	0.0
Bone awl	0.5	0.3	0.2	0.0
Needle	0.02	0.0	0.0	0.0
Drill	0.03	0.0	0.02	0.0
Other modified bone	0.03	0.0	0.03	1.6

Ornaments

Table 36 summarizes the ornaments recovered at Tsama; the few shell ornaments are discussed below. These objects were made of a variety of materials including turquoise, shell, ceramic, bone, selenite, and other stones and minerals. The most striking observations based on Table 36 are (1) the extremely high frequency of pendants relative to other ornaments and (2) their apparent significant increase from the Coalition period to the Classic period. This pattern is largely due to a cache of objects found in Study Unit 202, Kiva M-1, in the Middle Plaza (Windes and McKenna 2006:236). The cache contained 957 selenite pendants in various stages of production, with a total weight of 1309 grams (Figure 19). At least some of the pendants were found on the kiva floor. The fact that finished pendants and pendant blanks were found together suggests that the kiva was a workshop for such artifacts (see Costin 1991), with the final product probably intended for ritual use (as we discuss below). Materials from Kiva M-1 are assigned to the Classic period, further suggesting that a high level of craft specialization was an aspect of Classic period economic life.

Figure 19. Sample of selenite pendants found together in Kiva M-1.

Table 36. Counts of Ornaments by Component.

Artifact Type	Material	Component			
		Coalition	Coalition E	Classic	General
36A. Count					
Bead	Turquoise			3	
Bead	Unknown bone	3		44	
Bead	Unknown stone			1	
Tube	Unknown bone	12		1	1
Pendant	Ceramic		1	1	
Pendant	Selenite/gypsum/calcite			969	
Pendant	Other mineral	9		14	
Pendant	Shell	2		1	
Pendant	Turquoise			2	
Pendant	Unknown stone	1			
36B. Percentage					
Bead	Turquoise	0.0	0.0	0.3	0.0
Bead	Unknown bone	11.1	0.0	4.2	0.0
Bead	Unknown stone	0.0	0.0	0.1	0.0
Tube	Unknown bone	44.4	0.0	0.1	100.0
Pendant	Ceramic	0.0	100.0	0.1	0.0
Pendant	Selenite/gypsum/calcite	0.0	0.0	93.5	0.0
Pendant	Other mineral	33.3	0.0	1.4	0.0
Pendant	Shell	7.4	0.0	0.1	0.0
Pendant	Turquoise	0.0	0.0	0.2	0.0
Pendant	Unknown stone	3.7	0.0	0.0	0.0
36C. Density (Count/Kg of Gray Ware)					
Bead	Turquoise	0.00	0.00	0.05	0.00
Bead	Unknown bone	0.03	0.00	0.75	0.00
Bead	Unknown stone	0.00	0.00	0.02	0.00
Tube	Unknown bone	0.12	0.00	0.02	1.56
Pendant	Ceramic	0.00	0.14	0.02	0.00
Pendant	Selenite/gypsum/calcite	0.00	0.00	16.60	0.00
Pendant	Other mineral	0.09	0.00	0.24	0.00
Pendant	Shell	0.02	0.00	0.02	0.00
Pendant	Turquoise	0.00	0.00	0.03	0.00
Pendant	unknown stone	0.01	0.00	0.00	0.00

The notion that villages developed craft specialties is not new. An unusually large number of musical instruments was found at Arroyo Hondo (Lang and Harris 1984:188). Certain villages in the Galisteo Basin are well-known as glazeware pottery production centers (Schleher 2019). Pecos Pueblo appears to have specialized in Plains-Pueblo exchange (Davis 2019).

As a point of contrast, pottery production at Sand Canyon Pueblo and other 13th century sites in the Northern San Juan appears to have been widely dispersed, with small-scale production in nearly every household (Pierce et al. 2002; Pierce and Varien 1999; Till and Ortman 2007). It is also important to note that even if one removes the selenite pendant cache from consideration, there are higher densities of ornaments associated with the Classic component, suggesting an overall increase in the abundance of personal ornaments over time.

As we discuss in the introduction, Kiva M-1 can be associated with a winter moiety based on its location and floor features. It is interesting to consider whether the selenite pendants also had a winter association, for example as emblems of moiety membership. The selenite used to make the pendants is translucent, almost icy looking, and ice is a winter-associated substance. The selenite also has a somewhat whitish color, which is the color of the east, a winter-associated direction. Today, moiety membership is expressed through traditional clothing and jewelry in Tewa villages, and are consistent across moiety members when they dance together. Finally, a common element of the preparations for ceremonies in contemporary Tewa villages is production of the necessary items for community members, often by village leaders in kivas. It seems plausible that the Kiva M-1 cache represents the manufacture of an ornament intended for distribution to the Winter People at Tsama. If so, the cache may be an example of the ritual stimulus to craft specialization and exchange suggested by Spielmann (1998, 2002).

Table 37 lists the few shell objects in the Tsama collection. Marine shell is important in contemporary Pueblo ceremonial attire, and its traditional importance is also reflected in the use of words for shell in place names, but marine shell is generally rare in Northern Rio Grande sites (Fallon and Wening 1987:86–87). Tsama appears to be no exception. The rarity of shell in the site deposits is probably due to a combination of factors, including (1) the high value of marine shell, which would have led to more careful curation; (2) the fact that prized personal possessions such as shell ornaments most often entered the archaeological record in graves, and only a few graves were exposed during the Tsama excavations; and (3) the fact that shell is relatively fragile, which hinders its identification and recovery during excavation.

Table 37. Shell Objects.

PD	FS	Study Unit	Vertical	Com-ponent	Artifact Category	Qty.	Wt. (g)	Description
74	4	108	Level 4	Coalition	Shell	3	0.6	West Plaza, West Bank Room 4, 20 in. (51 cm) deep.
87	1	138	Level 9	Coalition	Other modified shell	1	1.0	Pendant.
290	7	137	Level 6	Classic	Other modified shell	1	2.3	Piece of shell, East Plaza, South Bank Room 5, Level 6, 1 ft. (0.3 m) W wall, 2 ft (0.6 m) SW, 36 in. (91 cm) deep.
18	9	302	Full Cut	Classic	Shell	1	0.2	Shell fragment found in trench (passageway) at big kiva.

Miscellaneous Objects and Samples

Tables 38 and 39 summarize items that derive from the Ancestral Tewa occupation of Tsama but do not fit into other artifact categories. None is from the Coalition East component. Faunal remains are discussed in the next chapter. Appendix D lists the macrobotanical (tree-ring, charcoal, radiocarbon) and soil (pollen, sediment, etc.) samples collected during the excavation, according to the available field notes. As of this writing, none of the samples listed in Appendix D has been analyzed. Comments associated with the samples indicate that some represent dung, ash, and basket-impressed adobe in addition to analytical samples.

Historical Artifacts

Table 40 lists the historical artifacts. All were encountered within 2 feet (0.6 m) of the modern ground surface. It is unclear if one of these represents the "metal piece that once may have been the clasp from an old Spanish book ... found deep in one of the Tsama rooms" (Ellis 1975:20). The limited number of historic artifacts is consistent with the inference that Tsama was vacated as a place of residence about the time the Spanish colony of New Mexico was established.

Table 38. Counts of Miscellaneous Items by Component.

Item Type	Component	
	Coalition	Classic
39A. Count		
Adobe	2	0
Effigy	1	0
Other modified vegetal	3	8
Plaster	1	0
39B. Percentage		
Adobe	28.6	0.0
Effigy	14.3	0.0
Other modified vegetal	42.9	100.0
Plaster	14.3	0.0
39C. Density (Count/Kg of Gray Ware)		
Adobe	0.02	0.00
Effigy	0.01	0.00
Other modified vegetal	0.03	0.14
Plaster	0.01	0.00

Table 39. Weights of Miscellaneous Items by Component.

Artifact Type	Component	
	Coalition	Classic
40A. Weight (g)		
Adobe	28629.3	0
Effigy	19.9	0
Other modified vegetal	17.4	21
Plaster	1915.5	0
40B. Percentage		
Adobe	93.6	0.0
Effigy	0.1	0.0
Other modified vegetal	0.1	100.0
Plaster	6.3	0.0
40C. Density (Count/Kg of Gray Ware)		
Adobe	293.1	0.0
Effigy	0.2	0.0
Other modified vegetal	0.2	0.4
Plaster	19.6	0.0

Table 40. Historical Artifacts.

PD	FS	Study Unit	Vertical	Com-ponent	Qty.	Wt. (g)	Description*
269	17	135	Level 4	Classic	1	2.5	East Plaza, South Bank, Depth 22 in (56 cm). A small fragment of white porcelain with blue decoration (hand-painted dark blue outline with lighter blue fill).
293	6	138	Level 2	Classic	1	17	East Plaza, Room 6, Level 2, Depth 11 in (28 cm). “Metal fragment.” A rectangular flat metal fragment, 4 cm wide, 0.5cm thick, transverse break at one end, one corner broken off as well.
2	2	201	Modern ground surface	Classic	1	27.9	Surface, middle mound. Broken, corroded metal spike with 0.4 in (11 mm) square head, 3.4 in (86 mm) long. Spike flattens and spreads downward to break.
6	3	103	Level 3	Coalition	10	16.1	Kiva W-4, Level 3, 28–39 in (71–99 cm). Thin, corroded metal Fragments found at a depth of 12.5 in (32 cm), NW 96 in. (244 cm), SW 198 in (503 cm), W Wall 93 in (236 cm).

Chapter 7

FAUNAL REMAINS

Distribution of Identified Specimens

Table 41 summarizes the identified specimens of animal bones in the Tsama collection, by component. The identifications were made by Steve Wolverton and his students at the University of North Texas. Faunal remains are about half as dense in East and Middle Plaza contexts as they are in West Plaza contexts. However, densities of the most common taxa, especially deer and turkeys, are fairly consistent over time. This pattern may be due to differential recovery of small-bodied animal remains across excavation areas.

The diversity of bird taxa other than turkeys (eagle and turkey vultures) is lower than that observed at Howiri (various hawk species, coots, bobwhites, and mergansers) (Fallon and Wening 1987:9394). The Tsama assemblage is also less diverse than that at Arroyo Hondo, which included bony fish and reptiles in addition to a greater variety of mammal and avian species (Lang and Harris 1984:145153). The reduced diversity at Tsama is likely due, at least in part, to the lack of screening, which would have increased recovery of smaller bones.

Faunal remains are typically compared across sites through the use of indices that summarize the relative recovery of groups of common economic taxa, including (1) turkeys (including “large birds”), (2) artiodactyls (including deer, antelope, elk, and “large/medium artiodactyls”), and (3) lagomorphs (cottontails and jackrabbits). The distribution of these three groups across components (Table 42) shows that the mix of remains of major economic taxa was quite consistent over time, and that artiodactyls (antelope, deer, and elk) are a substantial portion of the assemblage. The Tsama assemblage is very different from those at earlier Northern San Juan villages. For example, Muir and Driver (2002, Figure 6) show that artiodactyl remains constitute only about 5 percent of assemblages at Sand Canyon, and that they become less common over time. At Tsama, in contrast, artiodactyl remains constitute more than 40 percent of the specimens and if anything, they become more common over time. The results suggest that large game was substantially more abundant in the Northern Rio Grande region at the time Tsama was founded than in the Northern San Juan region from which many Tewa ancestors migrated, and that there was little hunting pressure on these animals over time despite the size of the Tsama community. It is possible that Northern Rio Grande populations managed game populations more effectively than their Northern San Juan ancestors had done. Interregional differences in climate and population distribution may have affected this pattern as well.

Representation of Skeletal Elements

Table 43 indicates the taxon and element for each faunal specimen in the Tsama collection. Meat-bearing elements (such as the ribs and long bones) represent the most frequently recovered elements across taxa. This is consistent with the interpretation of common taxa as food remains.

Table 41. Identified Faunal Specimens by Taxon and Component.

Scientific Name	Common Name	Component			
		Coalition	Coalition E	Classic	General
41A. Count					
Artiodactyl	Even-toed ungulate	1	0	0	0
Large artiodactyl	Even-toed ungulate	0	0	1	0
Medium artiodactyl	Even-toed ungulate	21	2	15	0
Odocoileus sp.	Deer	15	1	7	0
Cervidae	Deer	1	0	0	0
	Medium mammal	55	3	6	1
Antilocapra americana	Pronghorn	2	0	0	0
	Small mammal	3	0	0	0
Sylvilagus sp.	Cottontail	7	1	5	0
Lepus sp.	Jackrabbit	13	0	0	0
Ursidae	Bear	0	0	1	0
	Medium carnivore	2	0	0	0
	Large bird	16	1	8	1
Meleagris gallopavo	Turkey	14	1	5	0
Aquila chrysaetos	Golden eagle	1	0	0	0
Cathartes aura	Turkey vulture	1	0	0	0
	Unidentifiable	68	3	18	0
Total	**All Taxa**	**220**	**12**	**66**	**2**
41B. Percent					
Artiodactyl	Even-toed ungulate	0.5	0.0	0.0	0.0
Large artiodactyl	Even-toed ungulate	0.0	0.0	1.5	0.0
Medium artiodactyl	Even-toed ungulate	9.6	16.7	22.7	0.0
Odocoileus sp.	Deer	6.8	8.3	10.6	0.0
Cervidae	Deer	0.5	0.0	0.0	0.0
	Medium mammal	25.0	25.0	9.1	50.0
Antilocapra americana	Pronghorn	0.9	0.0	0.0	0.0
	Small mammal	1.4	0.0	0.0	0.0
Sylvilagus sp.	Cottontail	3.2	8.3	7.6	0.0
Lepus sp.	Jackrabbit	5.9	0.0	0.0	0.0
Ursidae	Bear	0.0	0.0	1.5	0.0
	Medium carnivore	0.9	0.0	0.0	0.0
	Large bird	7.3	8.3	12.1	50.0
Meleagris gallopavo	Turkey	6.4	8.3	7.6	0.0
Aquila chrysaetos	Golden eagle	0.5	0.0	0.0	0.0
Cathartes aura	Turkey vulture	0.5	0.0	0.0	0.0
	Unidentifiable	30.9	25.0	27.3	0.0
Total	**All Taxa**	**100.0**	**100.0**	**100.0**	**100.0**

Table 41. Identified Faunal Specimens by Taxon and Component.

Scientific Name	Common Name	Component			
		Coalition	Coalition E	Classic	General
41C. Density (Count/Kg of Gray Ware)					
Artiodactyl	Even-toed ungulate	0.01	0.00	0.00	0.00
Large artiodactyl	Even-toed ungulate	0.00	0.00	0.02	0.00
Medium artiodactyl	Even-toed ungulate	0.22	0.28	0.26	0.00
Odocoileus sp.	Deer	0.15	0.14	0.12	0.00
Cervidae	Deer	0.01	0.00	0.00	0.00
	Medium mammal	0.56	0.42	0.10	1.56
Antilocapra americana	Pronghorn	0.02	0.00	0.00	0.00
	Small mammal	0.03	0.00	0.00	0.00
Sylvilagus sp.	Cottontail	0.07	0.14	0.09	0.00
Lepus sp.	Jackrabbit	0.13	0.00	0.00	0.00
Ursidae	Bear	0.00	0.00	0.02	0.00
	Medium carnivore	0.02	0.00	0.00	0.00
	Large bird	0.16	0.14	0.14	1.56
Meleagris gallopavo	Turkey	0.14	0.14	0.09	0.00
Aquila chrysaetos	Golden eagle	0.01	0.00	0.00	0.00
Cathartes aura	Turkey vulture	0.01	0.00	0.00	0.00
	Unidentifiable	0.70	0.42	0.31	0.00
Total	**All Taxa**	**2.25**	**1.66**	**1.13**	**3.11**

Table 42. Relative Abundance of Major Taxonomic Groups by Component.

Group	Component			
	Coalition	Coalition E	Classic	General
Count				
Turkeys	30	2	13	1
Artiodactyls	38	3	23	0
Lagomorphs	20	1	5	0
Total	**88**	**6**	**41**	**1**
Percent by Component				
Turkeys	34.1	33.3	31.7	100.0
Artiodactyls	43.2	50.0	56.1	0.0
Lagomorphs	22.7	16.7	12.2	0.0

Table 43. Distribution of Faunal Elements by Species.

Scientific Name	**Artiodactyl**	**Large artiodactyl**	**Medium artiodactyl**	***Odocoileus* sp.**	**Cervidae**		***Antilocapra americana***		***Sylvilagus* sp.**	***Lepus* sp.**	**Ursidae**			***Meleagris gallopavo***	***Aquila chrysaetos***	***Cathartes aura***	
Common Name	**Even-toed ungulate**	**Even-toed ungulate**	**Even-toed ungulate**	**Deer**	**Deer**	**Medium mammal**	**Pronghorn**	**Small mammal**	**Cottontail**	**Jackrabbit**	**Bear**	**Medium carnivore**	**Large bird**	**Turkey**	**Golden eagle**	**Turkey vulture**	**Unidentifiable**
Antler			8	1	2												
Any foot phalanx																	1
Axis			1														
Basisphenoid			1														
Cervical			2											2			
Coracoid													1	1			
Cranial						1											
Femur			1					1	6	2			2	2		1	
Frontal			1	3													
Horn core							1										
Humerus			1	3					3	2			2	1	1		
Innominate			1						1		1						
Lateral metacarpus (ungulates)			1														
Lumbar			1														
Mandible				1													
Maxilla			2			2											
Medial phalanx (second phalanx)				2													
Metacarpus			2										2	1			
Metapodial	1		2	2			1										

Table 43. Distribution of Faunal Elements by Species.

Scientific Name	**Artiodactyl**	**Large artiodactyl**	**Medium artiodactyl**	***Odocoileus* sp.**	**Cervidae**		***Antilocapra americana***		***Sylvilagus* sp.**	***Lepus* sp.**	**Ursidae**			***Meleagris gallopavo***	***Aquila chrysaetos***	***Cathartes aura***	
Common Name	**Even-toed ungulate**	**Even-toed ungulate**	**Even-toed ungulate**	**Deer**	**Deer**	**Medium mammal**	**Pronghorn**	**Small mammal**	**Cottontail**	**Jackrabbit**	**Bear**	**Medium carnivore**	**Large bird**	**Turkey**	**Golden eagle**	**Turkey vulture**	**Unidentifiable**
Metatarsus			4	1		1							3				
Occipital			2														
Parietal				1													
Permanent tooth			1														
Premaxilla			1														
Proximal phalanx (first phalanx)			1	3													
Radius			1	2						5		2	2	1			
Rib			1			8		1									
Sacral		1															
Temporal				1													
Tibia			1	1					3	3			2	6			
Ulna				2						1			1	6			
Unidentified			2			52		1					11				88
Unknown tooth, unknown age						1											

Bone Tool Taxa and Elements

Table 35 in Chapter 6 summarizes bone tools from Tsama by type and component. Table 44 indicates the taxa and elements used for each tool type. The faunal identification is missing for one example of Other Modified Bone. Bone tools were most frequently made from the long bones of medium sized mammals, and that awls represent the most common artifact category.

Table 44. Bone Tools by Taxon, Element, and Type.

Taxonomic Category	Element	Tool Type			
		Antler	Awl	Needle	Other Modified Bone
Antilocapra americana	Metapodial	0	1	0	0
Odocoileus sp.	Metapodial	0	1	0	0
Odocoileus sp.	Metatarsus	0	1	0	0
Odocoileus sp.	Radius	0	1	0	0
Medium artiodactyl	Antler	1	2	0	1
Medium artiodactyl	Lateral metacarpus (ungulates)	0	1	0	0
Medium artiodactyl	Metacarpus	0	1	0	0
Medium artiodactyl	Metatarsus	0	3	0	0
Lepus sp.	Radius	0	3	0	0
Lepus sp.	Tibia	0	1	0	0
Medium carnivore	Radius	0	2	0	0
Medium mammal	Metatarsus	0	1	0	0
Medium mammal	Unidentified	0	31	0	3
Large bird	Radius	0	1	0	0
Large bird	Tibia	0	1	0	0
Large bird	Ulna	0	1	0	0
Large bird	Unidentified	0	1	0	1
Unidentifiable	Unidentified	0	6	2	0

Modifications on Faunal Specimens

Table 45 summarizes the modifications observed on faunal elements, by taxon. In most cases only one modification was noted, but 22 specimens were listed with a second modification (and of these, two were listed with a third). Table 45 documents only the primary modification, so that each specimen is counted only once. Faunal specimens listed as artifacts appear in other tables of this report. Table 45 provides clear evidence of butchery and cooking of most of the regionally common species, in the form of cut marks and localized burning. The fairly frequent occurrence of carnivore damage on larger bones suggests the presence of dogs.

Table 45. Faunal Modification by Taxon.

Taxon	Modification Type							
	Artifact	Burned Black	Burnt White, Gray, or Blue-Gray	Carnivore Damage	Cut Marks	Localized Burning	Pathological Condition	Rodent Gnawing
Antilocapra americana	1	1	0	0	0	0	0	0
Odocoileus sp.	6	4	0	3	5	4	0	1
Cervidae	2	0	0	0	0	0	0	0
Large artiodactyl	0	0	0	0	1	0	0	0
Medium artiodactyl	11	3	4	6	6	6	0	2
Artiodactyl	1	0	0	0	0	0	0	0
Lepus sp.	7	0	0	3	1	0	0	2
Sylvilagus sp.	1	0	1	1	2	1	0	7
Ursidae	0	0	0	1	0	0	0	0
Medium carnivore	2	0	0	0	0	0	0	0
Medium mammal	43	2	1	2	6	6	0	4
Small mammal	0	0	0	1	0	0	0	2
Aquila chrysaetos	1	0	0	0	0	0	0	0
Cathartes aura		0	0	1	0	0	0	0
Meleagris gallopavo	5	0	0	2	2	5	2	4
Large bird	17	0	0	1	2	0	0	6
Unidentifiable	29	32	17	0	4	5	0	2

Chapter 8

SPATIAL ANALYSIS

Measuring the Division of Labor Using Information Theory

Due to incompleteness of field notes and of provenience information on bags of artifacts and samples from Tsama, in many cases the Crow Canyon laboratory was able to determine only the plaza in which an excavated room was located (see Table 1). Additional work with the field notes may improve the situation but based on our current knowledge, it is not feasible to map spatial distributions of artifacts at the structure level. However, it is still possible to examine variation in the contents of excavated structures in the West, Middle, and East Plazas. Even if we do not know precisely where each structure was located, the artifacts and samples from the fill of a structure reflect the mix of activities that took place during the occupation of that part of the site. One can examine statistical variation in this mix of activities across locations and over time.

A long tradition of intrasite analysis works from tables of artifact frequencies across units. A classic example is Bolviken and others' (1982) study of Neolithic communities in Arctic Norway, where the authors examined biplots resulting from correspondence analysis to identify patterns of association between houses and specific stone tool types. A more recent example is Peterson and Shelach's (2012) analysis of Jiangzhai, a Neolithic community in China, which examines proportions of various groups of functional artifact types across households to identify levels of economic differentiation. Although both studies led to important insights, they did not handle diversity very well. In both studies, for example, the researchers aggregated rare artifact types into functional groups to facilitate comparisons of proportions and to reduce the number of zeros in the analysis. This is not ideal because most of the diversity in any study set, whether species in an ecosystem, professions in a city, or artifacts from an archaeological site, derives from a large number of rare categories. The complexity and differentiation of a system is also closely related to its diversity, so lumping rare categories prior to analysis limits one's ability to examine these important properties.

It would be useful to adopt an approach that accommodates rare categories while also handling all categories simultaneously. One such approach begins with the notion that the total artifact assemblage across all structures dating to a given period provides estimates of the relative frequency of various activities across the site as a whole. Although different activities produced material traces at different rates, differences in the mixes of artifact types across locations, relative to the overall assemblage, are likely to reflect spatial variation in the mix of activities that generated the assemblage at each location. Given this, we can ask how much variation there was in the mix of activities that took place in any specific location, given the overall frequency distribution of activities reflected in the general site assemblage. One useful measure for comparing the composition of assemblages from each location to the overall assemblage is the Kullback-Leibler divergence, D_{KL}, a measure related to the Shannon-Weaver (H) statistic (derived from information theory) that measures the relative entropy (uncertainty) between two probability distributions (Bettencourt et al. 2015; Cover and Thomas 2006; Dedeo 2018). For our purposes, we define his measure as:

$$D_{KL}\left[p(x|s_j)\|p(x)\right]=\sum_i p(x_i|s_j)\log\left(\frac{p(x_i|s_j)}{p(x_i)}\right) \tag{1}$$

In words, Equation 1 states that the Kullback-Leibler divergence D_{KL} of a frequency distribution of artifact types x from structure S_j, given the frequency distribution of those artifact types in the general assemblage, is the sum of a series of products, each product being the proportion of artifact categories in each structure times the logarithm of the ratio of that proportion to the proportion in the overall assemblage. The right side of Equation 1 suggests that large deviations in the proportion of common artifacts in a structure, and the presence of many rare artifact types, will have the greatest influence on D_{KL}. If certain artifact types are absent from certain locations, $p(x_i|s_j) = 0$, the associated term will be zero and it can be dropped from the sum.

In this application, the Kullback-Leibler divergence is interpreted as the amount of additional information needed to describe the pattern in artifact proportions observed in a location, given the aggregate pattern in artifact proportions across all locations. In other words, it is a measure of how much the mix of artifacts (and their associated activities) in a particular location deviates from the overall mix of artifacts (and activities) at the level of the settlement overall. If each person performs the same mix of activities in all locations, such that every person's activities are redundant and there is no division of labor, D_{KL} would approach zero and the only source of variation would be sampling error in artifact proportions. However, if people performed different mixes of activities, such that certain activities were more frequent in some locations than in others, D_{KL} would vary more across locations. In this sense, variation in D_{KL} across structures can be interpreted as a measure of the spatial (and thus social) division of labor.

The division of labor generally follows from the average connectivity of individuals in a system (Arrow 1994; Bettencourt et al. 2014; Hanson et al. 2017), and can be influenced by population size and the cost of movement over space. Increases in population and accumulation rates of several artifact categories at Tsama over time suggest increasing village-level specialization, and one might expect this to be mirrored at intra-community levels as well. Comparison of D_{KL} across locations and components provides some insight into the degree of spatial redundancy (or uniqueness) of activity mixes across the community and changing levels of functional diversity (specialization) among individuals and households within the community. Interpretation of the variation in D_{KL} across structures presumes that the sample of excavated structures constitutes a representative sample of locations. This is not true, but the best we can do in this situation is to assume that the sample we have approximates a representative one.

To accurately capture deviations from the overall mix of activities that took place in a given location, it is necessary to calculate D_{KL} separately for each component. In a relatively small community like Tsama, one might expect an expanding division of labor to be reflected in the quantitative mix of activities performed by individuals in addition to qualitative differences in the activities performed. In other words, in a community with a more extensive division of labor one might expect each individual to spend more time on certain activities and less time on others, and for the emphases of different individuals to be complementary (i.e., each person's deficit is made up through exchanges with others in the community). One can visualize this situation as a series of pie charts, one for each individual, where the slices in each pie represent the proportions of a person's total effort that they put into each activity. As the division of labor expands, one might expect to see (1) a greater number of slices overall and (2) increasing variation in the sizes of the pieces representing different activities across individuals. We illustrate this below.

The overall degree to which behavior is spatially structured in a settlement can be further summarized using a second measure from information theory known as the mutual information. This measure is calculated from D_{KL} as:

$$I(s,x) = \sum_{j} p(s_j) D_{KL}[p(x|s_j) \| p(x)] \tag{2}$$

Equation 2 states that the mutual information among locations in a settlement and the mix of activities is the sum of the product of the proportion of all artifacts from each location and its associated Kullback-Leibler divergence. This measure summarizes how much uncertainty in the frequency distribution of artifacts is reduced by knowing which structure the artifacts come from, with a larger number indicating a greater reduction in uncertainty. This measure can also be interpreted as the total amount of information that is gained by considering locations as well as the overall activity mix. In this sense, it is a form of correlation coefficient between space and activity.

Analysis of Artifact Assemblages Across Structures

We compiled counts of 49 variables for 27 structures from the West Plaza associated with the Coalition period component and 10 structures from the Middle and East Plazas associated with the Classic period component. We excluded levels of excavated East Plaza rooms associated with the Coalition East component, contexts with unclear provenience, and structures for which chipped stone debris was missing from the assemblage. For pottery, stone, and bone artifacts we focused on functional categories to emphasize the activity represented by the object; for faunal remains we focused on taxonomic identifications based on the assumption that different species were obtained and utilized in different ways; and for chipped stone debris we focused on raw materials based on the assumption that different materials were used to make different types of stone tools. The dataset is presented in Appendix F. Forty of the 49 categories we defined occur in at least one Classic period structure; 48 occur in at least one Coalition period structure. A summary of the dataset follows:

- *Pottery*: counts of white ware bowl, mug and canteen, jar, and ladle sherds; counts of gray ware jar sherds (cooking pots); counts of modified and shaped sherds.
- *Bone tools*: counts of bone awls, needles, and drills.
- *Adornments*: counts of beads and pendants of any material and counts of bone tubes. We reduced the count of beads and pendants from Kiva M-1 (STR-202) from 42 and 983 to one each, so that frequencies from the large cache found within this structure would not dominate the results.

- *Faunal remains*: numbers of identified specimens of various taxa, with turkeys and large birds combined, and with the various artiodactyl categories combined.
- *Chipped stone debris*: counts of flakes and angular debris of fine-grained basalt (including pieces identified as "igneous"); two varieties of obsidian identified visually; gray chert, Pedernal chert, quartz, quartzite, other cherts, and silicified sandstone.
- *Chipped stone tools*: bifaces, projectile points, other chipped stone tools, and cores (including modified cores).
- *Ground stone tools*: counts of whole or fragmentary griddle stones, one-hand manos, two-hand manos, and abraders. We excluded metates due to the evidence (reviewed earlier) that they were not recovered consistently.
- *Pecked and polished stone tools*: counts of whole or fragmentary stone axes, mauls, hammerstones, floor/plaster polishers, hide grinders, and pot polishers.

Figures 20 and 21 present pie charts showing the composition of each structure, and the composition of the overall assemblage, for all structures in the Coalition and Classic period datasets. The charts show that the most common categories by far are whiteware bowl sherds and cooking potsherds, with the remaining categories being much less frequent. There is also some variation in the composition of assemblages across structures, with individual structures deviating from the composition of the overall assemblage for that period. Finally, there is a change in the relative abundance of the most common categories, with cooking potsherds being relatively less frequent and whiteware bowl and jar sherds being relatively more frequent in Classic Period structures. D_{KL} provides a single measure that accommodates large numbers of rare categories through the use of log-ratios, and also captures the overall degree of variation across structures.

Figure 22 presents box and dot plots illustrating the distribution of log transformed D_{KL} measures across excavated structures from the Coalition period to the Classic period. The results suggest that the distributions of these values are approximately log-normal, and that during the Coalition period occupation there was less variation in the mix of activities in the vicinities of excavated structures, versus their mix for the site as a whole, than was the case during the Classic period. Both the range and midspread of D_{KL} values for the Classic period structures are larger than they are for the Coalition period structures. The standard deviation of D_{KL} values increases from 0.062 to 0.237, a roughly four-fold increase, and Levene's test for equality of variances suggests that these differences are unlikely due to chance alone ($F = 5.650$; d.f. = 1, 35; $P = 0.0231$). The mutual information between space and activity mixes also increased over time, from a value of $I(s,x) = 0.0915$ to $I(s,x) = 0.1008$ between the Coalition and Classic periods. This is not a trivial change, but in percentage terms it is quite a bit less than the four-fold increase in the D_{KL} standard deviation, and five-fold increase in population, that occurred over the same time. Together, these results suggest increasing variation in the mix of individual activities and an increase in the spatial structuring of activities. This increasing heterogeneity in individual activities corresponds to decreasing individual functional diversity, that is, increasing specialization. Thus, it provides evidence that the division of labor did expand over time.

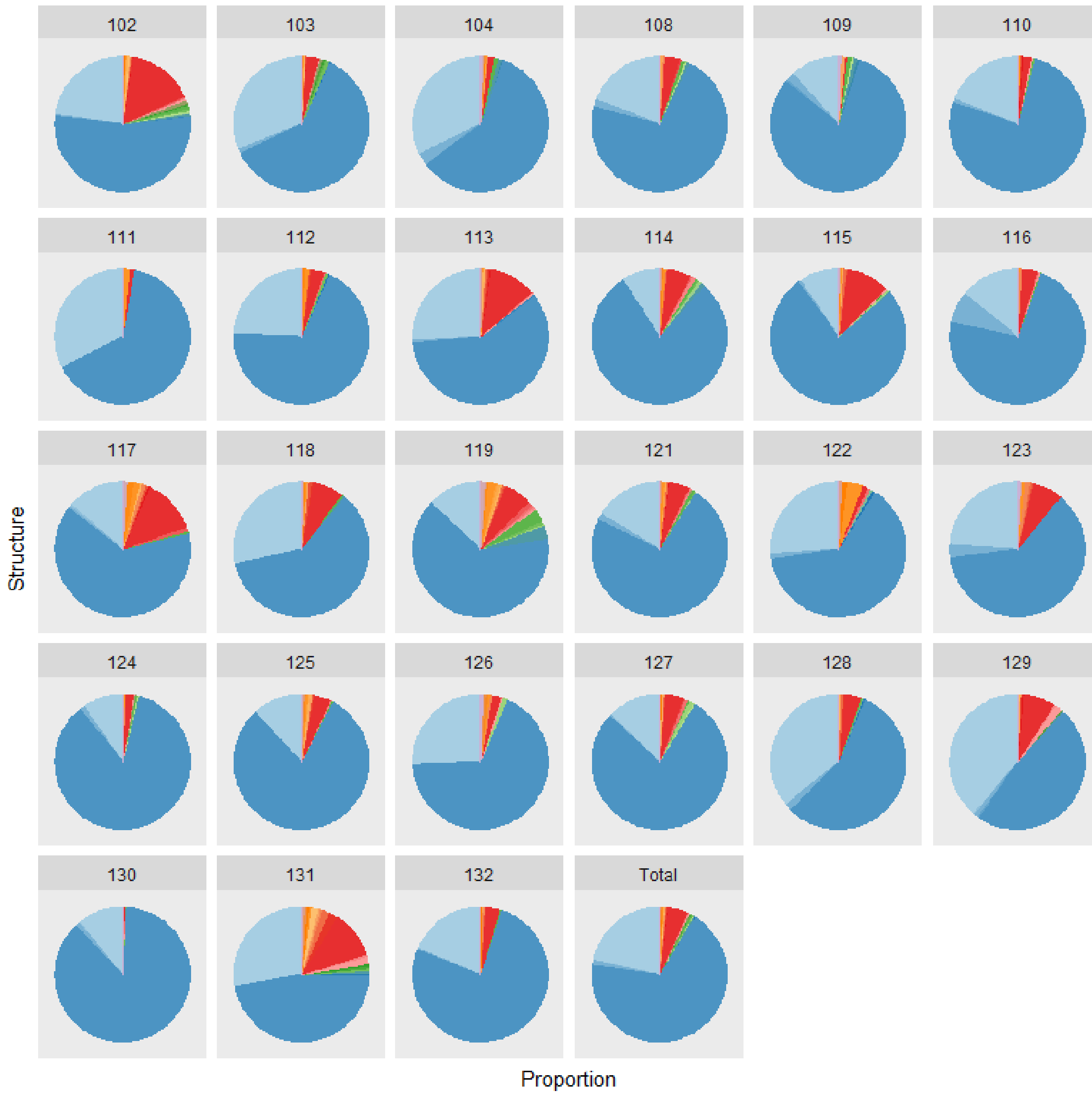

Figure 20. Room-by-room composition of assemblages from the Coalition period. See Figure 21 for the legend.

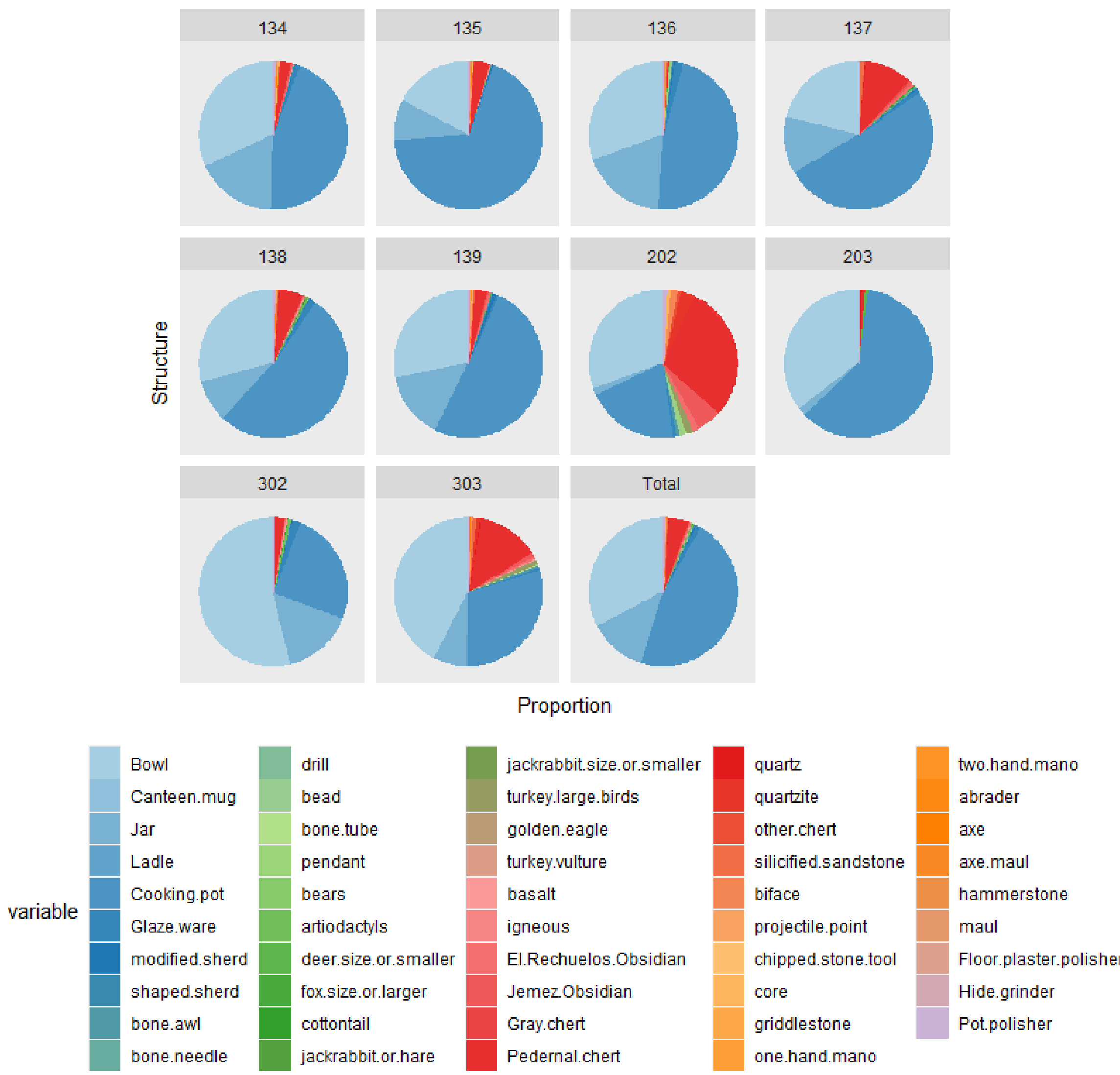

Figure 21. Room-by-room composition of assemblages from the Classic Period.

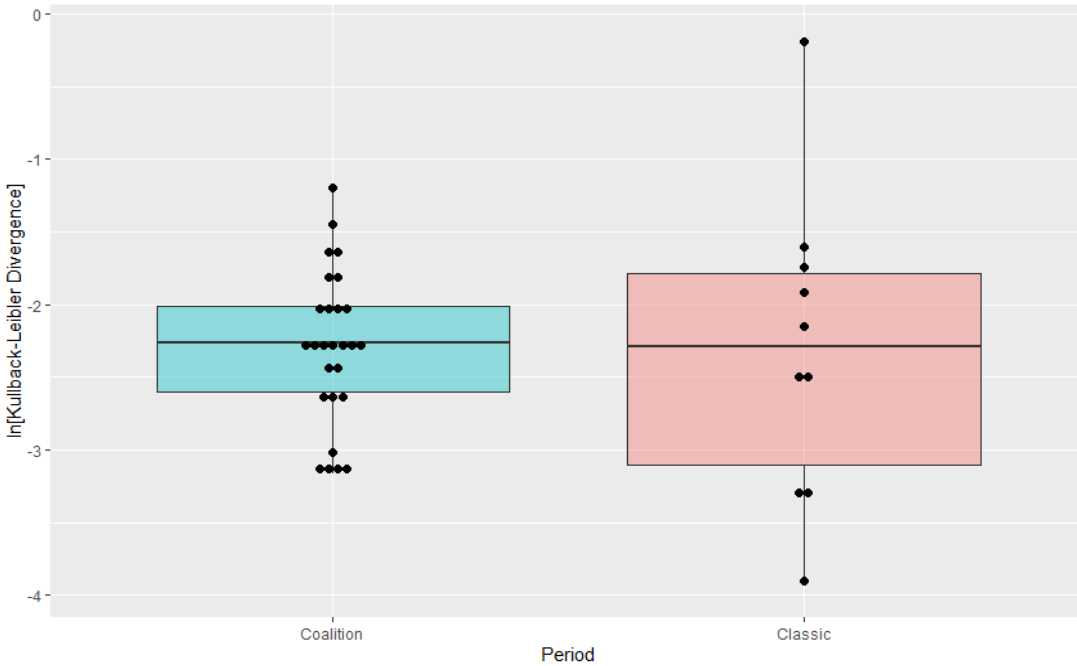

Figure 22. Dot/box plots of Kullback-Leibler Divergences for structure assemblages.

An important additional consideration is the effect of sample size on D_{KL}. One would expect larger errors in estimates of population proportions for assemblages with smaller sample sizes, and this may introduce a positive bias to D_{KL} estimates. Figure 23, which compares D_{KL} with sample size across structure assemblages, suggests that D_{KL} may be inflated for smaller sample sizes at least. Even after controlling for the cache of selenite pendants from Kiva M-1 (STR 202), that structure still stands out as having the largest D_{KL} value. It may be more appropriate to compare the residuals of D_{KL} estimates to the LOESS curve (locally weighted fit line) in Figure 23 as a means of controlling for sample size. Figure 24, which compares the distributions of these adjusted D_{KL} values, shows that this procedure does not change the results. The range and midspread of values remain larger for Classic period structures than for Coalition period structures, and Levene's Test for equality of variances remains significant (F = 5.091; d.f. = 1, 35; P = 0.0304). These results strengthen our interpretation that activities became increasingly spatially structured as the Tsama community grew. We further interpret this pattern as reflecting an expanding division of labor across households during the Classic period, as has been suggested at the inter-village scale in this report and for the Northern Rio Grande more generally (Ortman and Lobo 2020).

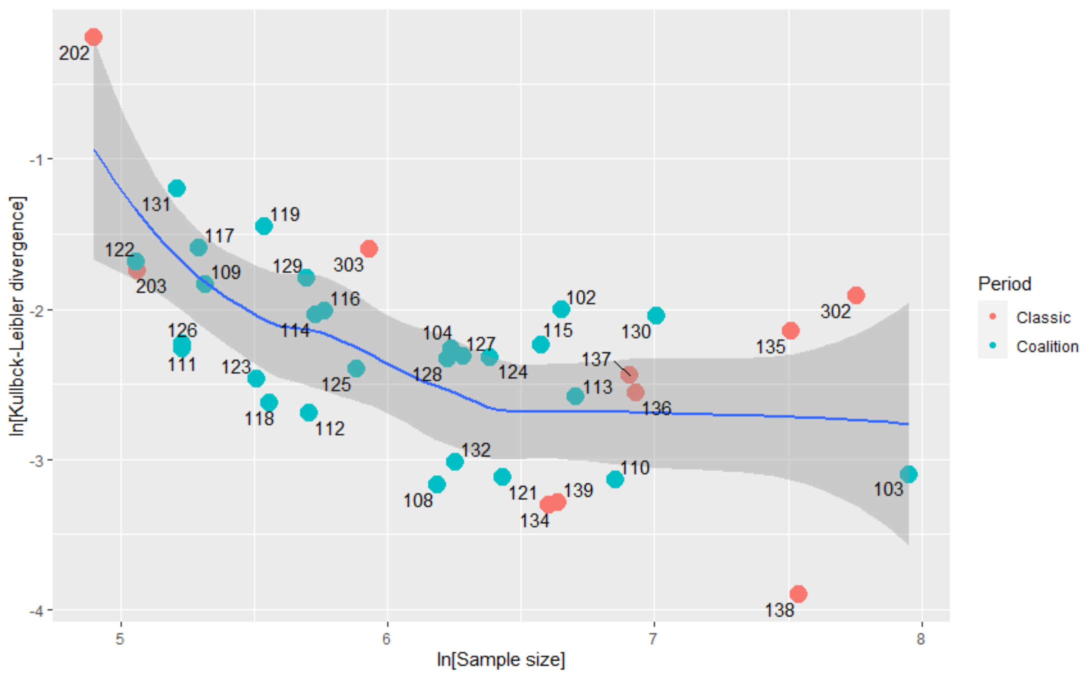

Figure 23. Relationship between D_{KL} and sample size. The fit line is a LOESS curve with the standard error shown in gray. Labels for data points are structure numbers.

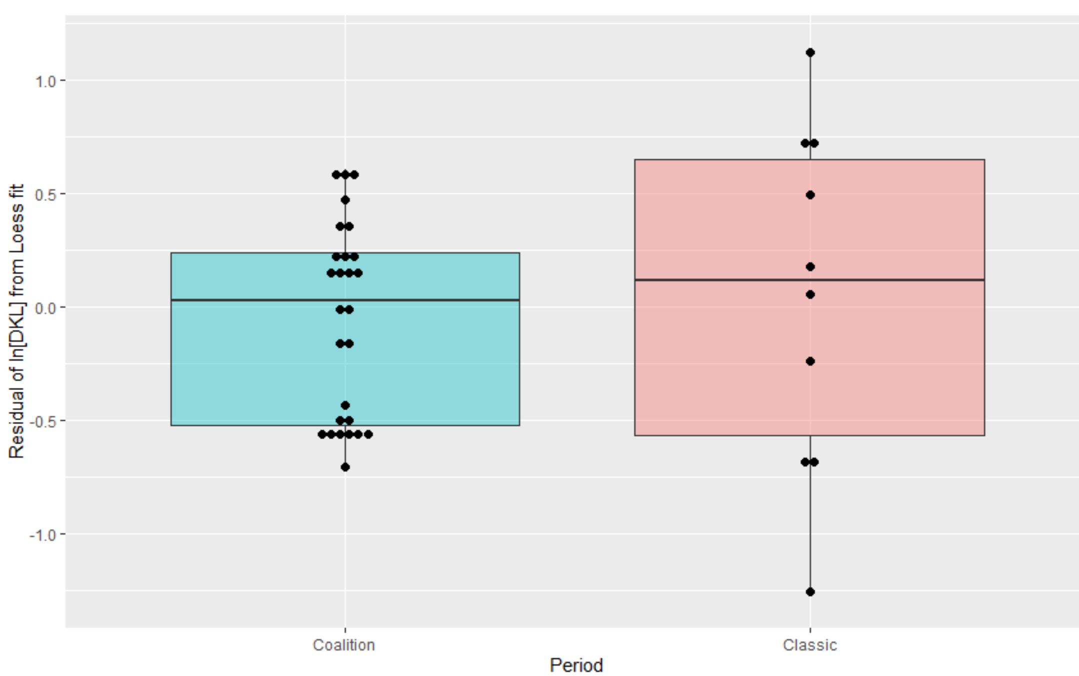

Figure 24. Dot/box plots of residuals from a LOESS curve fit of D_{KL} versus sample sizes.

Chapter 9

SUMMARY OF RESULTS

Although the Tsama Pueblo collection derives from a field school where there was undoubtedly variation in the quality and skill of the excavators, and where artifacts were collected without screening, in many ways the artifact assemblages appear to be more consistent than the field notes. Patterns in the relative abundances of artifact types at both the component and the structure level appear generally consistent with those recovered from more recent excavations that did employ screening, and the observed patterns are interpretable in terms of past human behavior as opposed to the behavior of the field school students. Indeed, the only artifact class that appears to have been collected inconsistently was large ground stone tools, especially metates. In contrast, there is a great amount of variation in the type, detail, and completeness of architectural and stratigraphic information reported in the TA notebooks.

The primary reason for our success is that the entire collection was removed from the original field bags and reanalyzed under laboratory conditions using well-defined protocols, aided by a relational database developed over many years while processing materials from Crow Canyon Archaeological Center excavations. As a result, the data collected from the recovered artifacts is much more consistent than the information recorded for each excavated context in the field, where TAs were given little guidance and had to rely on their own judgment regarding what should be recorded.

The fact that so much useful information can be gleaned from legacy collections (including from field school excavations that took place 50 years ago) should be taken as a sign that additional projects utilizing collections from older excavations (even previously published ones) would be fruitful. (For additional examples of successful projects using legacy collections, see Wilson et al. 2015 and Adler and Dick 1999.) Given Pueblo peoples' objections to new excavations in ancestral sites, projects focused on collections and notes from the many large-scale, mid-20th century excavations at Northern Rio Grande Pueblo sites (e.g., Paa-ko, Tonque, Rowe, Sapawe, Yunque, Cuyamungue, Las Madres, Pojoaque, Te'ewi, and Kapo) should be given high priority.

Turning to our specific results, one of our most basic findings is that ratios of whiteware sherds to grayware sherds, and of glazeware sherds to grayware sherds, both increased substantially over time (Table 4). Gray ware was used primarily for cooking and whiteware for serving, so in the absence of evidence for substantial changes in cooking methods, one would not expect the gray ware consumption rate per person per year to have changed much over time. Given this assumption, the changing ratio of whiteware to grayware sherds was most likely due to increases in the consumption rate of whiteware pottery, per person per year, during the Classic period. This increased consumption rate of whiteware, which was typically decorated and used in social events such as meals, implies that the intensity of social interaction among residents of Tsama Pueblo increased as the community grew. Also, the fact that glaze ware, which was made south of Santa Fe, is 50 times more frequent per kilogram of gray ware in the Classic component than it is in the Coalition component (Table 4) indicates a substantial increase in the importation of pottery over time.

This logic suggests that one way of gauging the relative abundance of various classes of artifacts in site deposits is to divide the amounts of these artifacts by the total weight of grayware pottery from the same set of contexts. Grayware pottery most likely accumulated at a consistent rate per person-year of occupation at the site, regardless of socioeconomic changes, so it is possible to express the accumulation of other artifact classes in terms of a per capita rate Throughout the report, this strategy has revealed patterns across different artifact classes which suggest that material living standards improved over time. These trends are mirrored in the increasing size of domestic rooms, which also suggest increases in material possessions (and perhaps also increased investment in private storage of personal possessions) per capita (Figure 5).

Our tabulations of the artifact data by component show that the densities (counts per kilogram of grayware pottery) of many artifact classes changed over time. By this measure the densities of beads, pendants, and shaped sherds (at least some of which represent unfinished pendants) all increased between the Coalition and Classic periods (Tables 16 and 36), suggesting an increased emphasis on personal adornment. Pot polishers used to burnish whiteware vessels (Table 31), and modified sherds (at least some of which were used in forming vessels; Table 16) also increased, consistent with the increasing rate of whiteware production and consumption.

Our inference that whiteware production increased at Tsama and other ancestral Tewa sites is reinforced by Duwe's (2019) compositional analyses of sherds from various portions of the northern Tewa Basin using inductively coupled plasma mass spectrometry (ICP-MS). During the Coalition period a sizeable fraction of the white ware consumed at Tsama and Kapo (the adjacent village downstream) was made of Pajarito Plateau materials, but during the Classic period this fraction declined significantly (Table 46). In addition, during the Classic period a larger fraction of the vessels consumed at Pajarito Plateau sites were made of raw materials local to Tsama Pueblo.

Table 46. Pottery Sample Sourcing Results for the Northern Tewa Basin.
(Samples per composition group, by site. From Duwe 2019, Table 8.3).

	Late Coalition Period		Classic Period	
Compositional Group	**Chama**	**Pajarito**	**Chama**	**Pajarito**
Chama (Tsama and Kapo)[1]	2	9	12	0
Tsiping	7	16	12	10
Ojo Caliente	38	2	210	1
Rio del Oso	7	0	57	0
Pajarito Plateau[2]	0	7	42	45

Notes: [1]Chi-square P<.001, [2]Chi-square P=.013.

These results are consistent with the increased densities of polishing stones, modified sherds, and whiteware sherds at Tsama, all of which suggest an increasing per capita production rate for whiteware vessels and perhaps also an increasing per capita export rate for such vessels. Combined with the Classic period importation of glazeware vessels already mentioned, there is abundant evidence for a dramatic expansion in the per capita production of decorated pottery for exchange, at Tsama and across the Northern Rio Grande more generally. In other words, there is strong evidence for an increasing division of labor at the inter-community level, and of increasing material living standards as well.

On the other hand, the densities of projectile points and knives (Table 18), hide grinders (Table 31), and bone awls (Table 35) all decreased over time. The consistent density of artiodactyl remains across components (see below) suggests that the decreased density of points and knives was more closely related to a decline in interpersonal violence (Kohler et al. 2014) than to a decline in hunting, but the decreasing density of hide grinders and bone awls suggests a decreasing emphasis on hide-working during the Classic Period. This may be due to the substitution of cotton textiles for leather as cotton production increased. Some of the modified sherds noted above could also represent fragments of broken vessels repurposed as gardening tools, which are often found in the gravel mulch field areas where, apparently, cotton was grown. The density of projectile points in the Coalition component was higher than it was at Sand Canyon Pueblo, but in the Classic Component it was lower (Table 18).

A change in the morphology of grayware vessels is indicated by the changing ratio of rim sherds to all sherds (Table 13). Specifically, the fraction of grayware sherds that were rims increased substantially during the Classic period, implying that the diameters of the mouths of grayware jars increased relative to their volumes. This change roughly coincided with the fading of exterior surface texturing on grayware vessels. Experimental research suggests that exterior texturing on cooking pottery imparts a radiator effect that helps to control cooking temperatures, thus decreasing the incidence of boil-overs and making it feasible for indented corrugated vessels to have narrower necks and smaller mouths (Pierce 2005). The data from Tsama appear to reflect these changes in reverse.

There are several notable differences in the chipped stone assemblages from Tsama Pueblo and Sand Canyon Pueblo, a slightly older settlement in the central Mesa Verde region and the likely home of many Tewa ancestors. One difference derives from variation in the materials used for ground stone tools and for building at each site. At Tsama, many ground stone tools were made of hard materials that did not require sharpening as frequently as the sandstone tools used for maize grinding at Sand Canyon Pueblo (Table 28). In addition, the sandstone architecture at Sand Canyon was shaped by pecking, but the adobe architecture at Tsama was finished using floor/plaster polishers (Table 31). As a result, pecking stones are common in the Sand Canyon Pueblo assemblage but almost absent in the Tsama Pueblo assemblage. This difference also translated into a much higher density of chipped stone debris of coarse-grained raw material, derived from the manufacture and maintenance of pecking stones, at Sand Canyon (Table 22). However, the density of chipped stone still increased over time at Tsama, suggesting an increasing rate of chipped stone tool production per person (Table 20). We also found that ratios of finished tools to debitage vary substantially across Northern Rio Grande sites. Production of chipped-stone tools may have been more uneven across space than was the consumption of finished tools. This is one of many lines of evidence for expansion of the division of labor across and within communities identified in this report.

Another important difference between the stone tool assemblages of Tsama Pueblo and Sand Canyon Pueblo can be seen in the greater diversity of raw materials used for manos at Tsama (Table 28). The relatively even representation of manos of differing grits at Tsama, in comparison with the much more uniform materials at Sand Canyon, suggests the emergence of a multi-stage grinding process at Tsama. This would have resulted in higher quality corn meal that was suitable for a wider range of recipes. One such recipe may have been wafer bread cooked on griddle stones, which occur at Tsama and other Northern Rio Grande sites but not at Sand Canyon Pueblo (Table 26). Such technical improvement in basic production processes is another hallmark of economic development.

The primary raw materials used for chipped stone tools at Tsama were obsidian from the Jemez mountains and chert (actually, chalcedony) from Cerro Pedernal (Table 25). Both are high-quality materials widely used across the region. At Tsama, the mountains that demarcate the source locations of both materials are visible on the horizon. The common occurrence of cortex on flakes and angular debris of both materials indicates that these materials entered the village as minimally processed chunks, and that most stages of reduction took place on site. However, procurement of these two materials appears to have changed over time (Table 24). Cortex is more prevalent on Pedernal chert than it is on obsidian during both periods, but over time cortex became less prevalent on Pedernal chert and more prevalent on obsidian. It appears that over time, the obsidian coming to Tsama was less processed, while the Pedernal chert arriving at the site was more processed. Both trends are consistent with improvements in the procurement and distribution of raw materials in the Classic period: Pedernal Chert, the closer raw material, was more carefully reduced prior to importation, while obsidian, the more distant material, was less reduced. This trend may also reflect changes in control over access to these resources over time as the regional population of the Pajarito Plateau decreased and that of the Chama valley increased.

A final line of evidence which is consistent with economic development at Tsama over time derives from a spatial analysis of artifact assemblages from excavated structures using ideas and methods derived from information theory. This analysis showed that the frequency distributions of 49 artifact types were more varied across nine Classic period structures than they were across 27 Coalition period structures. This pattern is apparent even after controlling for sample size effects. The results suggest that the mix of activities conducted in any given location at Tsama varied more during the Classic period than it did during the Coalition period. A reduction in the spatial redundancy of activity mixes, and a corresponding increase in specialization among individuals and households, represents an expanding division of labor in the community.

Most of the economic change just discussed took place in a context of a growing village population, increasing opportunities for specialization and exchange simply due to the number of people who lived in the same place. The increasing size and permanence of settlements had a downside, however: an increased potential for adverse environmental impacts. For the residents of Tsama, one such impact that could have been experienced by a declining population of large game. In the Northern San Juan, studies of faunal remains show a striking decline in the availability of artiodactyls over time, consistent with overhunting (Muir and Driver 2002). It is thus interesting that even though Tsama was larger and longer-lived than most Northern San Juan communities, the densities of remains of major economic taxa (artiodactyls, rabbits and hares, and turkeys) are consistent over time (Table 42). In particular, the frequencies of artiodactyl remains are both higher and more consistent over time at Tsama than they are in Northern San Juan sites (Table 43). These dramatic differences suggest development of stronger institutions for regulating resource use across larger groups of people, leading to better management of wild game populations. It may also reflect increasing inter-village exchange in artiodactyl products, which would have moderated local environmental impacts. It is tempting to connect these changes with the emergence of the deer dance (still a prominent winter dance in Tewa villages today) as a moral force for the care and management of deer populations by Tewa communities.

Vertical stratification of pottery types in the excavated rooms in the south bank of the East Plaza demonstrated that a Late Coalition period village lay beneath the floors of the Classic period village (Tables 2 and 3). This finding is significant for our understanding of the history of Tsama, and of Tewa society overall, because it indicates that when Tsama was first established it took the form of a paired village community. Based on a demographic analysis of pottery assemblages from these two areas, each village initially had about 100 residents. The two villages eventually joined into a single village, located at the East Plaza, about AD 1400 (Figure 12). This coalescence may have occurred during an ebb in community population but if so, the village rebounded to a size of about 1,000 persons by the middle 1400s. During the 1500s the population dwindled again, such that only a few Tewa people remained when the first Spanish capital of New Mexico was established in 1598.

The dynamic nature of Tsama's demographic history revealed by this analysis reinforces suggestions by Duwe and Anschuetz that people moved frequently between ancestral Tewa communities in Pre-Hispanic times (Duwe and Anschuetz 2013; see also Ortman and Davis 2019). Reduced social barriers to migration would have encouraged economic development, by making it easier for individuals to follow opportunities across the landscape over time, even as nodes in regional social networks remained fixed. Reduced barriers to movement would also have created a self-regulating system that allowed local areas to recover from episodes of intensive human use. This dimension of ancestral Tewa sustainability is an important avenue for additional research.

Two lines of evidence suggest that it is reasonable to associate the Late Coalition period east village with the Winter People and the west village with the Summer People, as known from Tewa oral tradition, 20th century ethnography, and contemporary practice. Although the floor plan of the east village was obscured by construction of the East Plaza, the plan of the west village is consistent with a summer association: the central plaza in this village is oriented to the northeast, that is, toward the summer sunrise. Second, we found two differences in pottery raw materials that associate the east and west villages at Tsama with the east and west sides of the Tewa Basin, respectively. Smeared-indented corrugated pottery was more frequently covered with a mica slip in the east village, and black-on-white pottery was more frequently tempered with pumice in the west village (Table 8). Mica is most abundant on the slopes of the Sangre de Cristo mountains on the east side of the Tewa Basin, and pumice and other volcanic deposits (from past eruptions of the Jemez Mountains) are most abundant on the west side. Tewa migration traditions also suggest that the Winter People are associated with the east side of the Tewa Basin and the Summer People with the west side.

Tewa migration traditions place the Tewa ancestral homeland northwest of the Tewa Basin, on the far side of the San Juan River (Parsons 1994[1926]). To assess this possibility, we compared the repertoire of designs on locally made whiteware bowls at Tsama with those of Mesa Verde style bowls from the Northern San Juan. The analysis built on Ortman's previous study of continuities between the Mesa Verde and Northern Rio Grande design styles but in this case, we used pottery types as opposed to provenience as the basis for chronological grouping (Table 14). The revised analysis duplicated Ortman's earlier results, reinforcing the inference of historical connections between the two regions. The best way to interpret the Late Coalition period painted pottery at Tsama is to think of it as a continuation of the Mesa Verde style on vessels made with local raw materials, subject to new influences that eroded the connection between pottery designs and weaving even as Mesa Verde style rim and framing treatments continued to be used.

While the results add support to the inference of an ancestor-descendant relationship between the Mesa Verde region and the Tewa Basin, it does not rule out the idea that people from several traditions came together to create Tewa society (Bernstein and Ortman 2020; Boyer et al. 2010; Duwe and Anschuetz 2013; Duwe and Cruz 2019; Ortman 2020). The results also indicate that the history of Tsama—the coalescence of two villages into a single pueblo with Winter and Summer People—reflects episodes enshrined in Tewa traditional history. A similar history has been reconstructed for Cuyamungue, near present-day Pojoaque (Bernstein and Ortman 2020), but additional research will be needed to determine the extent of this pattern.

The cache of 957 selenite pendants in various stages of production (Figure 19) ties in with several interpretive threads in this report. First, the find is direct evidence of craft specialization: the pendants are in various stages of production, are all made of the same raw material, were all found together, and are far more numerous than any domestic group could possibly use. The selenite pendant cache thus illustrates the expanding division of labor we have inferred from changes in the densities of a variety of artifacts, and from spatial variation in these densities across Classic period Northern Rio Grande Pueblo communities.

Second, several aspects of the cache connect it to the social organization of Classic period Tsama Pueblo. The cache was found in Kiva M-1, the southern of two kivas west of the East Plaza. The kiva has ritual floor features that emphasize the winter sunrise (to the southeast). The position and layout of this kiva contrasts with that of contemporaneous Kiva E-1, which is twice as large, is in the center of the East Plaza, and has floor features that emphasize the equinox sunrise (i.e., in the middle of the sun's annual path). There is thus a strong basis for associating Kiva M-1 with the Winter People. The icy appearance of the selenite pendants strengthens this association. In Tewa communities today, ceremonial attire and adornment is characterized by clear distinctions between Winter and Summer People and by a strong emphasis on uniformity within each moiety. Community leaders often produce such items in kivas as part of their preparations for a dance and distribute the items as part of the event. We infer that the selenite pendant cache represents specialized craft production by Winter moiety leaders related to the ceremonial life of the Tsama community. As such, the find provides strong evidence for the deep historical connection between ritual practice, divisions of labor, social integration, and economic development in Tewa society.

Chapter 10

CONCLUSIONS

In this report we have placed the Tsama community in its ecological and culture-historical context and have presented summaries of the artifacts, samples, and faunal remains in the collection resulting from Florence Hawley Ellis' 1970 field school excavations. The main objectives of this report were to summarize Crow Canyon Archeological Center's work with the collections and notes and to provide a guide to projects that have taken place since that time. In this final section we return to the findings summarized in Chapter 9, with respect to the three interpretive themes developed in the introduction.

Institutions, Demography, and Economic Development

A key, if expected, finding of this research is that the residents of Tsama experienced a series of interrelated economic, demographic, and institutional changes between the community's founding about AD 1250 and the coming of the Spanish about AD 1600. Table 47 summarizes these changes, each of which has been inferred from specific lines of evidence presented and discussed earlier in the report. We discuss each of these changes in greater detail below.

Economic Change

The most prominent pattern we found in the Tsama assemblage is the substantial increase in the densities of many different artifact classes (measured as weights or counts per kilogram of grayware pottery; hereafter, KgG) over time. This pattern includes whiteware sherd weights (0.58 to 1.85 Kg/KgG), glazeware sherd weights (0.001 to .0346 Kg/KgG), pot polisher counts (0.06 to 0.15/KgG), modified sherd counts (0.09 to 0.91/KgG), bead counts (0.031 to 0.822 KgG), pendant counts (0.123 to 0.514 KgG when excluding the selenite cache), and chipped stone debitage (9.14 to 18.47/KgG). Because grayware vessels were used primarily for cooking, it is reasonable to assume that the accumulation of grayware was near-constant per person-year of occupation. In turn, increases in the ratios of other artifact classes to gray ware imply an increase in the relative consumption rate (and thus the relative accumulation rate), of these artifact classes per person-year of occupation. Because the use-lives of the various artifact types most likely did not change much over time, the observed pattern suggests that the Tsama population produced more pottery, personal adornments, and chipped stone tools per capita over time, and that households maintained larger momentary inventories of these goods.

This interpretation is reinforced by the increasing size of domestic rooms, from an average of about 6.5 square meters to about 9 square meters, over time. The average household at Tsama thus had about 40 percent more roofed space for storage of food and other household goods by the mid-1400s than it had had in the mid-1200s. Collectively, these lines of evidence provide strong support for the conclusion that material living standards at Tsama rose over time.

Table 47. Social Change at Tsama.

Pattern	Early Occupation (ca. AD 1300)	Late Occupation (ca. AD 1500)
Increases in per capita production/consumption of housing, household goods, chipped stone tools, and ornaments		
Mean room floor area (m^2)	6.47	9.17
Kg Whiteware/Kg gray ware	0.58	1.85
Kg Glazeware/Kg gray ware	0.001	0.0346
Pot polisher density (count/Kg gray ware)	0.06	1.5
Modified sherd density (count/Kg gray ware)	0.09	0.91
Bead density (count/Kg gray ware)	0.031	0.822
Pendant density (count/Kg gray ware)	0.123	0.514
Chipped stone debitage density (count/Kg gray ware)	9.14	18.47
Improvements in product quality: substitution of cotton clothing for hide clothing; multi-stage maize grinding, griddle stones		
Hide grinder density (count/Kg gray ware)	0.15	0.03
Bone awl density (count/Kg gray ware)	0.47	0.19
Demographic changes: increased community size; stable regional population; increased internal migration; reduced interpersonal violence		
Site population	100s	>1000
Projectile point density (count/Kg gray ware)	0.41	0.21
Social/institutional changes: visitors welcomed to ceremonies; elaboration of government; elaboration of public ritual; expanding division of labor		
Plaza size (square meters/person)	4.5	8
Kivas	D-shaped kivas that accommodated kin groups	Fewer kivas, of 2 size classes, that accommodated larger non-kin-based groups
Artiodactyl NISP/Artiodactyl+Turkey+Lagomorph NISP	0.432	0.561
D_{KL} variance across structures	0.0039	0.0564
Mutual information between structures and artifacts	0.0915	0.1008

Economic growth involves increases in the total value of the goods and services produced per person and per unit time. This includes increases in the number of things produced per person, but also in the quality of the things being produced. Examples of this second dimension occur at Tsama as well. For example, densities of hide grinders and bone awls (used primarily to make hide clothing) both decreased over time (0.15 to 0.03 and 0.47 to 0.19, by count/KgG, respectively), as the extent of gravel mulch fields (used for growing cotton) increased (see Figure 6). This suggests at least partial substitution of cotton clothing, which was lighter and more versatile, for hide clothing. In addition, the adoption of grinding tools of various levels of fineness, and of griddle stones, suggests an improvement in food quality and thus social value. In other words, the residents of Tsama appear to have had had higher-quality food and clothing, in addition to more of it, as time progressed.

Demographic Change

An equally important finding is that improvements in per capita living standards developed in the context of significant demographic change. Several lines of architectural, ceramic, and ecological evidence together suggest that Tsama grew from a village of a few hundred people at AD 1300 to a town of more than 1,000 people by AD 1500—an average annual growth rate of about 0.8 percent over two centuries. Population growth at Tsama was part of a regional process of coalescence of a roughly stable population into fewer, larger settlements (as opposed to general growth of the regional population) (Ortman and Lobo 2020). Second, the population history we reconstructed for Tsama, based on its pottery assemblage, implies that individuals and households were relatively free to move between Tsama and other communities in the region. This would have allowed people to follow economic opportunities (or avoid economic consequences) created by shifting climate, local resource depletion, and changing economic and social contexts (Duwe and Anschuetz 2013). Finally, the reduction in density of projectile points (0.41 to 0.21/KgG) despite a constant supply of large game suggests a reduction in the need for, and use of, weapons in interpersonal conflict. All of the demographic changes and at least some of the economic changes characterize the Northern Rio Grande as a whole (Kohler et al. 2014; Ortman and Coffey 2019; Ortman and Davis 2019; Ortman and Lobo 2020; Schneider 2019). Thus, our suggest that Tsama is simply one more example of processes that characterized all of ancestral Tewa society.

Institutional Change

Finally, we emphasize several institutional changes that seem to have supported and reinforced these changing demographic and economic conditions. First, the increased openness of Tsama to visitors is indicated by the fact that plaza space increased faster than population over time. Using the number of rooms as a proxy for population, the amount of plaza space in the West Plaza is 4.5 square meters per room (862 m^2, 188 rooms), but the Middle and East Plazas contain 8 square meters per room (11,000 m^2, 1,330 rooms), despite the fact that the latter room blocks collectively include about seven times as many rooms as the West Plaza. In AD 1300 there was not much room left over when West Plaza residents crowded into their plaza for a ceremony, but during the 1400s there was substantial additional space in the East Plaza for friends and relatives from adjacent Pueblos. This reflected but also greatly facilitated the Tsama's expanded social network, within which goods and services could flow.

Second, the functional diversification of kivas over time (Table 48) indicates expanded social integration. Excavations in the West Plaza (by Ellis and Greenlee) uncovered evidence of at least three D-shaped "corner kivas" with flat faces abutting adjacent domestic rooms, and one free-standing circular kiva (Greenlee's Kiva K-2 is not shown on the Windes and McKenna site map [Figure 2] but appears to have been immediately north of Kiva K-1). The floor plan of the eastern Late Coalition Period village is unknown, but Windes and Mckenna's map suggests the presence of at least one small kiva at the south edge of the excavated area in the south bank of rooms in the East Plaza. The physical connection of the D-shaped kivas to specific groups of rooms suggests an association between these kivas and kin-based groups.

Table 48. Summary of Excavated Kivas at Tsama.
(K-1 and K-2 data from Greenlee 1933; W-3, W-4, M-1, and E-1 data from Windes and McKenna 2006)

Kiva	Location	Floor area (m^2)	Plan	Features
K-1A (1B)	S courtyard of the West Plaza (as rebuilt)	57 (28)	Circular, free-standing	Hearth-deflector-ash pit oriented E
K-2	S courtyard of the West Plaza	20	D-shaped, facing S	Hearth-deflector-ash pit oriented E
W-3	SE-facing courtyard at SE corner of West Plaza	25	D-shaped, facing E	Hearth-deflector-ash pit oriented E, sipapu beneath hearth
W-4	S courtyard of the West Plaza	20	D-shaped, facing E	Hearth-deflector-ash pit oriented E, sipapu beneath hearth, 0.64 m long foot drum in NE quadrant
M-1	Southern of 2 kivas east of the N–S room block in the Middle Plaza	36	Circular, free-standing	Hearth-deflector-ash pit oriented E, two cloud blowers in ash pit fill; 2.1m foot long drum along NW wall, facing SE, Biscuit B bowls in fill; loom anchors opposite foot drum along SE wall
E-1	Center of the East Plaza	93	Circular, free-standing	Hearth-deflector-ash pit oriented E; 9.4 m long foot drum in W half, oriented N–S and facing E; possible sipapu west of the foot drum; 8 roof support posts in a square oriented to the cardinal directions.

In the West Plaza the ratio of kivas to rooms is one D-shaped kiva for no more than 60 rooms and one circular kiva for a village of about 180 rooms. The pattern thus suggests a village organization involving several residential kin groups whose leaders met in the freestanding circular Kiva K-1. Perhaps this same organization was replicated in the eastern village, in which case Kiva K-1 can be viewed as the meeting place of the Summer People who lived in the West Plaza.

The Middle and East Plazas, in contrast, are associated with five circular free-standing kivas, all of which appear to have been positioned with respect to the East Plaza. The two kivas in the Middle Plaza were placed along the east side of the main north–south room block, facing the west edge of the East Plaza. The placement, floor features, and horizon view of Kiva M-1 suggest that the southern of these two kivas was the meeting room of the Winter moiety; if so, the northern kiva was the meeting room of the Summer moiety. This interpretation of the northern kiva is reinforced by the fact that a line extending from the kiva toward the mid-summer sunrise also extends directly into the West Plaza to the southwest.

The inference that both kivas were used during the occupation of the East Plaza is supported by the presence of Biscuit B bowls within the foot drum cavity of Kiva M-1 and the fact that the chamber was not filled with trash after it burned (indicating that it was decommissioned at the end of the Classic period occupation). Two additional kivas, west and north of the East Plaza, were most likely meeting rooms for other sodalities. Finally, the largest kiva at Tsama is in the center of the East Plaza. Its size, orientation to the east, and floor features suggest that this was the lead kiva "in the middle of the structure" and the center of operations for the Made People. In the village as a whole, there is one "small" kiva for about every 325 rooms and the single "big" kiva for a village of about 1300 rooms. These ratios are much too large for kivas to have served individual kin groups. Instead, the pattern indicates a transformation in community organization from a mixed kin-based and sodality-based structure at AD 1300 to a network of sodality organizations at AD 1500.

A third dimension of institutional change for which we have archaeological evidence is the expansion of ritual practice. This is most clearly seen in the cache of 957 selenite pendants, in various stages of production, found together on the floor of Kiva M-1. We have argued that this kiva was most likely the headquarters for the Winter moiety, and that the selenite from which the pendants were being made was appropriate for use in emblems of membership in that moiety. The find is a window into the economic dimension of expanding plaza-based ceremonialism. Tewa dances today involve hundreds of community members dressed in regalia that is mostly uniform, but with differences that betray the moiety affiliation of each dancer or dance troop. The regalia is passed down through the generations, but there is a steady demand for new or replacement items and thus for raw materials. In this context, the cache of selenite pendants may represent the archaeologically visible tip of an iceberg of specialized craft production, organized by sodalities, developed in response to the material requirements of plaza-based ceremonies involving most community members as well as visitors. Spielmann and Graves have carried this line of reasoning further by noting that public feasting, which required large decorated bowls, accompanied dances, and would have encouraged additional production and exchange of vessels (Graves and Spielmann 2000; Spielmann 1998, 2002, 2004). The development of plaza-based ceremonies can thus be seen as a stimulus to craft specialization and the division of labor, reinforcing an economic process known as Smithian growth (Arrow 1994; Kelly 1997; Ortman and Lobo 2020).

Comparative analysis of Tanoan kin terms suggests that the ancestors of Tewa people lived in communities organized around matrilineal clans (Cruz and Ortman 2021; Ortman 2018; Whiteley 2015). Scholars ranging from Fred Eggan (1950) to John Ware (2014) have made similar arguments based on household and community plans of ancestral Pueblo settlements in the San Juan drainage. In contrast, traditional Tewa government, as documented by ethnologists, emphasizes a large number of non-kin-based organizations with well-defined organizational structures, specific responsibilities in community affairs, and officers who are identified, groomed, and installed by existing members (Ortiz 1969; Parsons 1929). The archaeology of Tsama Pueblo provides clear evidence for the emergence of this system during the Classic Period, as Duwe (2020) has suggested. Tewa traditional history suggests that new institutions were established gradually in response to specific problems. The fact that the institutions appear more clearly over time at Tsama Pueblo, coincident with the economic and demographic changes reviewed above, indicates that the changes in economy, population, and institutions were mutually reinforcing. The archaeology of Tsama Pueblo thus provides a clear addition to the record of Tewa social development, as defined by several research efforts, from the time of the initial formation of Tewa society to the coming of the Spanish (Acemoglu and Robinson 2012; Lobo et al. 2020; Morris 2013; North et al. 2009; Ortman 2016a).

Finally, the fourteen-fold increase in the variance of D_{KL} values and corresponding increase in mutual information values resulting from comparisons of artifact assemblages across excavated structures suggests increasing diversity in the spatial structure of activities over time, consistent with an expanding division of labor across households. This change implies a community in which economic institutions facilitated and encouraged interdependency among households, as opposed to household self-sufficiency.

Sustainability?

One issue arising from this analysis is the degree to which the process of social development we have reconstructed was sustainable. We would say that the evidence is mixed. On the one hand, the population history we reconstructed for Tsama suggests that at a generational time scale, the advantages of long-term investment in a specific place did not always outweigh the advantages of moving elsewhere. The fact that such movement, which must have been between established communities for the most part, could take place at all implies the existence of a regional identity, perhaps marked by the distribution of Biscuit ware pottery, defining an area within which households could shift in response to changing local conditions. One functional outcome of this reality would have been opportunities for the land surrounding local communities to recover after episodes of intensive human use. If so, it may be more appropriate to view Tewa society as a whole, rather than the individual village, as the unit of sustainability (Anschuetz 2005, 2006, 2007; Duwe and Anschuetz 2013).

On the other hand, the net result of this process might be expected to be long-term maintenance of the local resource base, i.e., steady resource availability over time. Our one line of evidence relevant to this issue is the availability of large game. Tables 41 and 43 show a remarkable continuity in the availability of large game despite a five-fold increase in community population, and despite a continuous occupation spanning three centuries. Indeed, from the Coalition period to the Classic period, artiodactyl remains increased in abundance relative to other taxonomic groups (from 43 percent to 56 percent) and maintained a constant density in the site deposits (0.389 to 0.384 specimens/KgG). Additional ancestral Tewa settlements were located no more than 6 km away in every direction, so the kind of source-sink dynamic suggested by Schollmeyer and Driver (2013) as a potential mechanism for the maintenance of artiodactyl populations over time does not fit the Tsama case. If anything, the inverse process was occurring, where the human population adjusted its location to maintain animal populations, rather than animal populations moving in response to human hunting.

Additional factors, such as the development of a specialized hunt society and increasing inter-village exchange of large game products, may also have contributed to the observed consistency in the accumulation rate of artiodactyl bones. Still, to the extent that the cycles of movement identified at Tsama were widespread, it suggests that ancestral Tewa society not only led to increasing material abundance for its human participants but also to a stable environment. In the broad scope of human history, growing societies have most often been marked by inequality and oppression rather than shared abundance (Flannery and Marcus 2012), and by substantial environmental degradation rather than sustainability (Redman 1999). These downsides of social development also appear to have plagued earlier eras of Pueblo history (Kohler 1992; Plog and Heitman 2010; Schollmeyer 2005). In this context, the accomplishments of ancestral Tewa society are remarkable.

Space, Time, and Community

In the preceding section, we argued that the Tsama community experienced a centuries-long period of mutually reinforcing economic, demographic, and institutional changes, with the net result being improved material living standards for community members. We also suggested that the ultimate driver of this episode of social development was a combination of demographic changes (which brought larger numbers of people into regular contact) and institutional changes (which increased the likelihood that the resulting interactions would be characterized by balanced reciprocity, whether immediate or delayed).

From our present-day vantage point, in a society where, nominally, mutually beneficial interactions among non-kin are the norm, these sorts of changes may not seem remarkable. But it is important to recognize that the ability to bring large groups of people together for sustained, intensive, and mutually beneficial social interactions is not intrinsic to human nature. Humans are only able to maintain a few hundred face to face relationships at a time, and our earliest human ancestors lived almost exclusively in small, kin-based groups (Gamble et al. 2014). In addition, studies of small-scale societies around the world find that social coordination problems (as opposed to resource limitations) are the primary cause of community fissions (Walker and Hill 2014). In other words, the ability of humans to form larger and more inclusive groups does not arise from our psychological predispositions; rather, it is something humans have had to learn how to do. How did the Tsama community accomplish this?

For a growing community to function, the group must extend the social circle within which appropriate behavior is expected, and that individual behavior must be increasingly regulated through norms that connect desired behavior to basic emotional and moral instincts. In contemporary nation-states this regulation is achieved largely, though not entirely, through formal laws that are (or at least are intended to be) applied equally to all citizens and enforced by public institutions (Acemoglu and Robinson 2012; North et al. 2009). In past societies, in contrast, regulation was achieved by connecting norms to religious ideas and institutions (Norenzayan 2013). The norms made social interactions among strangers more predictable and efficient, thus allowing a society characterized by networks of interdependency that extended beyond the limits of kinship to emerge.

In other words, larger human communities can persist only if the behavior of their members is regulated through norms accepted by the community and transmitted between generations. For this to occur the norms must have moral authority, such that a person who violates them can expect public condemnation. In turn, moral authority is typically achieved as follows. First, the norms are promoted and enforced by people in positions of authority. Second, the positions of authority are established by (a) historical narratives that root them in tradition and articulate their justification and purpose and (b) religious discourses that connect them to a timeless natural order. Third, the positions are further justified through material symbols, ranging from personal attire to the built environment, which connect the internal organization of the community to its traditions and worldview.

The archaeology of Tsama Pueblo illustrates how this process accompanied the economic, demographic, and institutional changes previously discussed. The initial community, with its paired east and west villages, expresses a key episode in the Tewa origin narrative where two different groups, the Winter People and Summer People, entered the Tewa Basin and each of which built separate villages (Figure 25). The specific arrangement at Tsama, with the east village downstream and the summer village upstream, also reflects the order in which the two peoples entered the basin, and perhaps gives ceremonial priority to the Winter People's village, where the community would one day coalesce. These villages appear to have been kin-structured and were of a scale where internal social integration could be maintained through face-to-face relationships. At least one of the two villages also had a special kiva within which its leadership could meet.

The Winter People's village at Tsama took advantage of the strong view to the southeast, down the Rio Chama and toward the mid-winter sunrise behind the mountain that Tewa people revere today as the cardinal east mountain. It also expressed its relationship with the east through the its potters' choice to add a mica slip to the exteriors of cooking vessels. The Summer People's village, in contrast, took advantage of the view to the west, up the Rio Chama and toward Tsip'ing, an important landmark associated with Tewa migrations in ritual practice today. The summer village also expressed its relationship with the west through its potters's choice to add pumice to the clay of serving vessels, and with the summer by orienting its major plaza toward the mid-summer sunrise.

Each village thus acknowledged its relationship to the other, and to the larger world, as was appropriate given its residents' affiliations and roles in the formation of a new society. It seems highly likely that this arrangement also made a moral claim: the functionality of the community was the shared responsibility of the Summer People and Winter People, such that it was right and proper for each to defer to the other when the other was in charge, and for leadership to alternate with the seasons. In this way, people of adjacent villages, each based on kinship and face-to-face relationships, could come together to form a single larger community.

As time passed the growing community coalesced into a single pueblo, the spatial arrangements of the Summer and Winter Peoples were abstracted, and the village layout did not directly manifest a specific episode of the Tewa origin narrative. Instead, it both reflected and reinforced the community's social charter (Figure 26). During the Classic period the mounds of the old West Plaza, upstream from the East Plaza, expressed the flow of Tewa ancestors downstream over time, from the northwest to the southeast. In addition, the southwest corner of the East Plaza opened to the west, toward yesterday, and across the mounds of the West Plaza toward Tsip'ing and the previous homeland of Tewa people.

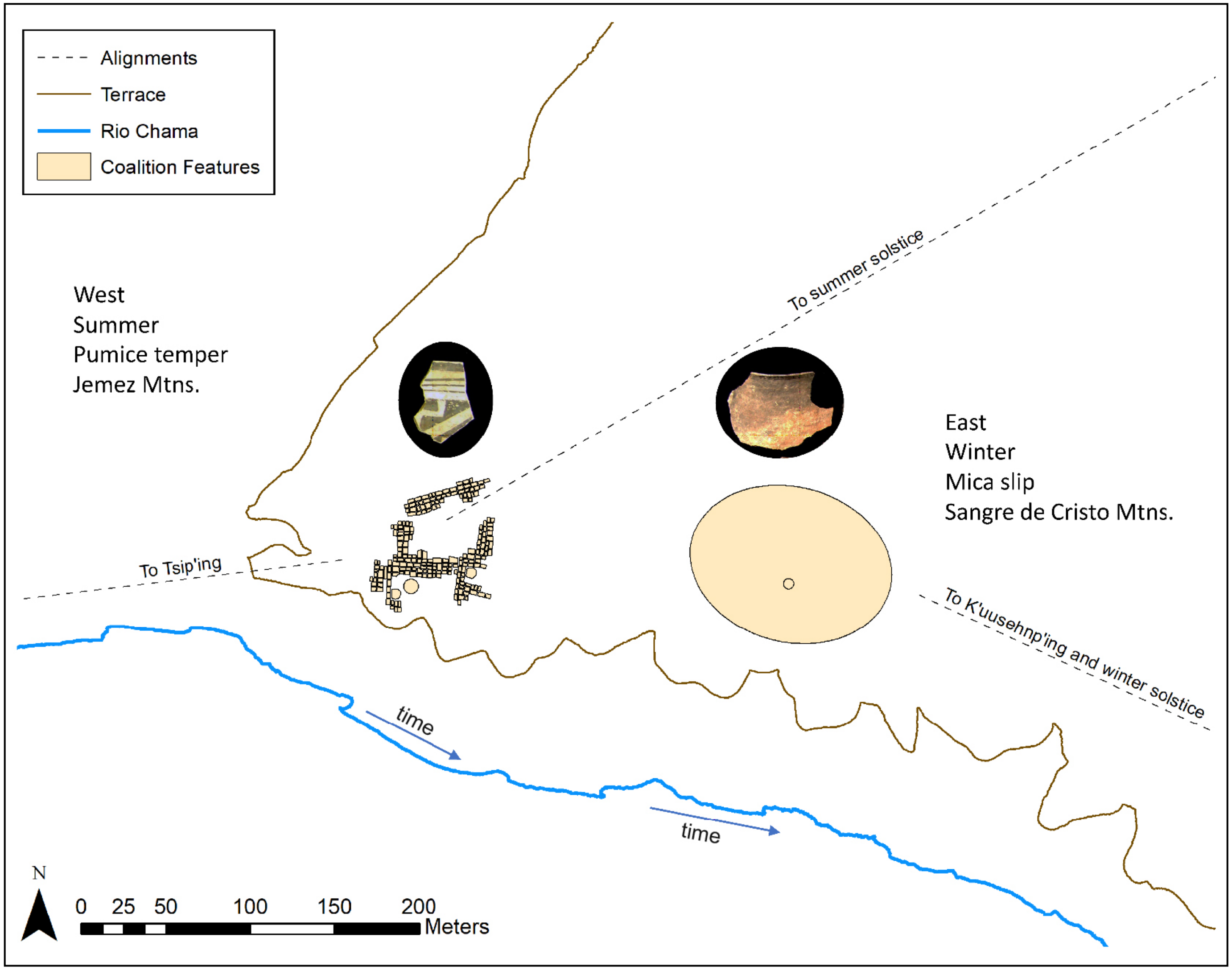

Figure 25. Tsama Pueblo during the Late Coalition period.

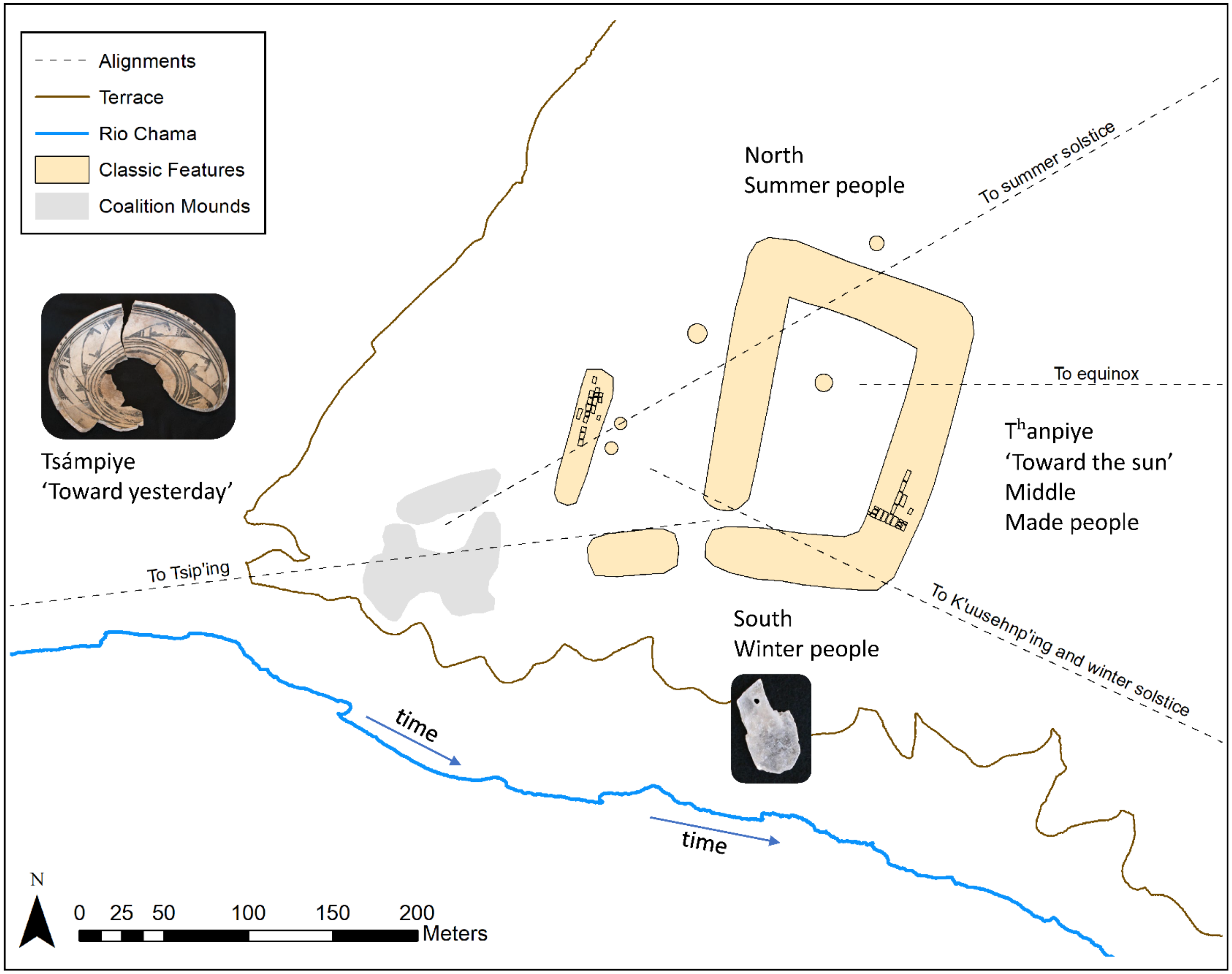

Figure 26. Tsama Pueblo during the Classic period.

The winter and summer kivas are not in the center of the village, however. That place was reserved for Kiva E-1, the largest at Tsama. It faces due east, toward the equinox sunrise, and is literally *tepingeh*, the kiva in the middle, the likely the home of the Made People. The moiety kivas, in contrast, are west of the East Plaza, upstream, reflecting an earlier time; and the people themselves surround the middle kiva, which in contemporary Tewa thought is *p'okwingeh,* "the lake-place"—the point of contact between past and present, and between the world of the spirits and the world of the living (Ortiz 1969; Swentzell 1990). The arrangement at Tsama thus appears to map the story of Tewa becoming and also the institutional hierarchy of the community, with moieties having come together under the ultimate supervision of the made people. The landscape and the story reinforce each other, while both confer authority on the norms and institutions required for a larger community, including persons not closely tied by kinship, to function.

In sum, the Classic period pueblo at Tsama represents a continuation, expansion, and elaboration of ideas expressed in the Late Coalition period paired village community, and provides a rich materialization of the Tewa origin narrative and its associated social charter (Table 49). These expressions are overlapping and intricate, ranging from allusions to ancestral pottery styles to the actual remains of an ancestral village, to alignments of specific buildings with landscape features and celestial events, to expressions of the passage of time, to correspondences between buildings and people, the earth and sky, and time and space. The likely effect of these expressions was to confer legitimacy and authority on the norms and institutions that were required for a community of more than a thousand people to grow, persist, and improve the lives of its members through increasing social connectivity and interdependence.

Table 49. Tsama and Tewa Traditional History.

Tsama Pueblo	Tewa Oral history
Tsip'ing is to the west.	West (sunset) is the direction of the past.
K'uusehnp'ing is to the southeast.	Migration was from the northwest.
Winter solstice	The beginning
Late Coalition paired villages	Migration was as Summer and Winter people.
The East Village is downstream.	The winter people led the way.
Weaving imagery on Late Coalition pottery	Tewa people originated in the distant north.
Pumice temper in West Village pottery	The summer people's home is on the west (Jemez) side of the Tewa Basin.
Mica slip on East Village pottery	The winter people's home is on the east (Sangre de Cristo) side of the Tewa Basin.
The Rio Chama flows southeast.	Migration was downstream along a river.
West Plaza mounds during the Classic period	The migration process was downstream and from the northwest, and occurred in steps.
The Late Coalition period villages coalesced into the East Plaza during the Classic period.	Winter and Summer villages eventually came together.
The middle kiva is in the East Plaza.	The Made People are in the middle and closest to the lake.
The Classic Period moiety kivas are west of the East Plaza.	The Winter and Summer People were created prior to the Made People but follow their lead.
Continuation of rim ticking, and thick-and-thin framing patterns, on Biscuit wares	Tewa people originated in the distant north.

Seeking life

Tewa prayers often refer to a life of abundance—for plants, animals, the land, and the people—as the goal of human action. We hope this exploration of the archaeology of Tsama Pueblo has convinced readers that Tewa ancestors achieved this goal in the centuries prior to Spanish contact. Figure 27 summarizes many of the quantitative changes we have observed for a variety of measures, in the form of annual percentage rates of change over a two hundred year period, between roughly AD 1300 and 1500.

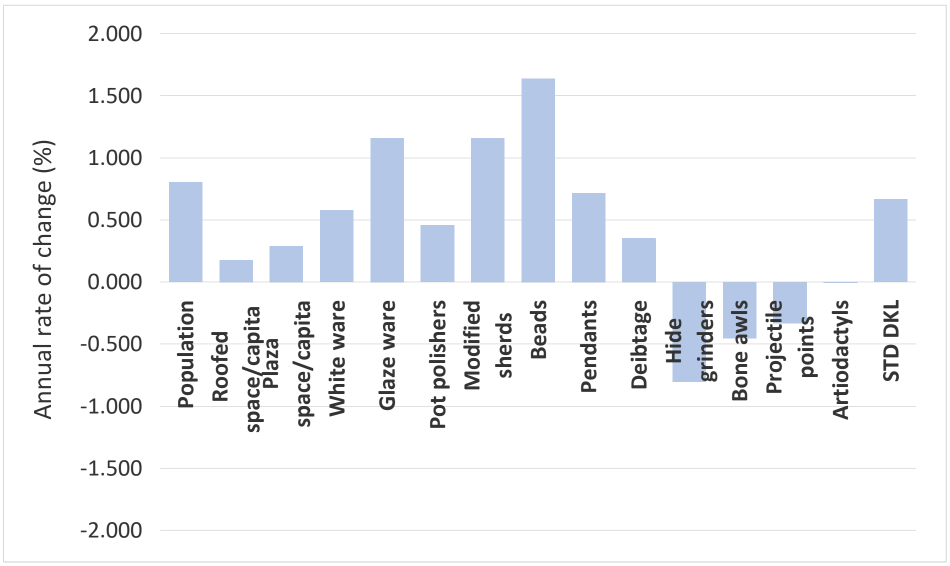

Figure 27. Quantitative summary of change at Tsama Pueblo.

Based on these measures, the people of Tsama Pueblo experienced rising per capita rates of production and consumption for a range of goods; increased access to nonlocal goods; an expanding division of labor at the intra- and inter-community levels; improving quality of food, clothing, and shelter; and declining inter-personal violence. Over this same period the community's population grew to several times its original size, barriers to movement in and out of the community were lowered, and the community increasingly opened its doors to friends and neighbors in adjacent villages for ceremonies. These economic and demographic changes did not negatively affect populations of large game. Finally, the material culture, built environment, and surrounding landscape of the community expressed its history, norms, and institutions, imbuing its leaders with moral authority and encouraging appropriate behavior among community members who lacked close kinship ties.

Given that the Tsama community was initially established by a small group of immigrants (who were starting over on a lightly inhabited frontier), these accomplishments stand as a testament to the foresight of Tewa ancestors regarding how to create communities that met human needs. Our ability to reconstruct the evolution of the Tsama community on so many levels, from concrete physical functions to sacred propositions, is due to several factors.

First, ancestral Tewa people have left a remarkably complete record of their lives, which they share with people today through archaeology, so that all can benefit from their experience. One might say that the prayers of Tewa ancestors for the welfare of plants, the animals, people, and the physical world have been answered to some extent through the thoughtful apprehension of material traces of their experiences.

Second, Tewa ancestral sites have largely escaped destruction so that careful and systematic observation of the physical remains is possible.

Third, the archaeologists who investigated Tsama in 1970 took care to document where the materials they collected came from, and the museum that curated these materials took care to preserve this information for nearly 40 years so that the Crow Canyon project described here was feasible.

Fourth, Tewa communities have persisted despite five centuries of European colonialism, such that their language and culture continue as a living tradition. Indeed, today the Tewa population is growing, and Tewa people will thankfully remain with us for generations to come. Finally, Tewa people have been generous enough to share aspects of their language and traditional knowledge with the larger world, providing an opportunity for outsiders to perceive and share the connections between economics, demography, social institutions, cultural norms, and spiritual concepts that Tewa ancestors discovered or instituted, in ways that will, we hope, resonate more broadly. For all these reasons, the present and future owe Tewa people and their ancestors, including those who lived at Tsámaˀówîngeh, a debt of gratitude.

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Appendix A

POTTERY PHOTOGRAPHS

Room numbers are from the original excavation notes. Structure numbers were assigned during initial cataloging at Crow Canyon Archaeological Center.

Figure A.1. Wiyo Black-on-white from West Plaza Room 15 (Str. 119), Level 5 fill (PD 194).

Figure A.2. Santa Fe Black-on-white from Kiva M-3 (Str. 204), Level 1 (PD 40).

Figure A.3. Santa Fe Black-on-white from Kiva M-3 (Str. 204), Level 2 (PD 41).

Figure A.4. Santa Fe Black-on-white from West Plaza Room 106 (Str. 110), Level 8 (PD 94). Top: interior surfaces. Bottom: exterior surfaces.

Figure A.5. Santa Fe Black-on-white from East Plaza Room 6 (Str. 138.1), Level 8 (PD 299).

Figure A.6. Santa Fe Black-on-white from Kiva W-4 (Str. 103). These sherds were found in the fill above the floor (PD 5) and at floor contact (PD 7).

Figure A.7. Wiyo Black-on-white bowl. No provenience information was found for the vessels.

Figure A.8. Tsankawi Black-on-cream jar lid.
Top: interior. Bottom: exterior.

Figure A.9. Partial Biscuit B bowl.

Figure A.10. Biscuit Ware puki.

Figure A.11. Nearly complete Biscuit B bowl.

Figure A.12. Biscuit B Bowl with residue coating the interior.

Figure A.13. Fragmentary Kotyiti Glaze-on-red bowl.

Appendix B

OTHER CERAMIC ARTIFACTS

In this table and those that follow, " indicates inches (× 2.54 = cm) and ' indicates feet (× 30.48 = cm).

PD	FS	Study Unit Type	Study Unit No.	Component	Qty.	Weight (g)	Comments
0	2	NST	000	General	1	12.2	Clay cloud-blower pipe. “Found in test pit 30" below floor, or 73" below surface.”
1	29	NST	101	Coalition	1	2.5	West Plaza surface. Broken pottery figurine.
1	32	NST	101	Coalition	1	1.8	North of West Plaza, Surface, “cloud blower frag.”
6	10	STR	103	Coalition	1	24.3	Kiva W4 Level 3 (28.5 to 39"). Ladle Handle.
7	2	STR	103	Coalition	1	28.5	Kiva W4, floor contact, cloudblower.
13	9	STR	102	Coalition	1	3.6	Kiva W3, firebox.
16	2	STR	302	Classic	1	45.9	“cloud blower”; 11' 2" from corner trench; 6' 1" deep; 9.5' from N wall; May also be Kiva 1 East Plaza South bank.
16	1	STR	302	Classic	1	52.7	“cloud blower”; May also be Kiva 1 south bank; 11' 2" NE corner trench; 6' 1" deep/9.5" N. wall.
22	7	STR	202	Classic	1	34.9	M-1 kiva below fireplace. Cloud blower.
22	6	STR	202	Classic	1	28.2	Box1386. Middle Kiva. 7" under ashpit. Cloud Blower.
48	4	STR	303	Classic	1	3.7	Clay Bell, back dirt from Kiva 1.
67	6	STR	107	Coalition	8	3.6	WW1. Level 9 (48–54"). 13/14. Chunks of white clay?
91	9	STR	110	Coalition	1	5.8	WW6. Clay cloudblower. Level 5: 24–30". Tri NW67"xSW140", west wall 61",depth 23" from NE corner.
91	6	STR	110	Coalition	1	152.2	WW6, Level 5, Awl sharpener of pottery (?).
102	2	STR	111	Coalition	1	12.2	Pottery cloud-blower pipe. “Found in test pit 30 in. below floor.”
121	1	STR	113	Coalition	1	3.0	WN1, 60"deep, beneath 2nd floor, “cloud blower” frag.
166	1	STR	127	Coalition	1	11.9	WN31, Level 5, 27" deep, “Wiyo bowl-ceremonial?”
190	3	STR	118	Coalition	1	9.6	WN11, Level 6, 30 1/2" deep, (floor), pipe.
223	1	STR	126	Coalition	1	1.0	WN30, cloud blower fragment, Level 2.
268	8	STR	135	Classic	1	1.8	East Plaza. Room 2. Level 3. Depth 14". Potential tip of cloud blower.

Appendix C

POLISHING STONES

PD	FS	Component	Condition	Material	Weight (g)	Field Notes (entered as written in original notes, except for standardizing measurement format)
Group 1: Pot Polishers						
38	4	Coalition	Complete	Quartzite	6.8	“pottery polisher.” West Plaza West Bank Rm 1. West Wall 93". RA 75" SW 100" 55" deep. 1 flat facet.
21	9	Classic	Complete	Quartzite	7.1	Kiva M-1 Floor. 1 rounded facet. Pot polisher.
272	15	Classic	Complete	Quartz	14.5	Long, "pencil" polisher for pottery. One polished, rounded end.
298	4	Coalition E	Complete	Quartzite	41.4	East Plaza, Room 6, Level 4 (18–24"). Pot polisher, multiple rounded facets.
296	7	Classic	Complete	Quartzite	44.3	East Plaza. South bank. Room 6. Level 5. Depth 28". Pot polisher, multiple rounded facets.
224	5	Coalition	Complete	Unknown	44.3	Depth 11.5". Pot polisher, 1 flat facet.
258	13	Classic	Complete	Basalt	47.7	East Plaza, South Bank, Room 1, Level 3. Pot polisher, many rounded facets.
295	17	Classic	Complete	Quartzite	51.9	East Plaza. Room 6. Level 4. Depth 20". Pot polisher, multiple rounded facets.
161	3	Coalition	Complete	Sandstone	57.3	WN27, 20/127, Level 9, floor. Pot polisher. 2 rounded facets.
295	13	Classic	Complete	Unknown	59.7	East Plaza. Room 6. Level 4. Depth 18". Pot polisher, multiple rounded facets.
258	12	Classic	Complete	Quartzite	61	Level 3 (12–18"); East plaza, South bank, Room 1.
296	5	Classic	Complete	Igneous	81.4	East Plaza. South bank. Room 6. Depth 28". Pot polisher, multiple rounded facets, striation wear.
61	3	Coalition	Complete	Igneous	81.5	West Plaza West Room 3 Level 3. Depth 9.5". Burned polishing stone. 2 flat facets.
295	14	Classic	Complete	Igneous	82.6	East Plaza. Room 6. Level 4. Depth 19". Battered on two ridges. Pot polisher, 2 rounded facets.
211	2	Coalition	Complete	Igneous	82.6	Depth 12.25”. 31” from SW corner, 118” from SE corner, 18.5” from south wall. Pot polisher, many rounded facets.
81	2	Coalition	Complete	Quartz	83.2	WW Room 5, Level 3, 12"–18". Pot polisher. 1 flat facet.

PD	FS	Component	Condition	Material	Weight (g)	Field Notes (entered as written in original notes, except for standardizing measurement format)
Group 2: Floor/plaster polisher						
296	6	Classic	Incomplete	Igneous	102.3	East Plaza. South bank. Room 6. Level 5. Depth 27". Floor/plaster polisher, 2 flat facets.
306	1	Coalition E	Complete	Quartzite	103.3	East Plaza, South Bank, Level VI (30–36"); both ends have been modified. Pot polisher, 2 rounded facets.
303	3	Classic	Complete	Basalt	118.6	East Plaza, Room 7, Level 3 (12–18"). Floor/plaster polisher, 2 flat facets.
258	2	Classic	Complete	Unknown	123.1	Room 1. Level 3. "No provenience." River cobble. Pot polisher, many rounded facets.
270	10	Classic	Complete	Quartzite	126.4	East Plaza, South Bank, Room 2, Level 5 (24–30"). Pot polisher? 1 rounded facet.
258	1	Classic	Complete	Unknown	126.6	Room 1. Level 3. "No provenience." River cobble. Pot polisher, 1 rounded facet.
274	5	Coalition E	Complete	Unknown	130.8	Level #9 (48–54"); East Plaza, South Bank, Room #2. Pot polisher. Multiple rounded facets, adhering material.
272	9	Classic	Complete	Basalt	131.5	East Plaza. South bank. Room 2. Level 7. Depth 37". Pot polisher? Battered on ridges. Multiple rounded facets, striation wear.
271	7	Classic	Complete	Basalt	134.5	East Plaza. South bank. Room 2. Level 6. 30–36". Depth 32.5" SE. Pot polisher? Many rounded facets.
302	1	Classic	Complete	Basalt	141	East Plaza. Room 7. Level 2. Depth 10.5". Floor/plaster polisher, 1 flat and 1 rounded facet.
151	4	Coalition	Complete	Granite	146.1	West Plaza North Bank Room 26, Level 7, 34" deep. 1 flat facet.
274	2	Coalition E	Complete	Unknown	146.2	Level #9 (48–54"); East Plaza, South Bank, Room #2. Floor/plaster polisher? Multiple rounded facets.
12	5	Coalition	Complete	Basalt	164.7	Kiva W3. Polishing Stone. Some red ochre is present. 2 flat facets.
218	3	Coalition	Complete	Sandstone	199.8	Depth 16". Floor/plaster polisher, 1 rounded facet.
310	2	Surface	Complete	Igneous	199.9	East Plaza. South bank. Level 5. Depth 24". Battered on several ridges. 2 lightly polished, rounded facets.
306	7	Coalition E	Complete	Quartzite	238.4	East Plaza. South Bank. Room 7. Level 6. Depth 32". Battered on one end. Floor/plaster polisher, 2 flat facets.
269	13	Classic	Complete	Igneous	242.1	East Plaza. South bank. Room 2. Level 4. Depth 21.5" SE. Red pigment on edges. Floor/plaster polisher, 1 flat facet, striation wear.
118	9	Coalition	Incomplete	Basalt	242.9	Depth 6" off floor. Floor/plaster polisher. One flat facet.

PD	FS	Component	Condition	Material	Weight (g)	Field Notes (entered as written in original notes, except for standardizing measurement format)
239	8	Coalition	Complete	Granite	306.1	West Plaza East Bank Room 5, Level II. Hide grinder, one rounded facet, some chemical wear.
192	4	Coalition	Complete	Igneous	328.2	Depth 15". Flat facets on both surfaces. Adobe floor grinder.
301	4	Classic	Incomplete	Igneous	408.7	East Plaza. South Bank. Room 7. Level 1. Depth 0–6". Battered on one end. Floor polisher, one flat facet, striation wear.
5	13	Coalition	Complete	Igneous	414.8	Called “polishing stone.” Kiva W4, Level 2. NW 227", SW 135", Depth 21.5", South wall 9". Artifact consists of an ovoid alluvial cobble. One face is ground to a flat facet.
123	2	Coalition	Complete	Granite	417.1	West Plaza North Bank Room 2, Level 2. Probable hide grinder/polisher, rounded facet.
307	8	Coalition E	Complete	Granite	431.9	East Plaza. South Bank. Room 7. Level 7. Depth 36.25". Hide grinder, 2 rounded facets, chemical wear.
269	5	Classic	Complete	Unknown	481	East Plaza, South Bank, Room 2, Level 4 (18–24"). Floor/plaster polisher, 1 flat and 1 rounded facet, striation wear.
306	8	Coalition E	Complete	Igneous	486	East Plaza. South bank. Room 7. Level 4. Depth 20.75". Two battered ridges. Floor/plaster polisher, 2 flat facets.
233	2	Coalition	Complete	Igneous	499.2	Floor polisher, one flat facet
61	4	Coalition		Igneous	574.5	West Plaza West Bank Room 3. Depth 10.5". Hide grinder? 2 rounded facets.
233	3	Coalition	Complete	Quartzite	595.1	Found with FS 2 listed above; see notes for FS 2 for location. Flat facets on both surfaces.
269	14	Classic	Complete	Basalt	639.8	East Plaza. South bank. Room 2. Level 4. Depth 23" SE. "Rhyolite floor polisher." 2 flat facets, striation wear.
			Group 3: Hide grinder with pigment			
237	4	Coalition	Complete	Granite	784.3	Level 5. Depth: 28". Probable hide grinder, 2 rounded facets, one with reddish staining.
191	1	Coalition	Complete	Unknown	884.6	Level 2. Depth 8". Possible hide grinder, one rounded facet with adhering hematite.
269	6	Classic	Complete	Granite	885.5	East Plaza, South Bank, Room 2, Level 4 (18–24"). Hide grinder, 2 rounded facets, some striations and chemical wear.
158	1	Coalition	Complete	Basalt	898.5	Depth 32". Probable hide grinder. 2 rounded facets, with hematite stains.
131	3	Coalition	Fragment	Igneous	903.7	West Plaza North Bank Room 7, Level III, Mano. Probable polisher/grinder, rounded facets on both surfaces.

PD	FS	Component	Condition	Material	Weight (g)	Field Notes (entered as written in original notes, except for standardizing measurement format)
36	7	Coalition	Complete	Igneous	906.6	West Plaza West Bank Room 1. Level 7. Hide polisher, 1 rounded facet, with hematite staining.
318	1	General	Complete	Metamor-phic	912.2	Probable hide grinder, rounded facet on one surface with reddish stain; SW 73", SE 48", N wall 22", depth 19.5".
51	2	Coalition	Complete	Unknown	952.9	“paint stone”? Depth 1". A hide grinder. Both surfaces covered with pigment, rounded facet on one side.
6	6	Coalition	Complete	Igneous	1383.1	Kiva W4, Level 3 (29"–40"), 74" NW corner, 60" W wall, 162" SW corner, 30 1/4 deep; “paint stone”. Hide grinding stone, one rounded facet with hematite staining.
141	4	Coalition	Complete	Quartzite	1453.4	Box 16B. 20/109. Depth 19". Probable hide grinder, one rounded facet with hematite.
189	6	Coalition	Complete	Igneous	1547	Depth 29". Possible plaster polisher, one flat facet, covered in red pigment, circular wear-marks.
191	9	Coalition	Complete	Granite	1567.6	Depth 7". Probable floor polisher with facet.
274	6	Coalition E	Incomplete	Basalt	1603	Level #9 (48–54"); East Plaza, South Bank, Room #2. Possible plaster polisher--one flat facet with red & white staining.
286	2	Classic	Complete	Granite	1775.8	East Plaza. South Bank. Room #5. Level 2. Depth 9.5". Three flat, very polished facets. One beveled surface, striation wear. Battered ridge on one end. Floor polisher.
136	3	Coalition	Complete	Granite	1920.2	Depth 44". Level 8. Plaster polisher? One flat facet with hematite staining.
202	1	Coalition	Complete	Igneous	1995.5	Depth 19". Probable hide grinder, one rounded facet covered in hematite.
68	3	Coalition	Complete	Basalt	2295.3	Cobble. 7.8” × 6.4” × 2.5”. West Plaza West Bank Room 3. Level 10. Floor. "Paint stone." Hide grinder, one rounded facet with hematite.
177	12	Coalition	Complete	Igneous	2684.5	Depth 24". One rounded facet with hematite. Probable bison hide grinder.
31	1	Coalition	Fragment	Unknown	3819.3	Level 2. Hide-working stone, probably for bison, 2 rounded facets, each with hematite staining.

Appendix D

OTHER MODIFIED STONE

PD	FS	Study Unit	Vertical Position	Component	Weight (g)	Notes (entered as written in original notes, except for standardizing measurement format)
5	42	103	Level 2	Coalition	1220.9	W4. Kiva. Depth 26". "Hoe with red ochre."
5	45	103	Level 2	Coalition	48.5	W4 Kiva. Depth 22". Groundstone scraper.
7	9	103	SR04-1	Coalition	2498.9	Cobble. Kiva W4. Possible lapstone, recorded as a paint stone in the field. 8.4" × 7.2" × 2.5".
32	4	104	Level 3	Coalition	1800	West Plaza West Bank Room 1. Level 3. Depth 7.5". "Paint stone". Smeared with hematite.
33	3	104	Level 4	Coalition	1702	West Plaza West Room 1. Level 4. Possible lapstone with hematite.
37	1	104	Level 8	Coalition	980.6	broken mineral stone. SW 4" NW 116" 42" deep.
52	3	106	Level 3	Coalition	663.3	Pot lid? Depth 9".
75	5	108	Level 5	Coalition	15.1	"Fetish". West Plaza West Bank, Room 4, Level 5, 23.5" deep. Quadruped in profile.
75	6	108	Level 5	Coalition	34.7	West Plaza West Bank Room, Level 5 (24–30) 21"deep. Drilled pendant?
98	2	111	Level 4	Coalition	1532.4	Cobble. Depth 14". "Paint stone." Covered with hematite. 7.6" × 5.6" × 1.4".
109	5	112	Level 8	Coalition	520.9	West Plaza West Room 10, Level 8. Pecked stone ball
118	10	113	Level 7	Coalition	972.1	Depth 60". Possible lapstone with hematite.
128	1	114	Level 7	Coalition	1730.1	Depth 36", Level 7. Possible lapstone. Smeared with hematite.
135	4	117	Level 7	Coalition	2814.8	Level 7. Possible lapstone with hematite.
136	2	117	Level 8	Coalition	665.6	Depth 43". Paint stone. Probable metamorphic stone.
139	10	121	Level 3	Coalition	274	Depth 8.5". Quartzite. Pecked stone ball
142	1	121	Level 6	Coalition	701.3	Level 6. Depth 28.75". Identified as "paint stone" on bag. Is smeared with hematite on several surfaces.
157	5	123	Level 5	Coalition	713.9	Depth 24". Potcover. Fire-altered, oxidized.
166	7	127	Level 5	Coalition	1079.4	Depth 29". Two-hand mano re-used as a paint stone or polishing stone for adobe/plaster. Hematite on one surface.
174	1	115	Level 1	Coalition	546.9	West Plaza North Bank Room 3, Level 1, 4.5" deep. "Paint stone--broken." May have been used to process red and white pigments.
180	5	115	SR00-1	Coalition	1728.6	Depth 36.5". "Wall plug." "Found directly below wall feature; communication or vent hole cover."
182	9	116	Level 3	Coalition	473.6	West Plaza North Bank Room 4, Level 3. Pecked stone ball.

PD	FS	Study Unit	Vertical Position	Component	Weight (g)	Notes (entered as written in original notes, except for standardizing measurement format)
187	2	118	Level 3	Coalition	3575.5	Cobble. Depth 16". 9.6" × 7.2" × 1.6". Recorded as a paint stone in the field, traces of red ochre on one face.
189	7	118	Level 5	Coalition	6450.0	Vesicular basalt. Depth 27". Possible lap stone with hematite.
205	1	120	Level 7	Coalition	389.8	Depth 34". Potential grinding stone. One concave pecked surface, smooth rounded facet on opposite surface.
213	4	124	Level 6	Coalition	201.3	West Plaza North Bank Room 28, Level 6, 25.5" deep, concretion. Probably a fetish collected for its unusual structure.
213	7	124	Level 6	Coalition	5.7	West Plaza North Bank Room 28, Level 6, 26" deep, "fetish?" Groundstone in the shape of a bone awl or spine.
240	5	131	Level 3	Coalition	48.1	Level 3. Depth 13". Possible paint stone.
242	4	131	Level 5	Coalition	257.2	West Plaza East Bank Room 5, Level 5. Possible lapstone with pigment.
251	2	133	Level 2	Coalition	353.1	West Plaza East Bank Room 7, Level 2, 6–12". Small amount of red ochre on artifact. Pecked stone ball.
275	2	135.1	Level 10	Coalition E	1200.2	East Plaza, South Bank, Room 2, Level 10, 54–60". "Paint stone;" hematite present on surface of stone.
306	6	139.1	Level 6	Coalition E	96.9	East Plaza, South Bank, Room 7, Level 6, 30–36". Small square shape, maybe fragment of groundstone.
2	21	201	Modern Ground Surface	Classic	12.1	East Plaza, middle east mound. Surface. Volcanic tuff vessel.
3	31	301	Modern Ground Surface	Classic	91.7	Ground and/or polished alluvial cobble. From "lithics" bag.
3	44	301	Modern Ground Surface	Classic	58.7	Surface, east Plaza, south roomblock. "Lightning Stone."
21	19	202	SR00-1	Classic	7.3	"Bones and stuff." "floor." Kiva M1. Piece of rock?
30	6	302	Full Cut	Classic	66.4	May be ground or polished.
46	4	303	Level 1	Classic	33	Lightning stone. No clear facets.
261	2	134	Level 6	Classic	8.2	E. Plaza, S. bank, Rm. 1, Lv. 6, 16" SW corner, 6" S. wall, 34" deep. Fetish?
266	2	135	Level 1	Classic	201.7	East Plaza, Surface, Room 2. Pecked stone ball.
267	3	135	Level 2	Classic	166.2	East Plaza, South Bank, Room 2, Level 2, Depth 38" SE. Pecked stone ball. Round to cubic in shape.

PD	FS	Study Unit	Vertical Position	Component	Weight (g)	Notes (entered as written in original notes, except for standardizing measurement format)
269	16	135	Level 4	Classic	19.2	East Plaza, South Bank, Level 4, Depth 22". Fetish, appearance of a champagne cork, banded siltstone with transverse banding. Possibly dolomite.
269	12	135	Level 4	Classic	147.8	East Plaza, Room 2, Level 4, Depth 19.75" SE. Pecked stone ball.
269	10	135	Level 4	Classic	255.1	East Plaza, Room 2, Level 4, Depth 23" NE. Pecked stone ball.
269	11	135	Level 4	Classic	142.9	East Plaza, South Bank, Room 2, Level 4, Depth 18" SE. Pecked stone ball.
270	8	135	Level 5	Classic	626	Level 7 (36–42"), East Plaza, South Bank, 24" Depth, "Shaft Abrader," groove is 0.6" wide × 11" long, widening to 2" at one end, burned vegetal material adhered to the bottom (see FS 9).
271	3	135	Level 6	Classic	528.6	East Plaza, South Bank, Room 2, Level 6, 30–36". Pedernal chert. Pecked stone ball.
276	3	136	Level 1	Classic	67.8	East Plaza, South Bank, Room 4, Level 1, 0–6". Hughes and Romero. Two pieces Selenite, 14" E wall, 10" N wall, 15" NE corner.
281	9	136	Level 6	Classic	0.2	Greenish stone, probably turquoise or azurite.
282	8	136	Level 7	Classic	282.6	East Plaza, South Bank, Room 4, Level 7, 36–42". Hughes and Romero. Hammerstone, 24" SE corner, Abutting E wall, 37" deep. Shaped, ground into sphere. Fire-blackened.
290	5	137	Level 6	Classic	528.1	East Plaza, South Bank, Room 5, Level 6, Depth 31.5". Shaft straightener. Two grooves. One raised ridge perpendicular to grooves.
293	5	138	Level 2	Classic	71.8	East Plaza, Room 6, Depth 10.5". "Lightning stone."
295	22	138	Level 4	Classic	6.1	Removed from PD 295 FS 7. Small, with a ground edge.
297	8	138	Level 6	Classic	159.9	East Plaza, Room 6, Level 4, Depth 21". "Fetish" of vesicular basalt. Looks like two stacked donuts with decreasing diameter, dimple at top and bottom end.
301	1	139	Level 1	Classic	10.6	East Plaza, South Bank, Room 7, Level 1, 0–6". Modified calcite.
302	4	139	Level 2	Classic	154.0	East Plaza, Room 7, Level 2, Depth 12". Labeled a "paint–grinding stone" in the field. Many ground facets with different shapes. Stone is red siltstone.
302	7	139	Level 2	Classic	17.1	East Plaza 7, Level 2. "Polishing Stone"
311	5	000	Level 7	General	148.7	East Plaza, South Bank, Level 7, Depth 41". "Paint stone." Has red pigment on one face. Appears to have been used for grinding a red mineral pigment.

Appendix E

CATALOGUE OF SAMPLES

Component	Study Unit	PD	FS	Sample Type	Weight (g)	Comments (as written on the sample bag, except for standardized measurement formats)
Coalition	101	1	35	Pollen	17.9	W1 Test trench, Original plaza level.
Coalition	101	1	36	Pollen	23	W1 Test trench, Plaza abandonment level.
Coalition	102	12	8	Sediment	23.7	Kiva W3, fill 3" below floor, test pit.
Coalition	102	12	9	Pollen	15.5	Kiva W3, fill floor context, pollen sample.
Coalition	102	12	12	Pollen	25.6	Kiva W3, floor top, 37/92, pollen sample.
Coalition	102	13	6	Tree-ring	174.1	Kiva W3, Fire pit (below ash).
Coalition	102	13	7	Pollen	14.1	Kiva W3, firebox 8" below rim, pollen sample.
Coalition	102	13	10	Pollen	10.8	Kiva W3, fire pit 1" below rim, pollen sample.
Coalition	102	14	5	Pollen	24.2	Kiva W3, from sipapu under fire pit, pollen sample.
Coalition	103	6	7	Tree-ring	988.2	Dendro in adobe. Kiva W4, Level 3 (28–39), 29" deep, 15.5" NW, 17" SW, 12" W.
Coalition	103	7	6	Pollen	16.9	Kiva W4. Pollen Sample.
Coalition	103	7	11	Pollen	16.7	Kiva W4, Below floor.
Coalition	103	9	6	Pollen	9.8	Kiva W4 Outside. Firepit ash/pollen sample.
Coalition	103	9	7	Pollen	18.3	Kiva W Corner of firebox. Pollen sample.
Coalition	103	9	8	Pollen	8.1	Kiva W4 Outside. Ash/Pollen sample.
Coalition	103	9	9	Sediment	No data	Kiva W4. 32" below firepit top, under small cobble in hole.
Coalition	104	38	5	Pollen	10.2	WW1 Level 9. 2nd floor.
Coalition	104	38	6	Pollen	11.7	WW1 Level 9.
Coalition	104	38	7	Pollen	13.8	WW1 Level 9. Below 2nd floor.
Coalition	104	38	8	Pollen	12.8	WW1 Level 9. Between 1st & 2nd floor.
Coalition	106	57	4	Pollen	17.9	WW Level 2. Pollen floor sample.
Coalition	106	58	6	Sediment	No data	WW2. Level-2nd floor. Tri: SW59"×NW140" West wall 61". Depth 50.5".
Coalition	106	58	7	Pollen	11.2	WW2. Floor pollen sample. Tri: NW120"xSW137". West wall 111" and 45" deep.
Coalition	106	59	4	Sediment	No data	WW2: Level 2nd floor. 4 1/2" down. Tri SW 59" x NW 140". West wall 61". Depth 52 1/2".

Component	Study Unit	PD	FS	Sample Type	Weight (g)	Comments (as written on the sample bag, except for standardized measurement formats)
Coalition	106	59	5	Sediment	No data	WW2, below 1st floor, above 2nd floor, 1.25" below 1st floor and 1.5" above 2nd floor. Tri: SW59"×NW140". West wall 61", depth 49.25".
Coalition	107	69	3	Pollen	5.5	West Plaza, West Bank Room 3, 0" floor.
Coalition	107	69	4	Sediment	3.5	WW Room 3 Level Floor. Turkey dung. Floor sample.
Coalition	107	71	3	Pollen	19.9	West Plaza West Bank Room 3, 1.25, under floor.
Coalition	108	76	12	Sediment	No data	WPW. Level 6. 30-36". "Turkey dung."
Coalition	108	78	4	Pollen	18.7	WW4, Level 8, floor.
Coalition	109	87	3	Pollen	18.9	Pollen sample.
Coalition	109	87	4	Pollen	11	Pollen sample.
Coalition	109	87	5	Pollen	14.6	Pollen sample.
Coalition	111	100	4	Pollen	10.5	WW7 Below floor 31". Pollen analysis. NW 72" SW 66" WW 48".
Coalition	111	101	1	Pollen	18.4	WW7 2" above floor. 27" deep. NW 31", SW 94", West Wall 29". Pollen sample.
Coalition	111	101	2	Pollen	13	WW7 floor level. 29" deep. NW 31", SW 94", West Wall 29". Pollen sample.
Coalition	112	110	4	Pollen	14.5	
Coalition	112	111	2	Pollen	20.2	WW10, 1" below floor.
Coalition	113	118	7	Pollen	80.6	WN1, floor level, south half of room.
Coalition	113	119	2	Radiocarbon	3.3	WN1, between 1st and 2nd floor, from central western part of room, 46" deep.
Coalition	113	119	3	Pollen	38.1	WN1, 2nd subfloor level.
Coalition	113	119	4	Pollen	10	WN1, under first floor level (cyst), pollen sample from pot.
Coalition	113	120	1	Pollen	29.6	WN1, 2nd floor level, firepit.
Coalition	114	128	5	Radiocarbon	32.4	WN2, Level 7, 41.5" deep.
Coalition	114	128	6	Radiocarbon	7.1	WN2, Level 7, 36" deep.
Coalition	114	128	7	Pollen	32.1	WN2, ground floor.
Coalition	114	129	1	Sediment	No data	WN2, test pit.
Coalition	115	175	2	Sediment	No data	Large piece of dung. 10.5" deep SE corner, 34.5" SE corner, 15.5" south wall, 104.75" SW corner; dung size: 4.5 × 3 × 1.5".
Coalition	115	180	1	Pollen	50	WN3, above floor, "few inches west of pot."
Coalition	115	180	6	Pollen	64.1	Str 115, Firebox WN3, 0.4"–0.75".
Coalition	116	185	2	Pollen	102.8	WN4, floor level, 30.5" deep.

Component	Study Unit	PD	FS	Sample Type	Weight (g)	Comments (as written on the sample bag, except for standardized measurement formats)
Coalition	117	137	3	Pollen	15.6	WN7, below floor.
Coalition	118	189	4	Radiocarbon	4.7	WN11, Level 5, 13/7, charcoal with turkey bones, 25" deep.
Coalition	119	191	6	Sediment	No data	WN16, 36/4, Level 2, 4.5" deep.
Coalition	119	194	14	Sediment	No data	WN16, crushed red ochre, Level 5, 36/51, 24" deep.
Coalition	119	198	2	Pollen	104.3	WN16, 37/73, from fill above floor.
Coalition	119	198	3	Pollen	109	WN16, 37/74, from floor contact.
Coalition	119	199	1	Pollen	90.4	WN 16, 37/75, sub-floor.
Coalition	120	207	1	Pollen	103.8	WN17, 13/22, ash and adobe from firepit.
Coalition	120	208	1	Pollen	89.8	WN17, 37/52, floor contact, 40" deep from NE corner.
Coalition	120	208	4	Pollen	90.2	Test pit under 2nd floor.
Coalition	120	208	5	Pollen	68.8	Floor 1, Str 120, WN17.
Coalition	120	208	6	Pollen	85.6	Floor II, WN 17.
Coalition	121	143	5	Radiocarbon	10.3	WN18, Level 7, 13/52, 33" deep.
Coalition	121	144	1	Pollen	86.3	WN18, Level 8 (40–45), 38" deep.
Coalition	121	144	2	Pollen	118.3	WN18, Level 8 (40–45), floor pollen sample.
Coalition	121	144	7	Radiocarbon	19.2	WN18, 13/20, Level 8, 37" deep.
Coalition	121	145	1	Pollen	75.7	WN18, test pit, 8" below floor level, from ash layer in test pit.
Coalition	122	150	6	Pollen	95.1	Depth: 34".
Coalition	122	153	1	Pollen	69.4	WN26, from east edge of test pit, 2" below floor.
Coalition	122	153	2	Pollen	105.2	WN26, from floor and south edge of test pit.
Coalition	123	156	4	Pollen	37	Level 1 (0–6"), 2" deep, Test Pit.
Coalition	123	159	5	Sediment	22.9	Turkey dung samples. WN27, Level 7, 34" deep, 13/13, associated with unfired sherd.
Coalition	123	160	4	Radiocarbon	17.2	WN27, Level 8, 48" deep, associated with burn area to the west.
Coalition	123	161	1	Pollen	77.7	WN27, above floor.
Coalition	123	161	2	Pollen	114.8	WN27, floor.
Coalition	123	162	1	Pollen	106.5	WN27, ash lens, test pit, 7" below floor.
Coalition	124	215	2	Pollen	15.4	WN28, above floor, 38.25” from SE corner.
Coalition	124	215	3	Pollen	13.8	WN28, floor contact, 41" deep.
Coalition	124	215	5	Pollen	9.2	WN28, below floor, 43.25" below.
Coalition	125	222	1	Pollen	17.8	WN29, fill above floor.
Coalition	125	222	2	Pollen	18.5	WN29, floor plaster, floor contact.
Coalition	125	222	3	Pollen	12.4	WN29, sub-floor pollen.

Component	Study Unit	PD	FS	Sample Type	Weight (g)	Comments (as written on the sample bag, except for standardized measurement formats)
Coalition	126	224	1	Sediment	1.1	Turkey dung. WN30, Level 3, 11.25" deep.
Coalition	126	227	2	Pollen	11.9	WN30, below floor.
Coalition	126	227	3	Pollen	21.3	WN30, floor.
Coalition	127	168	3	Pollen	35.8	WN31, test pit, below floor.
Coalition	128	173	1	Pollen	24.1	WN33, sterile soil sample.
Coalition	129	231	3	Radiocarbon	18.1	WN34, Level 4.
Coalition	131	243	4	Pollen	12.3	East Plaza. WE5, below floor, hearth, Depth 36".
Coalition	131	243	5	Pollen	27.2	East Plaza. WE5, above floor, hearth, Depth 36".
Classic	135	272	13	Sediment	No data	East Plaza, South Bank, Room 2, Level 7 (36-42"); three bags of soil with basket impressions, 5 rows/inch, 12 stitches/inch, 3-rod construction.
Classic	136	276	4	Pollen	25.3	ES 4. Depth 51".
Classic	138	294	8	Sediment	No data	East Plaza, Room 6, Level III (12-18"); sand found beneath pot fragment.
Classic	201	2	44	Pollen	22.7	Kiva W4, 3" below floor, Pollen test pit.
Classic	202	21	6	Sediment	No data	50 ml. 58.7g. Kiva M1. Floor. Associated with human remains 1 WH.7.2.E.
Classic	303	49	2	Sediment	26.4	East Plaza Kiva 1, fire pit, “ash/pollen sample.”
Surface	000	0	6	Sediment	No data	(no more info available)
Surface	000	0	11	Tree-ring	No data	Unknown provenience, “charcoal lump for dating.” (no other info available). MISSING

Appendix F

ASSEMBLAGES FROM EXCAVATED STRUCTURES

Coalition Period Structures		102	103	104	108	109	110	111	112	113	114	115	116	117	118
Pottery	Bowl	176	886	166	93	24	180	61	73	212	28	68	45	27	74
	Canteen/mug													1	
	Jar	3	28	15	9	4	9			5		4	24	1	
	Ladle		3	1		1									
	Cooking pot	416	1732	304	350	165	719	121	207	482	245	548	232	128	157
	Glaze ware	1	1							1					
	Modified sherd		1						1						
	Shaped sherd			1		1									
Bone Tools	Awl	4	5	5	3	2	1				3	1			1
	Needle	1													
	Drill		1									1			
Orna-ments	Bead	1									1				
	Bone tube	3			2	1						1			
	Pendant										1	2			
Faunal Remains	Bear														
	Artiodactyl	4	21		1		2		2		1				
	Deer size or smaller	6	13	5	3	2	2				2		1	1	1
	Fox size or larger											1			
	Cottontail	2	4												
	Jackrabbit or hare	1	8												
	Jackrabbit size or smaller	1	1												
	Turkey/large birds	6	17		1										
	Golden eagle		1												
	Turkey vulture		1												

Coalition Period Structures		102	103	104	108	109	110	111	112	113	114	115	116	117	118
Chipped Stone Debris	Basalt	4	3				4			4		2	1		
	Igneous										3				
	El Rechuelos obsidian	2	2						1	1			1		
	Jemez obsidian	1								1	1	1		2	
	Gray chert	1			2										
	Pedernal chert	123	85	7	18	1	18	2	9	92	18	74	12	26	19
	Quartz	1	1				3			2				1	
	Quartzite	1	3	1			2		1	4					1
	Other chert	1	2				2		1	2		1		1	2
	Silicified sandstone		1							3	1	6			
Chipped Stone Tools	Biface	2	2	1	2								2	2	
	Projectile point	1	1		1	2				1		1			1
	Chipped-stone tool	2	4												
	Core	4	4							4		1		1	
Ground Stone Tools	Griddlestone	1	1	1	1							1			
	One-hand mano														
	Two-hand mano	2	6	1	1		4	3	3	2	2	2	1	3	1
	Abrader			1					2			1		3	1
Pecked-polished Stone Tools	Axe	1	1												
	Axe/maul		2								1				
	Hammerstone			1											
	Maul	1					1								
	Floor/plaster polisher	1	1							1	1				
	Hide grinder		1	2								1		2	1
	Pot polisher			1		1									
Total		774	2843	513	487	204	947	187	300	817	308	717	319	199	259

Coalition Period Structures		119	121	122	123	124	125	126	127	128	129	130	131	132	Total
Pottery	Bowl	33	101	41	59	57	43	48	68	181	116	122	51	97	3130
	Canteen/mug								1		1	1			4
	Jar		10	2	8	6			1	9	3	11		2	154
	Ladle										1				6
	Cooking pot	164	453	100	153	504	289	127	417	282	142	964	86	395	9882
	Glaze ware									1					4
	Modified sherd			1						1			1		5
	Shaped sherd														2
Bone Tools	Awl	8	1			2			1		1	1	1		40
	Needle									1					2
	Drill			1											3
Orna-ments	Bead		1												3
	Bone tube					2			2						11
	Pendant	1						2	6						12
Faunal Remains	Bears														0
	Artiodactyl	2	1			1				1		1	1		38
	Deer size or smaller	8	4			1	1		1	1				1	53
	Fox size or larger												1		2
	Cottontail												1		7
	Jackrabbit or hare										1				10
	Jackrabbit size or smaller													1	3
	Turkey/large birds		1			2			1						28
	Golden eagle														1
	Turkey vulture														1
Chipped Stone Debris	Basalt	1				1		1			5	1	3		30
	Igneous	1	2				1				1		1		9
	El Rechuelos obsidian	1	1	1					4			1			15
	Jemez obsidian	3	1												10
	Gray chert								2						5
	Pedernal chert	17	31	2	18	11	14	4	23	20	23	2	21	18	708
	Quartz		1								1				10
	Quartzite					1	1		1	2	1		4		23
	Other chert	1			1		1		1					1	17
	Silicified Sandstone	1	3		1					4			3		23

Coalition Period Structures		119	121	122	123	124	125	126	127	128	129	130	131	132	Total
Chipped Stone Tools	biface				3	1		1					1	2	19
	projectile point						2		2		1		1	1	15
	chipped-stone tool												3		9
	core	1					1		1	1	1				19
Ground Stone Tools	griddlestone	2	2				1								10
	one-hand mano	1	1												2
	two-hand mano	5	4	6	2	1	2	1					1		53
	abrader	1													9
Pecked-polished Stone Tools	axe			2					1				1	1	7
	axe/maul						1	1	1						6
	hammerstone							1					1		3
	maul		1				1								4
	Floor/plaster polisher	1		1			1					2	1		10
	Hide grinder	2	1		1										11
	Pot polisher				1	1		1							5
Total		254	620	157	247	591	359	187	534	504	298	1106	183	519	14433

Classic Period Structures		134	135	136	137	138	139	202	203	302	303	Total
Pottery	Bowl	236	317	313	211	550	215	41	56	1254	160	3353
	Canteen/mug											0
	Jar	130	166	189	124	173	111	2	3	362	27	1287
	Ladle										1	1
	Cooking pot	330	1249	479	510	983	386	27	96	580	112	4752
	Glaze ware	6	2	19	9	26	4	1		41	2	110
	Modified sherd	1	5	3	2	2	6			2		21
	Shaped sherd	2	1	2		3	1			5		14
Bone Tools	Awl		1	1	3	2	1	1			2	11
	Needle											0
	Drill				1							1
Orna-ments	Bead			4				1				5
	Bone tube										1	1
	Pendant			2		1		1				4
Faunal Remains	Bear									1		1
	Artiodactyl		1		1	5				17		24
	Deer size or smaller			1	1	2	1		1			6
	Fox size or larger											0
	Cottontail				2	2				1		5
	Jackrabbit or hare											0
	Jackrabbit size or smaller											0
	Turkey/large birds				1	5		2		1	4	13
	Golden eagle											0
	Turkey vulture											0
Chipped Stone Debris	Basalt	1	2			5				8	1	17
	Igneous		1							2		3
	El Rechuelos obsidian	2	2		6	3	4	2		2	2	23
	Jemez obsidian	3			5	2	2	7		2	3	24
	Gray chert				3	3	1			2		9
	Pedernal chert	16	62	3	104	95	20	40	1	50	51	442
	Quartz				1	2			1		1	5
	Quartzite	1	2			4		4		1	3	15
	Other chert	1	3	1	2	1		1		1		10
	Silicified sandstone		1		8	5	3				3	20

Classic Period Structures		134	135	136	137	138	139	202	203	302	303	Total
Chipped Stone Tools	Biface			2				2			1	5
	Projectile point			2		2	1					5
	Chipped stone tool				2							2
	Core	3	2	1			2	1				9
Ground Stone Tools	Griddlestone		1									1
	One-hand mano										1	1
	Two-hand mano		1	1								2
	Abrader		2			1	1					4
Pecked-polished Stone Tools	Axe	1	1			3					1	6
	Axe/maul											0
	Hammerstone	1	1	1								3
	Maul											0
	Floor/plaster polisher	2	6			1	3					12
	Hide grinder		1		1							2
	Pot polisher	2	1			5		1				9
Total		738	1831	1024	997	1886	762	134	158	2332	376	10238