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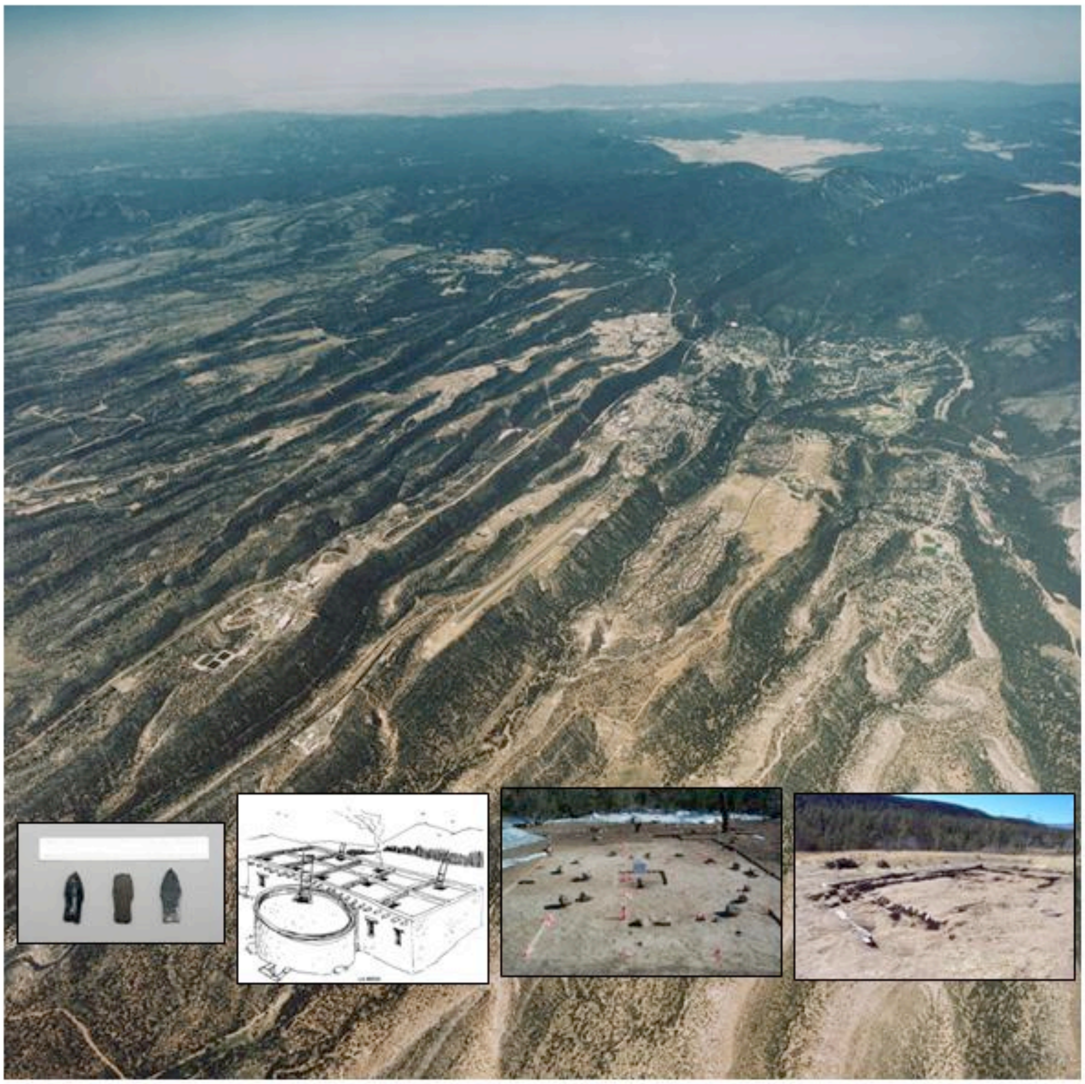
THE LAND CONVEYANCE AND TRANSFER DATA RECOVERY PROJECT: 7000 YEARS OF LAND USE ON THE PAJARITO PLATEAU



VOLUME 4: RESEARCH DESIGN

Edited by Bradley J. Vierra and Kari M. Schmidt

Ecology and Air Quality Group, Los Alamos National Laboratory

June 2008

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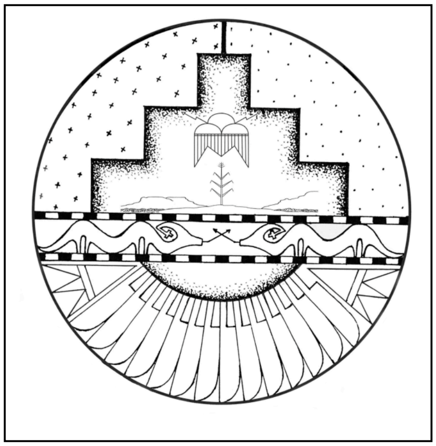

Artistic representation of the Pajarito Plateau; drawn by Aaron Gonzales.

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Title

THE LAND CONVEYANCE AND TRANSFER DATA RECOVERY PROJECT: 7000 YEARS OF LAND USE ON THE PAJARITO PLATEAU

Volume 4: Research Design

Cultural Resources Report No. 273

Prepared for

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Los Alamos Site Office

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June 2008

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CHAPTER 73
INTRODUCTION TO VOLUME 4

Bradley J. Vierra

The Land Conveyance and Transfer (C&T) Project data recovery program was implemented for seven archaeological sites in the White Rock Tract (A-19), five archaeological sites in the Airport Tracts (A-3, A-7, A-5-1), and 27 archaeological sites in the Rendija Tract (A-14). The results of the four-year excavation project were presented in Volumes 1, 2, and 3. Excavations were conducted from 2002 to 2005; thirty-nine archaeological sites were excavated and approximately 150,000 artifacts were collected. Volume 1 (Baseline Studies) included background information on the geology, geomorphology, and environment of the Pajarito Plateau, as well as on general dating techniques. Volume 2 (Site Excavations) presented the site excavation reports for the White Rock, Airport, and Rendija tracts and the results of site testing for the Technical Area 74 and White Rock Y tracts. Volume 3 (Analyses) provided the detailed results of artifact and sample analyses. This volume (Research and Conclusions) provides various specialized studies and answers to the final project research questions.

The C&T Project data recovery program involved the collection of data necessary to answer a series of detailed research questions as provided in the data recovery plan (Vierra et al. 2002). The data recovery plan presented a set of research contexts that consists of chronometrics, geoarchaeology, paleoenvironment, land-use, community and site organization, subsistence and seasonality, and technology, production, and exchange. These questions laid the ground work that guided the excavation of 39 archaeological sites ranging in age from Early Archaic campsites to Coalition period roomblocks to a Homestead era cabin. Chapter 85 presents the conclusion to this project by addressing the research questions.

As noted in the introduction to Volume 2 (Chapter 13), this project involved the hard work of many individuals. The majority of the field staff was comprised of graduate students, with several members of the project conducting their dissertation research on these data. The results of their research are presented here, in conjunction with several chapters involving project data. Vierra and Balice's chapter (Chapter 82), however, was written as part of the post-Cerro Grande fire archaeological site assessment. It is included here due to the potential effects of wildfires on obsidian hydration dating and includes data from the Rendija Tract. Overall, a wide range of topics are discussed in Volume 4, including Archaic foraging technology, prehistoric and historic ceramic production and exchange, prehistoric agriculture, trail systems, rock art, and the results of the project's site rehabilitation program. The information presented in Volumes 1 through 4 provides the data necessary to summarize and address the project research questions.

Finally, the C&T Project data recovery program involved a close working relationship with the affiliated tribal governments. The Pueblos of San Ildefonso and Santa Clara provided monitors to observe the excavations, identify sacred objects, and supervise the treatment of human remains. These monitors provide their own individual perspectives on the process of excavation, tribal consultation, and repatriation in this volume (Chapter 84). An open and fair dialogue was critical to the success of the project and has led to a strong working relationship between Los

Alamos National Laboratory and the Pueblos. As the Lieutenant Governor of Santa Clara once stated, “our ancestors have always watched over us, now it is our turn to take care of them.”

CHAPTER 74
ARCHAIC FORAGERS OF THE NORTHERN RIO GRANDE VALLEY, NEW MEXICO

Bradley J. Vierra

INTRODUCTION

The Pajarito Plateau is a unique geologic feature situated within the larger northern Rio Grande Valley. Archaic foragers roamed over this ancient landscape while hunting and gathering a variety of plant and animal species. These annual rounds involved a seasonal pattern of movement up and down the valley and between lowland and upland areas. This chapter presents the results of a preliminary study of the possible relationship between changes in climate, resource structure, foraging strategies, and Archaic projectile point technology in the northern Rio Grande Valley.

The northern Rio Grande Valley includes an area from the San Luis Valley and adjacent foothills of the San Juan Mountains to the north to the Santa Fe area and the Jemez Mountains in the south. From tundra and high mountain meadows in the San Juan and Jemez Mountains, to the marshes and grasslands of the San Luis Valley, to the piñon-juniper covered mesa tops, the region contains a diverse array of resources across elevations ranging from about 1600 to 4260 m (5200 to 14,000 ft). Lithic raw materials also abound in the area, including obsidian, fine-grained dacite, chalcedony, chert, and quartzite.

In order to spatially delineate the sample, I divided my study area into three separate zones (Figure 74.1). Zone 1 is located at the southern end of the region and includes the Santa Fe-Abiquiu area; Zone 2 includes the Taos-Tres Piedras area; and Zone 3 consists of the San Luis Valley and the Rio Grande headwaters. Zone 3 was included in a previous study conducted by Vierra et al. (2005) for the Late Paleoindian and Early Archaic time periods. In contrast, this study will focus on the Early, Middle, and Late Archaic periods in Zones 1 and 2. One hundred and thirty-nine Early Archaic, 87 Middle Archaic, and 172 Late Archaic projectile points provide the database used for this study. Figure 74.2 illustrates the frequency distribution across the 10 separate point types identified.

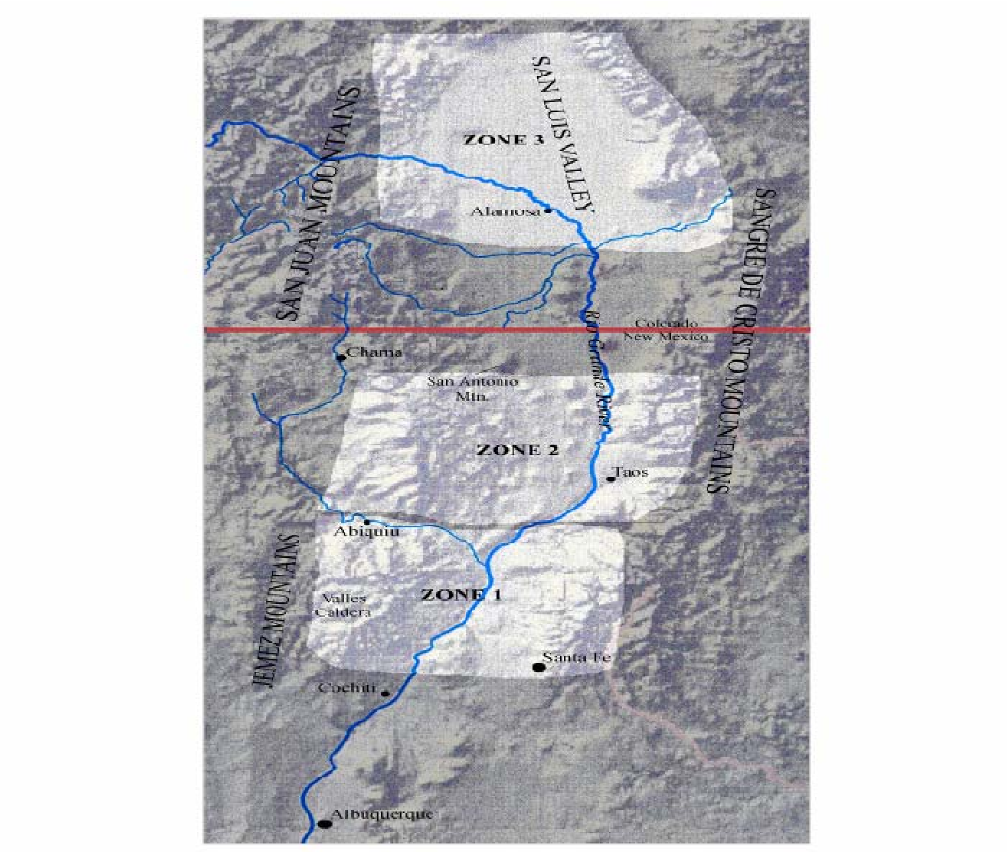


Figure 74.1. Location of study area Zones 1 to 3.

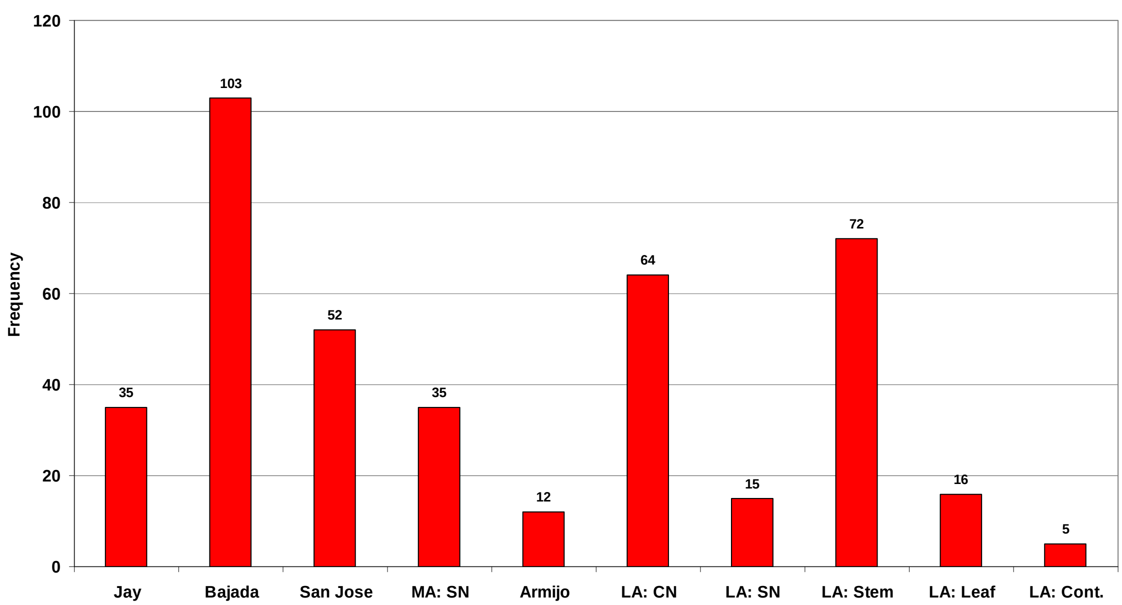


Figure 74.2. Distribution of Archaic point types.

ARCHAIC CHRONOLOGY AND ENVIRONMENT

The projectile point chronology used in this study follows the defined Oshara Tradition sequence (Irwin-Williams 1973). However, I would suggest a date range of circa 8000 to 6000 BP for the Early Archaic, 6000 to 4000 BP for the Middle Archaic, and 4000 to possibly as late as circa 900 BP for the Late Archaic (Vierra and Ford 2007). The Early Archaic includes Jay and Bajada points, the Middle Archaic consists of San Jose and possibly large side-notched points, and the Late Archaic includes Armijo and five other distinctive point types. These latter types consist of corner-notched, side-notched, stemmed, leaf-shaped, and contracting stemmed varieties. The exact temporal placement of these large side-notched points is unclear in this region; however, my review of the literature indicates that the radiocarbon dates, obsidian hydration data, and relative stratigraphic sequence data primarily indicate a Middle Archaic temporal designation (Vierra 1993a) and as such the points will tentatively be assigned to this period.

A review of documents at Eastern New Mexico University indicates that a range of radiocarbon dates were obtained during Irwin-Williams' Anasazi Origins Project near Albuquerque, New Mexico (Vierra 1996). These dates are illustrated in Figure 74.3, with a Late Paleoindian and Early Archaic date cluster between about 9000 to 6000 BP (uncalibrated), followed by a second cluster of Middle Archaic dates between 6000 and 4000 BP, followed by a continuous occupation from Late Archaic through the Ceramic period.

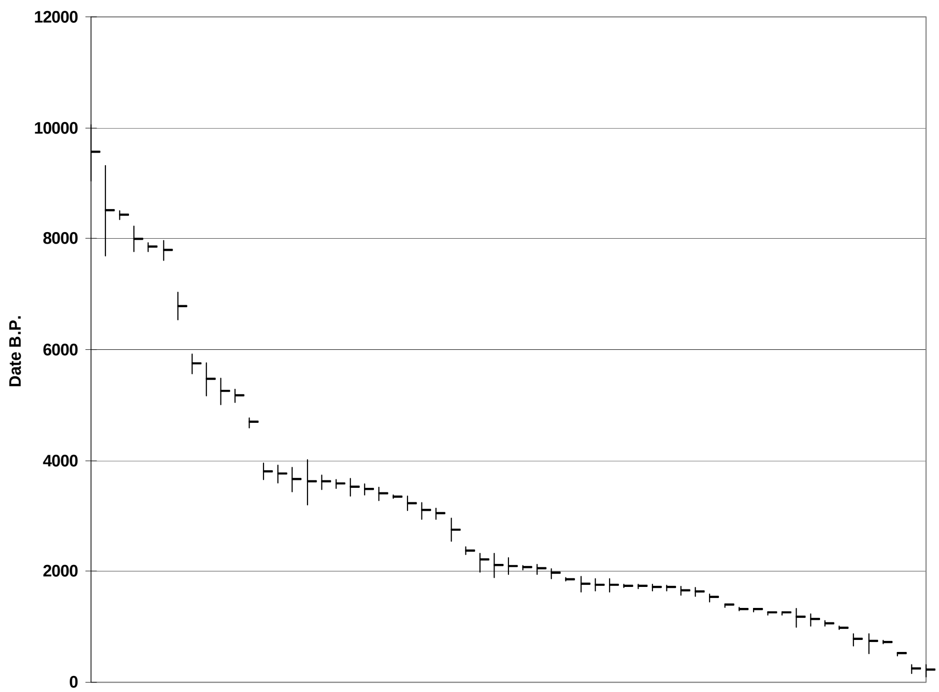


Figure 74.3. Radiocarbon dates from the Anasazi Origins Project.

Recent studies by Scott Anderson (Chapter 5, Volume 1; Anderson et al. 2007; Brunner-Jass 1999) and his students of pollen cores in the Jemez Mountains indicate that these Late Paleoindian and Early Archaic dates are separated by a period of decreased effective moisture when the Chihuahueños Bog had dried up from circa 8000 to 6500 BP. Pollen cores from basin lakes in the San Luis Valley show a similar trend with a decline in lake and creek levels after about 8000 BP and a period of least effective moisture at roughly 6500 BP (Jodry 1999; Jodry and Stanford 1996; Shafer 1989). This obviously had a significant effect on the Early Archaic foragers in the area, with their settlement system shifting to a north-south pattern within the northern Rio Grande Valley (Vierra et al. 2005). A variety of large, medium, and small size game was hunted, including evidence for bison hunting and fishing in the San Luis Valley (Jodry 2006; Vierra and Ford 2007).

There is evidence for moister conditions and the expansion of piñon-juniper woodlands in the northern Rio Grande Valley during the subsequent Middle Archaic (6000 to 4000 BP). This evidence is represented by increased percentages of piñon pollen at circa 4500 BP at Chihuahueños Bog, 4300 BP at Alamo Bog, and 4000 to 3500 at Alta Alamo Bogs (Chapter 5, Volume 1; Anderson et al. 2007; Brunner-Jass 1999; Stearns 1981). However, this pattern is clearly illustrated in a pollen diagram from the Anasazi Origins excavations at Collier Dune near Albuquerque (Figure 74.4). This diagram shows a marked shift from grassland to piñon-dominated pollen at about 4500 BP (Vierra 1997). It may be during the Middle Archaic that fall hunts in the Rio Grande Valley were becoming less successful, so these hunter-gatherers would have shifted their residence to the uplands where they could collect piñon nuts and hunt deer. Rather than dried bison meat, stored piñon nuts might have provided an important source of protein during the winter months (Vierra 2005a).

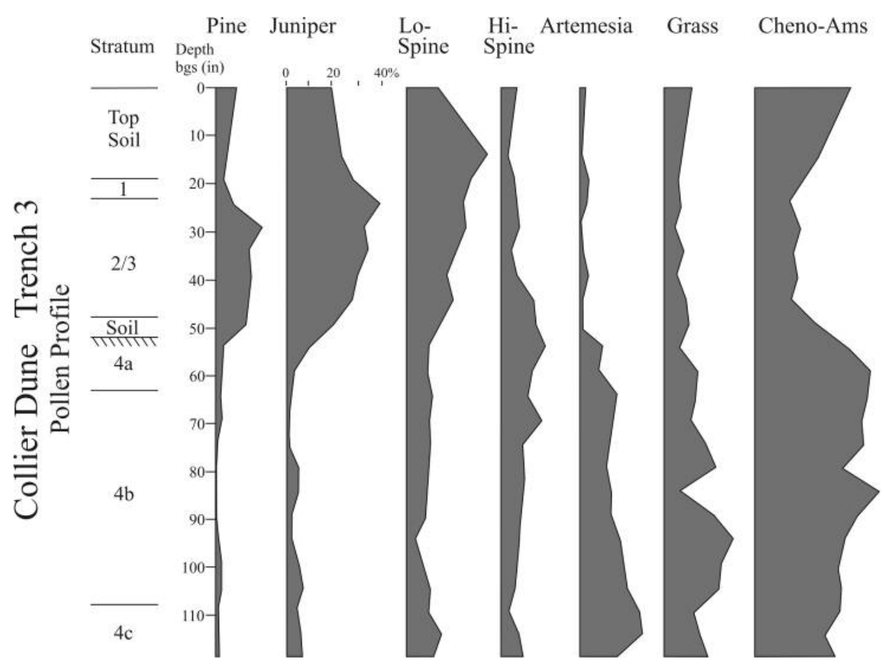


Figure 74.4. Collier Dune pollen profile.

The initial use of maize agriculture is dated to about 3000 BP during a period of increased effective moisture (Smith and McFaul 1997; Vierra and Ford 2006, 2007) (Figure 74.5). These moister conditions continue until about 2200 BP with the onset of drier conditions. The cyclical nature of the rainfall conditions during the subsequent time period has been described in the El Malpais data (Grissino-Mayer 1996). Late Archaic land-use appears to be characterized by a lowland/upland pattern within restricted areas of the Rio Grande Valley**.** This involved movements from the juniper-savanna in the early summer (Indian ricegrass), to the ponderosa pine/mixed conifer in the mid to late summer (cheno-ams, wild onions, berries, and wild potatoes), and then down to the piñon-juniper woodlands in the fall (pine nuts, acorns, broad leaf yucca, and cacti). Riverine settings also appear to have been used for winter campsites (Vierra 2003, this volume; Vierra and Foxx 2002, this volume).

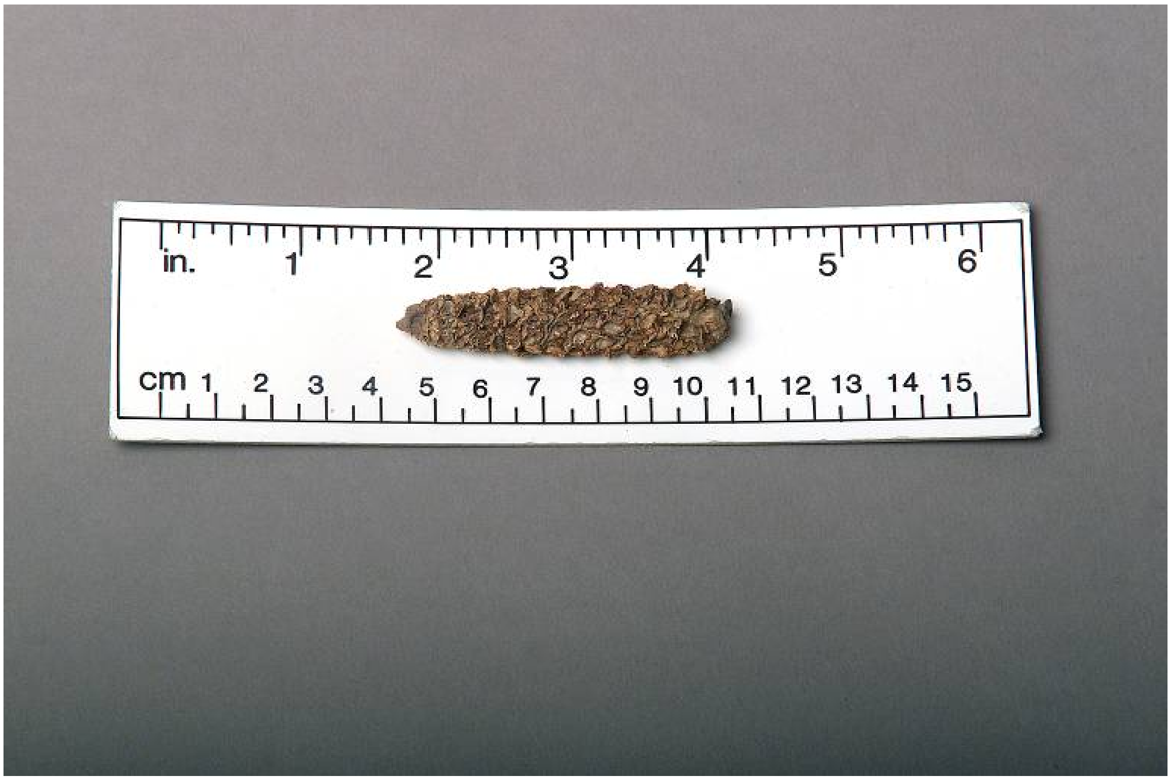


Figure 74.5. Maize cob from Jemez Cave.

ARCHAIC PROJECTILE POINT TYPOLOGY AND TECHNOLOGY

A total of 409 Archaic projectile points provide the database for research conducted for this chapter. Previous systematic studies of Archaic projectile points have identified important changes in point technology through time (e.g., Moore 1994; Moore and Brown 2002). Most notable of these are decreasing stem length, changes in basal morphology, and stem/base modifications (e.g., grinding and thinning).

The Early Archaic points are large stemmed points with long blades, slight shoulders, and a contracting stem (Figure 74.6). Jay points (upper) are generally larger than Bajada points (lower), with the latter exhibiting basal thinning and concave bases, and most of the former having straight or convex bases. These points are made from large biface blanks with a mean thickness of 8.3 mm. The base and/or lateral edges usually exhibit grinding (96%), with blade resharpening and rebasing also being common (86%). Previous studies indicate that Late Paleoindian groups often increased tool use-life by refurbishing the proximal end of broken points, while discarding the smaller base fragments. Early Archaic groups, on the other hand, resharpened the blade in conjunction with refurbishing the base. This may in part reflect a shift from the intercept hunting of large game in open settings to the increasing use of an encounter hunting tactic for medium to small game in wooded settings. This might also explain the shift to smaller-sized Bajada points.

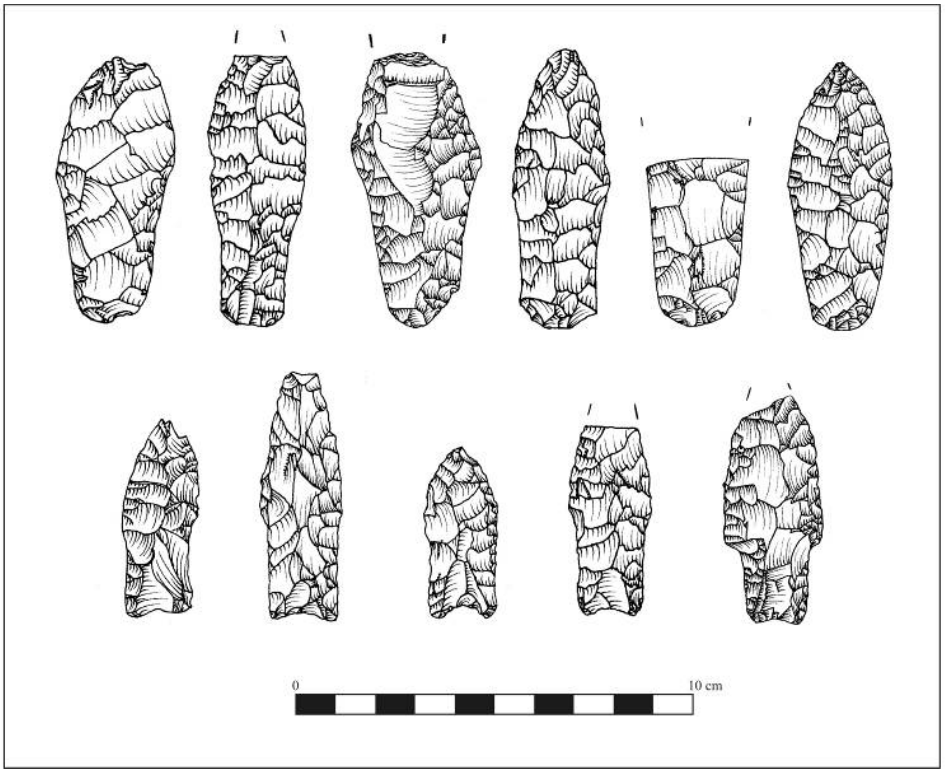


Figure 74.6. Jay (upper) and Bajada (lower) Early Archaic points.

Middle Archaic San Jose style points are characterized by large to medium size stemmed points with shorter blades and stems (Figure 74.7, upper). The blade is serrated with a concave base. The base and/or lateral edges often exhibit grinding (96%); however, the points are rarely rebased, but the blades are often resharpened (66%). They are often discarded when exhausted, with about 50 percent of the points being whole. Again, this point type is made from a large biface blank, with a mean thickness of 6.9 mm. This change in point morphology could have allowed for greater efficiency while encounter hunting in upland wooded environments. This might also explain the presence of serration, which would have increased bleeding and therefore provided a blood trail to follow. In addition, serration might also offset the decreased resharpening potential of the shorter blade by allowing for fewer resharpening events.

In summary, Early and Middle Archaic point technology is designed for a lower tool replacement rate that involves the production of points from biface blanks and heavy blade resharpening (also rebasing during Early Archaic). On the other hand, there is low point diversity, with generalized points being used to hunt various large, medium, and small size game.

Changes in point size and design presumably reflect the increasing importance of hunting medium to small size game in wooded settings.

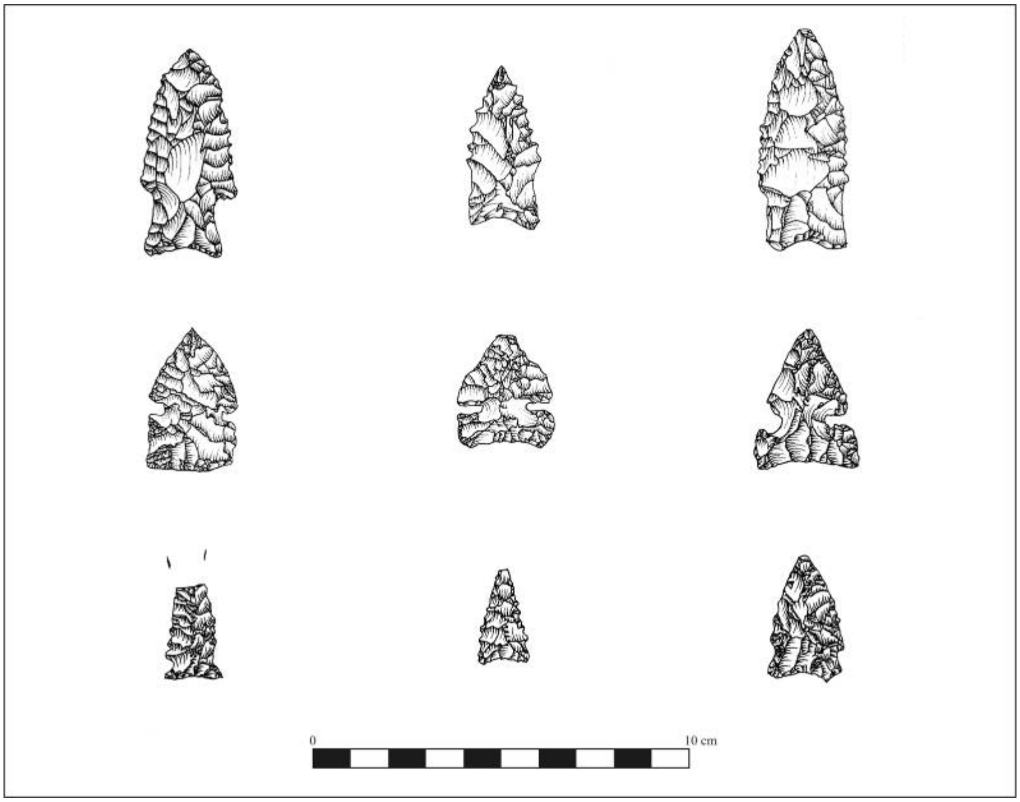


Figure 74.7. San Jose (upper), side-notched (middle), and Armijo (lower) Middle to Late Archaic period points.

On the other hand, if the large side-notched points are roughly contemporaneous with San Jose style points, then two very different technologies were being used at the same time (Figure 74.7, middle). All are made on thinner flake blanks with a mean thickness of 5.0 mm. These points exhibit less blade resharpening (52%) and almost no basal grinding (3%). They are more often being discarded when broken, with only 34 percent being whole.

Late Archaic Armijo points appear to represent a continuation of the San Jose style, with shorter blade and stem and the presence of serration and a concave base (Figure 74.7, bottom). However, there are important differences. These Late Archaic points are also made on thin flake blanks with a mean thickness of 5.1 mm. They also exhibit little resharpening (33%), but usually exhibit basal grinding (75%). Like the large side-notched points, they too are mostly being discarded when broken, with only 33 percent being whole.

The Late Archaic En Medio period is characterized by a shift away from the use of a few generalized point types to a variety of specialized point types. This includes at least five different types: corner-notched (n = 64), side-notched (n = 15), wide and narrow stemmed points with straight and concave bases (n = 72), leaf-shaped points (n = 16), and contracting stemmed points (n = 5) (Figure 74.8). All of these are made on flake blanks with mean thicknesses ranging from 5.4 to 5.9 mm, with evidence of the original ventral surface of the flake and plano-convex cross-section being common. These points are rarely resharpened (0 to 30%), with roughly half of the points being discarded either when broken or whole. They generally do not exhibit basal grinding (0 to 30%), which is especially true for the leaf-shaped points that may have been hafted with mastic. The leaf-shaped and contracting stem points also differ from most other Late Archaic points by being mostly serrated (75% versus 60%, respectively).

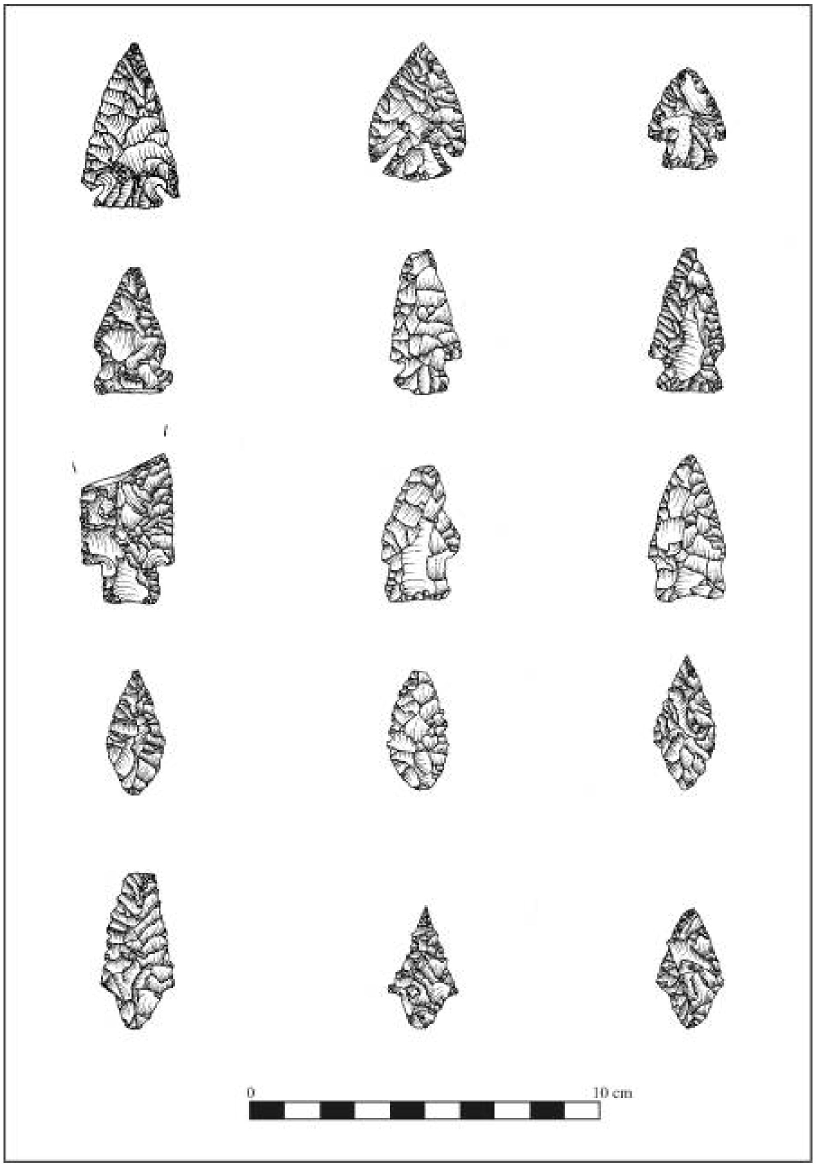


Figure 74.8. Late Archaic point types.

This diversity of Late Archaic point types presumably reflects the implementation of a variety of hunting tactics designed to efficiently procure specific types of game. The use of a few generalized point types, and low tool replacement rates due to resharpening during the Early and Middle Archaic, is now replaced with a diversity of point types and high tool replacement rates, with little blade resharpening to extend tool use-life. Flake blanks could reduce tool production costs and allow for a greater variety of smaller raw materials to be used, something important with restricted mobility. Otherwise, the use of a variety of specialized points sets the stage for the later adoption of the bow and arrow, circa AD 400.

REGIONAL LAND-USE

Distribution of point types across Zones 1 to 3 for Jay and Bajada points, and Zones 1 to 2 for the remaining point types, is provided in Figure 74.9 (left to right). There is an increase in the number of Jay points from south to north, with more Bajada points in the southern zones. The prevalence of Jay points in the San Luis Valley reflects the increased importance of large game hunting in this area, while the later Bajada foragers primarily exploited the wooded terrain in Zones 1 and 2. San Jose points are primarily represented in Zone 1, in contrast to the large side-notched points that are present in Zone 2. If this pattern continued into Zone 3, it might indicate that these side-notched points actually represent foragers entering the Rio Grande Valley from the north with San Jose foragers moving up from the south. There are also more Armijo points in Zone 2, but the sample size is only 12. On the other hand, all the other Late Archaic point types reflect a bias towards Zone 1, especially for the leaf-shaped points.

A variety of lithic raw materials were available to these ancient foragers, and the data indicate that they were very selective in choosing which material fit their tool requirements. The distribution of the three primary lithic raw materials is presented in Figure 74.10. There is a general decrease in the use of basalt from Jay, to Bajada, to San Jose, to large-side notched and Armijo points, with a corresponding increase in the use of obsidian through time. The increasing use of obsidian may in part reflect the increasing use of these upland resources areas, while dacite is primarily situated in lowland settings. Otherwise, very little chert/chalcedony is used for the production of most point types.

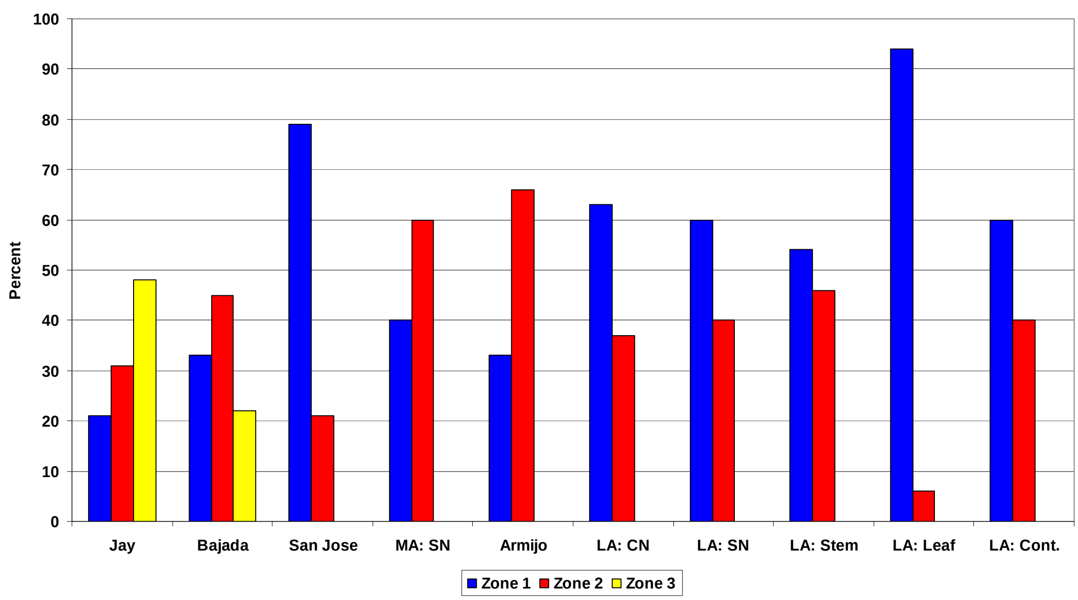


Figure 74.9. Distribution of Archaic point types by zone.

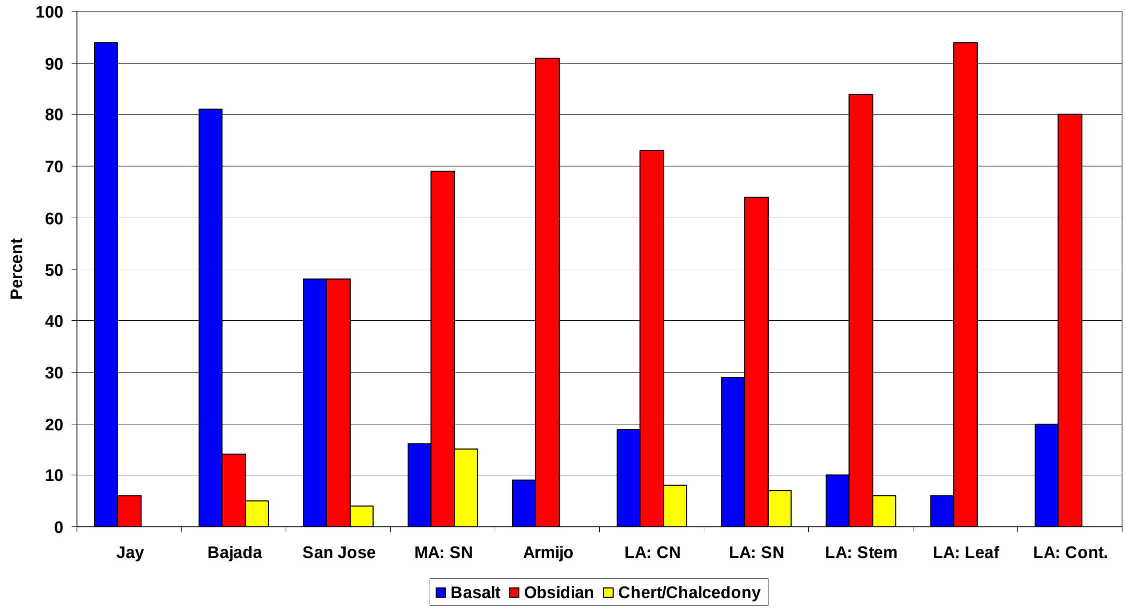


Figure 74.10. Distribution of material types for Archaic point types.

These data were then separated between Zones 1 and 2, with obsidian being visually segregated between the translucent central Jemez Mountains sources and the dusty El Rechuelos source situated at the northern end of the mountains. Figure 74.11 illustrates a similar pattern as observed in Figure 74.10, with the exception that most of the obsidian was derived from the central Jemez Mountains sources (i.e., Valle Grande and Cerro Toledo). In contrast, Figure 74.12 also shows a similar pattern as seen in Figure 74.10, but in this case most of the obsidian was derived from the El Rechuelos source**.** The two exceptions are the San Jose and Armijo style points, which have a mix of Jemez Mountains and El Rechuelos obsidian.

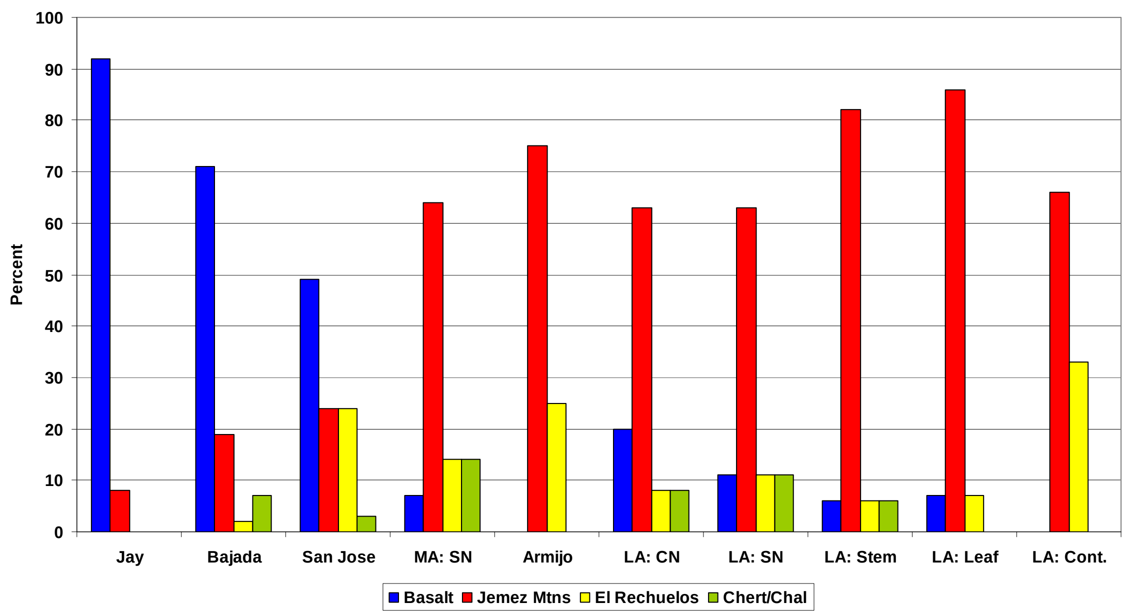


Figure 74.11. Distribution of material types for Archaic points in Zone 1.

An X-ray fluorescence analysis was conducted of a sample of 101 projectile points to further clarify this pattern. This sample consists of 72 obsidian and 29 dacite points. A previous study by Vierra et al. (2005) indicates that these "basalt" artifacts are actually a fine-grained black dacite, with three identified sources: the Cerros del Rio source in Zone 1 at Bandelier National Monument and the San Antonio Mountain and Newman's Dome sources near Tres Piedras in Zone 2.

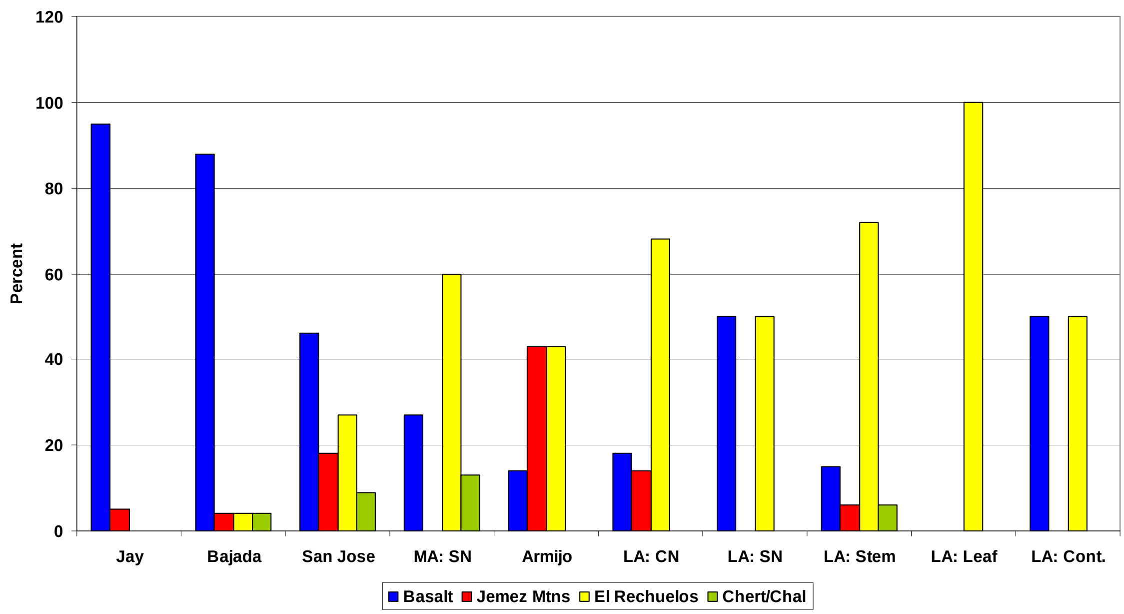


Figure 74.12. Distribution of material types for Archaic points in Zone 2.

Figure 74.13 illustrates the distribution of obsidian types in Zone 1. Due to the small sample sizes and similarities in distribution, the Early and Late Archaic samples have been merged into two single categories. On the other hand, the San Jose and large side-notched points have been kept separate because of important differences in these two distributions. Nonetheless, the central Jemez Mountains sources dominate Zone 1 with mostly Cerro Toledo and Valle Grande obsidian. However, the Early Archaic and San Jose-style points are also represented by obsidian derived from the southern Bear Springs source and a few items from the northern El Rechuelos source. Both San Jose and the large-notched points dominate the Valle Grande source. Since the Valle Grande obsidian source is restricted to the caldera, this pattern provides support for the contention that these Middle Archaic foragers were integrating these upland areas into their summer and fall seasonal rounds and thereby collecting more of this obsidian. This contrasts with the Cerro Toledo source, which is present along the eastern periphery of the caldera and in secondary deposits along the nearby canyons and Rio Grande Valley.

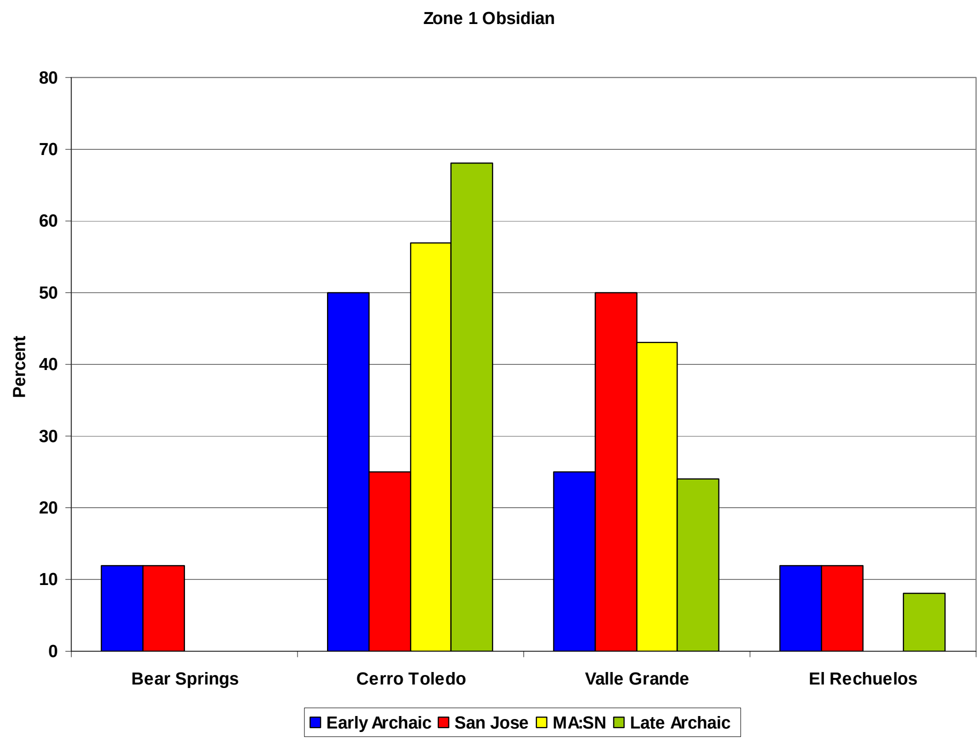


Figure 74.13. Distribution of obsidian types in Zone 1.

Figure 74.14 illustrates the distribution of obsidian types in Zone 2. In this case, most of the points are made of the northern El Rechuelos source. However, the Early Archaic again reflects a north-south pattern with all three central and northern obsidian sources represented. San Jose points continue to reflect the importance of Valle Grande obsidian, but now with El Rechuelos. Lastly, the large side-notched and Late Archaic points are primarily made of El Rechuelos obsidian. Together the obsidian data seem to support a north-south seasonal movement during the Early Archaic, with a more restricted north-south pattern during the Middle Archaic. The large side-notched and Late Archaic points were made on flake blanks with shorter use-lives. In this case, both sets of points are dominated by the most proximate obsidian source. Yet the question is, do these large side-notched points represent foragers moving down the Rio Grande Valley towards the Jemez Mountains and then turning north towards the San Juan Mountains? This contrasts to the Late Archaic, which probably represents an even more restricted pattern of movement that involves a mostly east-west, lowland to upland pattern.

Figure 74.15 illustrates the distribution of dacite in Zone 1. As can be seen, the Early Archaic sample contains examples of all three dacite types that are available in both Zones 1 and 2. In contrast, the later periods are characterized by smaller samples, but lack the San Antonio Mountain source, with some Newman's Dome. This also reflects a clear north-south pattern of movement between Zones 1 and 2 during the Early Archaic period.

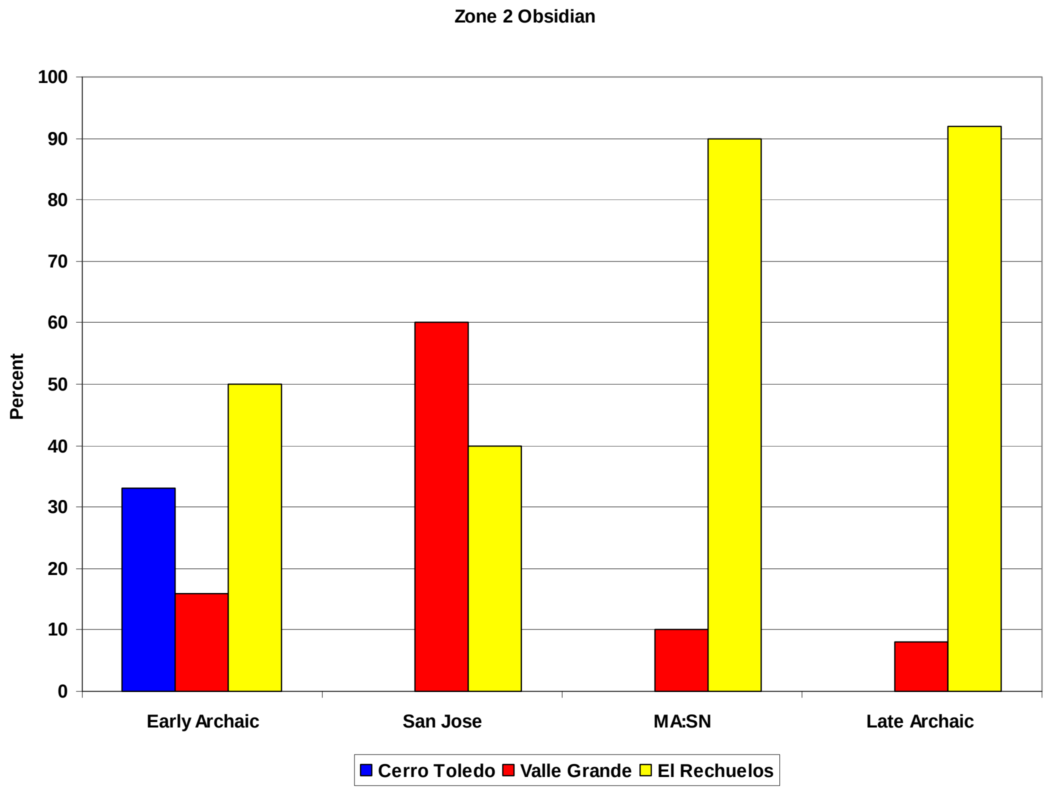


Figure74. 14. Distribution of obsidian types in Zone 2.

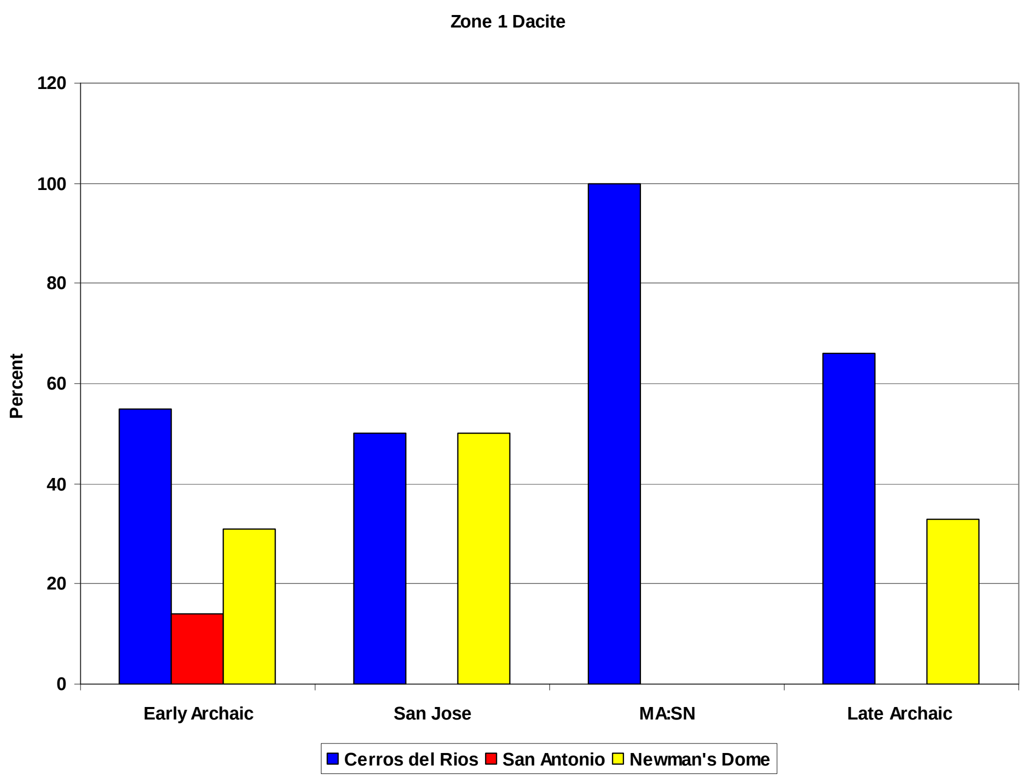


Figure 74.15. Distribution of dacite types in Zone 1.

Figure 74.16 illustrates the distribution of dacite in Zone 2. Again, all three dacite sources are represented in the Early Archaic sample. In contrast, the San Jose points are represented by both local dacite sources, but the large side-notched and Late Archaic points are solely made from the local Newman's Dome source. Presumably this continues to represent a long pattern of decreasing north-south movement from Early to Middle Archaic, with a much more restricted range during the Late Archaic. More data are needed from the San Luis Valley (i.e., Zone 3) to fully clarify the possible relationship with the southern Rocky Mountains for these large side-notched points.

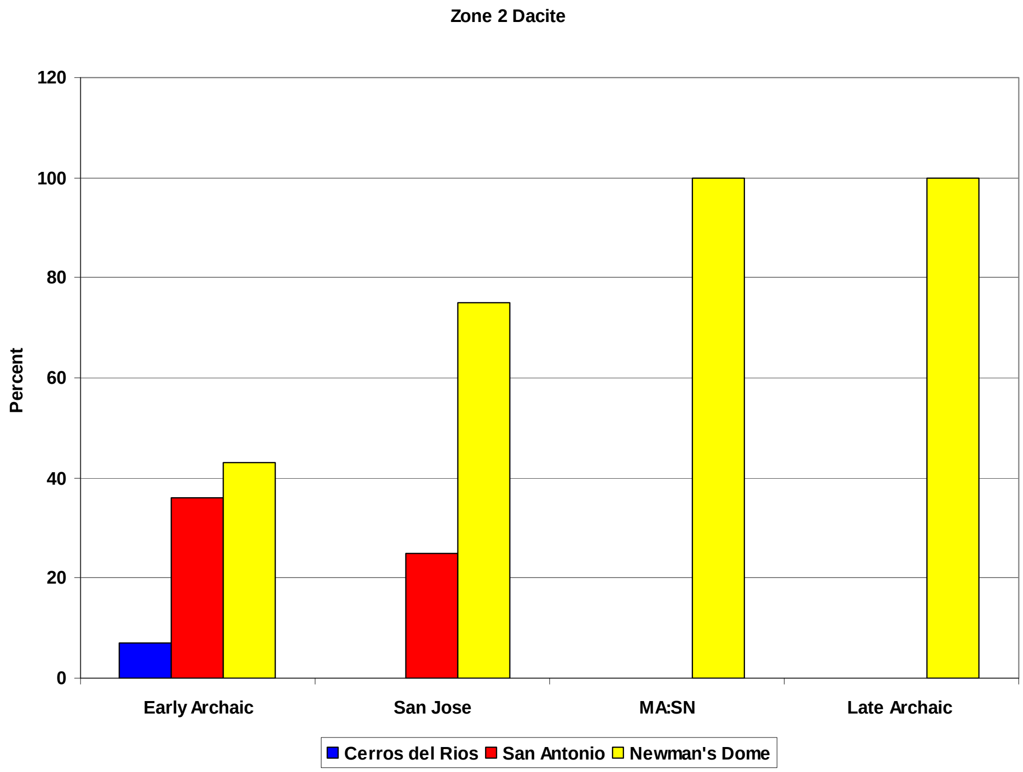


Figure 74.16. Distribution of dacite types in Zone 2.

CONCLUSION

In conclusion, this chapter has taken a preliminary look at the possible relationship between changes in climate, resource structure, foraging strategies, and projectile point technology in the northern Rio Grande Valley. Changes in Early and Middle Archaic period point typology and technology may be associated with the expansion of piñon-juniper woodlands in the region and a shift from hunting large game in open settings to more medium to small sized game in wooded settings. The projectile point technology was characterized by low point diversity and low tool replacement rates. In contrast, the Late Archaic point technology was characterized by high tool replacement rates and high point diversity. Annual movements became more restricted and oriented to a lowland-upland seasonal pattern. The long-term replacement of mostly dacite with obsidian lithic material is presumably associated with the increasing use of these upland resource areas. Overall, these changes in projectile point technology could reflect a "replacement when exhausted" versus a "replacement based on a probability of failure" strategy (Kuhn 1989). That is, Early to Middle Archaic groups were more residentially mobile, with a technology that was continuously being used and maintained. In contrast, Late Archaic groups were becoming more logistically organized while focusing on a greater variety of target species. Therefore, higher tool replacement rates could have been used as a means of increasing tool reliability and hunting success rates (also see Vierra 1992b:104).

CHAPTER 75
ARCHAIC UPLAND RESOURCE USE: THE VIEW FROM THE PAJARITO PLATEAU, NEW MEXICO

Bradley J. Vierra and Teralene Foxx

INTRODUCTION

In 1973, Cynthia Irwin-Williams (1973:5) stated that “two kinds of special activity sites are known outside the [Arroyo Cuervo] region: isolated hunting camps in the Jemez Mountains and repeated quarry workshop camps…” Five years later, one of the first systematic surveys in the Jemez Mountains was conducted along the valley of the Redondo Creek at elevations over 8000 feet (Moore et al. 1978). Although they found numerous lithic scatters, they were neither hunting camps nor quarries, but rather campsites where a range of hunting and gathering activities appeared to have taken place (also see Baker and Winter 1981). However, there has been very little systematic research conducted in these upland settings during the intervening 20 years.

This chapter reviews the archaeological evidence for the Archaic occupation on the central Pajarito Plateau. Recent survey and excavations conducted at Los Alamos National Laboratory (LANL) has identified over 50 Archaic sites and 175 lithic scatters. The survey evidence reveals the systematic and repeated long-term use of these upland resource areas by Archaic foragers. Indeed, several broad occupation zones can be identified. We summarize the ethnobotanical data on possible plant use for each vegetation community and suggest a possible seasonal strategy for exploiting these resource zones during the Late Archaic. Debitage artifact data from recently excavated Late Archaic sites are subsequently used to link lowland habitation to upland campsites to illustrate this complementary land-use strategy.

ARCHAIC LAND-USE AT LOS ALAMOS NATIONAL LABORATORY

LANL occupies the central section of the Pajarito Plateau**.** The plateau covers an area roughly extending from Santa Clara Canyon on the north to the mesas above Cochiti Pueblo on the south to the caldera on the west and the mesas overlooking the Rio Grande Valley to the east. LANL covers approximately 29,000 acres of land on this high mesa, ranging from about 6000 to 8000 feet in elevation. The mesa has been incised with several deep canyons that drain from the mountain country down to the river valley. Balice et al. (1997) have defined four basic vegetation types at LANL: juniper-savanna, piñon-juniper, ponderosa pine, and mixed conifer. Figure 75.1 illustrates the distribution of these vegetation types. As can be seen, most of the area is covered with piñon-juniper woodlands at the lower elevations and ponderosa pine at the higher elevations.

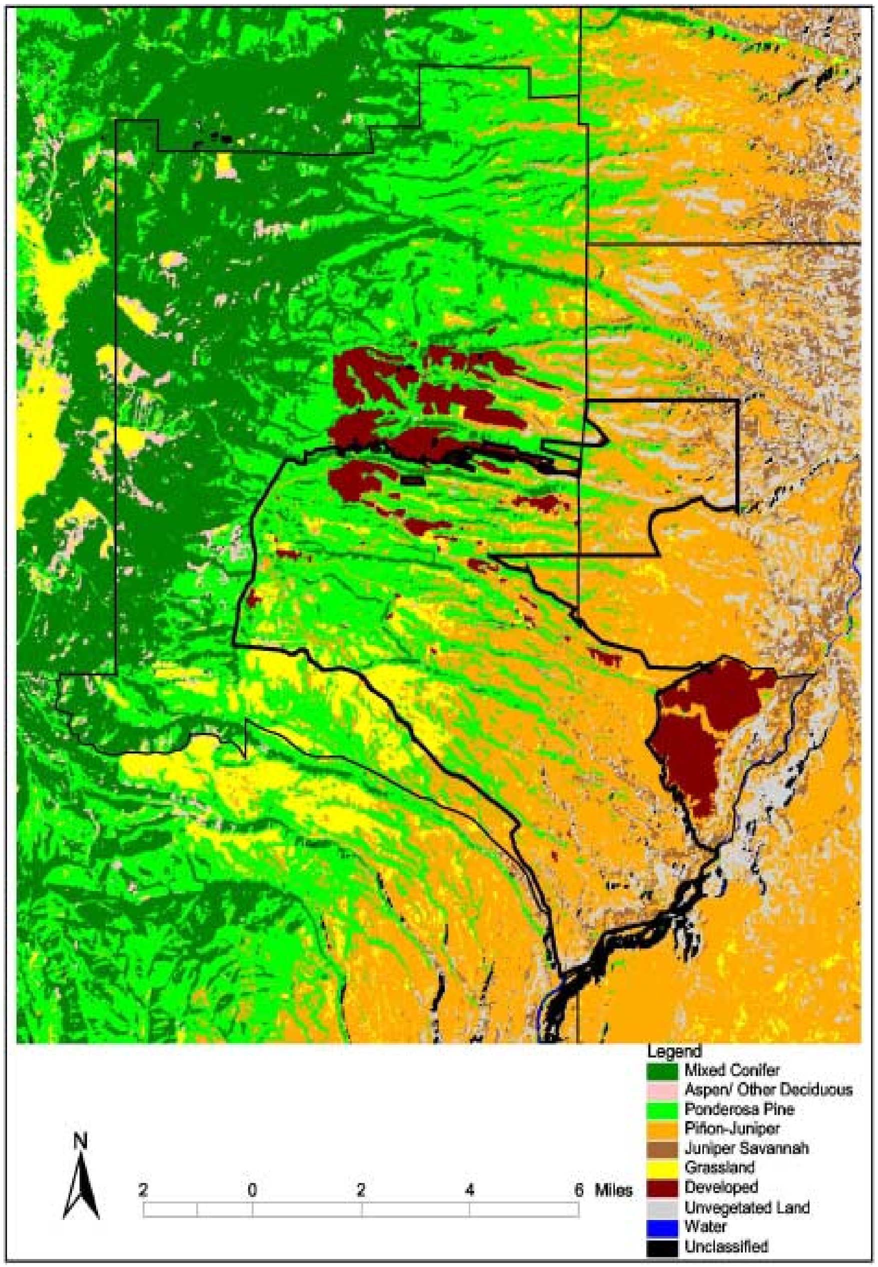


Figure 75.1. Vegetation types at Los Alamos National Laboratory.

A total of 51 Archaic sites have been identified at LANL. These sites are characterized by obsidian lithic scatters ranging from 40 to 140,000 sq m in size. The assemblages emphasize the production/maintenance of bifacial tools, with occasional one-hand manos and millingstones also present. The diagnostic Early, Middle, and Late Archaic projectile point types on the plateau are similar to those defined by Irwin-Williams for the Oshara Tradition (Figure 75.2). Figure 75.3 illustrates the relative percentage of sites by Archaic time period. As can be seen, there are very few Early Archaic sites, somewhat more Middle Archaic sites, and mostly Late Archaic sites represented.

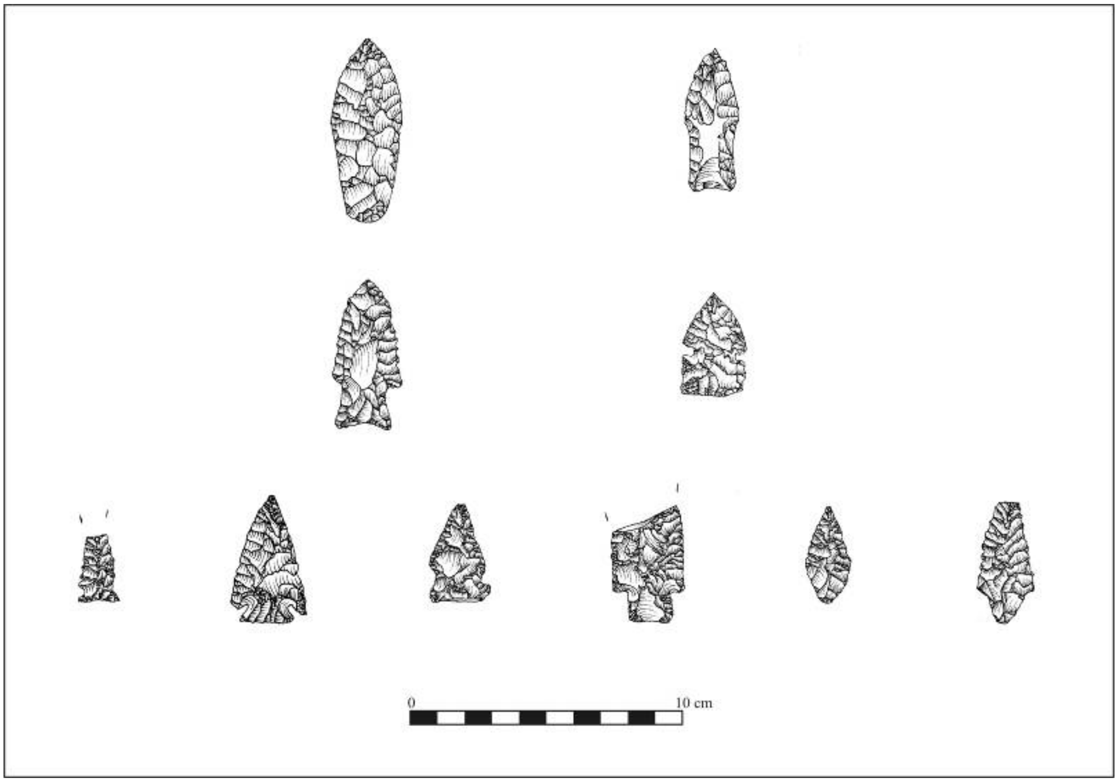


Figure 75.2. Diagnostic Early, Middle, and Late Archaic point types.

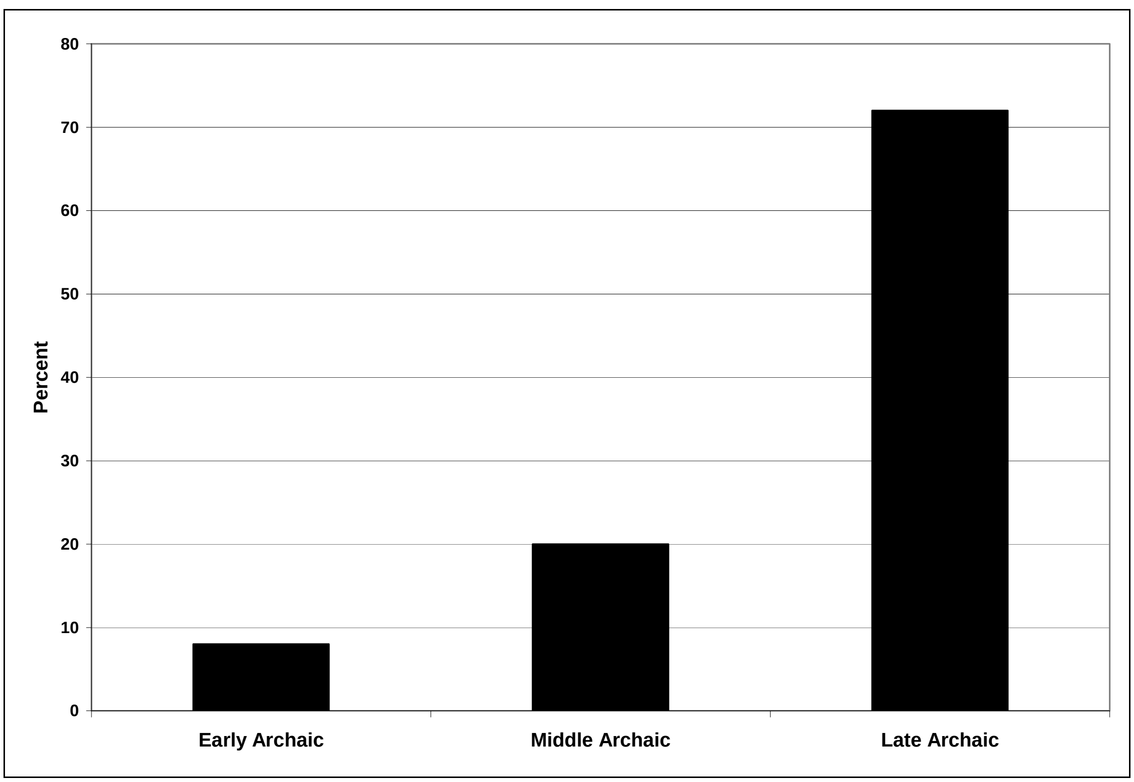


Figure 75.3. Relative frequency of Early, Middle, and Late Archaic sites.

This pattern does not necessarily reflect the increasing use of these upland areas through time, but rather the long-term effects of various geomorphic processes on the archaeological record. For example, although there is a Late Archaic site present on the surface of Mortandad Canyon, a charcoal sample was collected from an 11-m-deep core hole that yielded a date of 7260 BP, indicating that Early and Middle Archaic deposits may be buried within these alluvial settings (Reneau et al. 1996a). This chapter will therefore focus on the Late Archaic, given the number of archaeological sites represented, and the relative similarity in environment over the last 3000 years.

Figure 75.4 illustrates the distribution of Archaic sites at LANL. Since the distribution of sites is sparse, we have combined them with the distribution of all obsidian lithic scatter sites (Figure 75.5). In the latter case, we have used the actual site boundaries and not single points. These assemblages are also dominated by the production/maintenance of obsidian bifacial tools, but lack diagnostic projectile points. Given the previous data, it is likely that most of these sites represent Late Archaic occupations. Nonetheless, both figures illustrate several broad occupation zones: 1) juniper-savanna zone in the Rio Grande Valley, 2) piñon-juniper zone at lower elevations on the plateau, 3) piñon-juniper/ponderosa ecotone at mid-elevations on the plateau, and 4) ponderosa pine/mixed conifer ecotone at the higher elevations. It appears that the ponderosa pine and mixed conifer communities are also important to Late Archaic foragers and not only the piñon-juniper zone as has traditionally been argued.

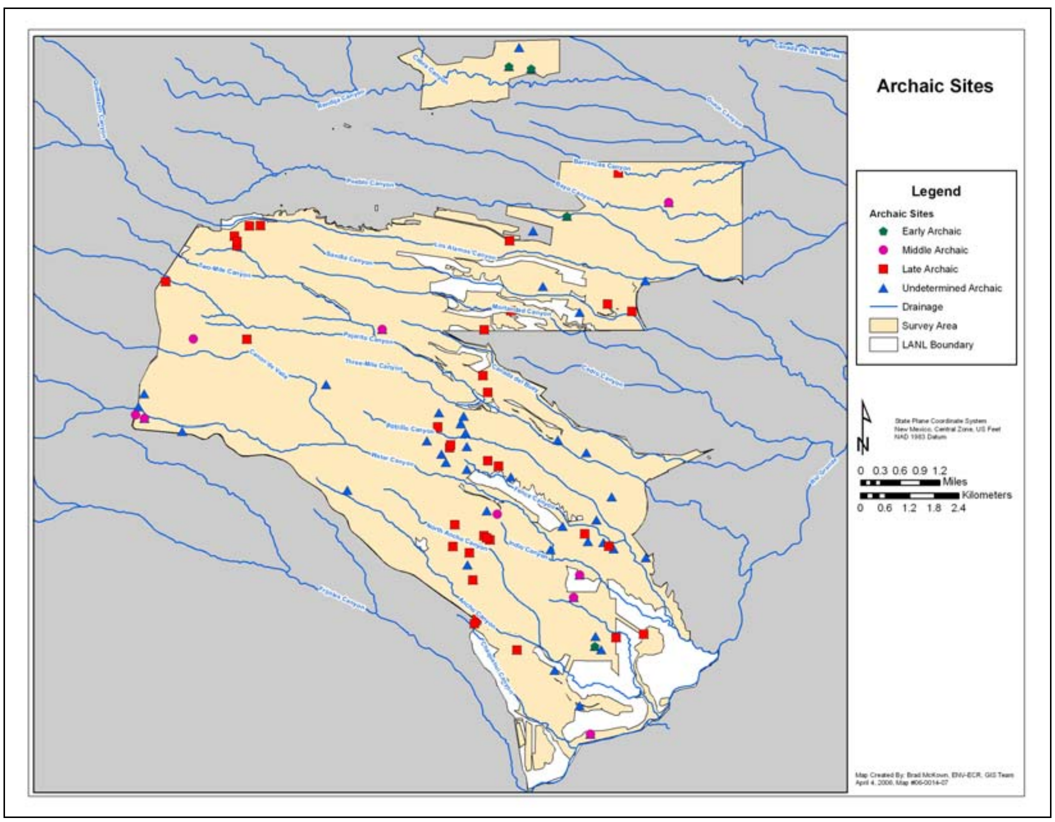


Figure 75.4. Distribution of Archaic sites at LANL.

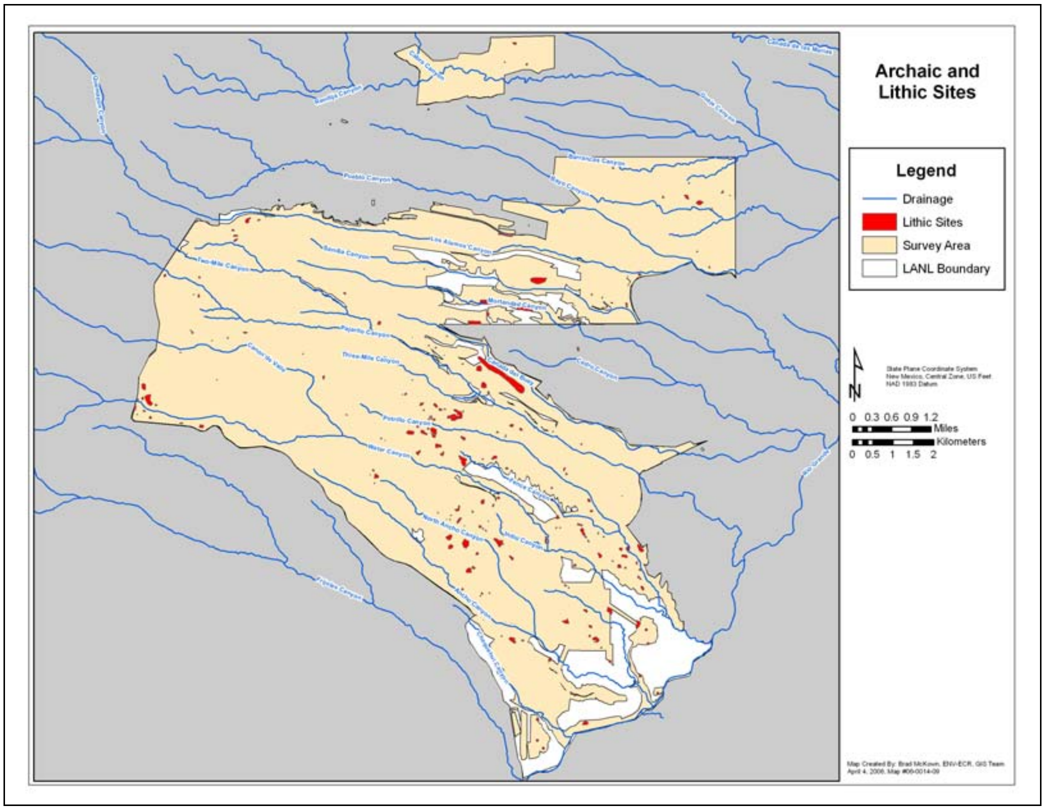


Figure 75.5. Distribution of Archaic and lithic scatter sites.

SEASONAL USE OF UPLAND AREAS

So, how were these Late Archaic foragers using these upland resource areas? A total of 985 plant species were described in Foxx et al.'s (1998) recent *Annotated Checklist of Vascular Plants in the Jemez Mountains*. This checklist provides information on plant locations, occurrence, phenology, and uses. Over 200 of the plants identified for the Jemez Mountains by Foxx et al. (1998) are also identified in Dunmire and Tierney (1995) as having specific ethnobotanical uses such as food, medicine, implements, and many with multiple uses. Using these two references, we constructed tables to analyze the possible plant use by elevation and activity for the Pajarito Plateau and east Jemez Mountains. Table 75.1 summarizes all the uses for the over 200 plants identified. Although many of the plants have multiple uses, we are confining our analysis in this paper to only the108 plants identified as subsistence plants.

Table 75.1. Plant uses by vegetation community.

Activity	Riparian	Jun-Sav*	PJ*	Pipo*	MC*	Burned
Medicinal (n = 148)	18	82	111	73	35	14
Food (n = 108)	23	41	77	56	30	13
Implements (n = 28)	4	14	20	15	6	4

Activity	Riparian	Jun-Sav*	PJ*	Pipo*	MC*	Burned
Coloring/Tanning (*n* = 37)	6	19	24	16	6	6
Construction (*n* = 16)	6	7	9	8	4	2
Smoking (*n* = 13)	0	8	11	3	9	1
Cordage (*n* = 6)	2	3	2	2	1	1
Total	**59**	**174**	**254**	**173**	**91**	**41**

*Jun-Sav is juniper-savanna; PJ is piñon-juniper; Pipo is *Pinus ponderosa* or ponderosa pine; MC is mixed conifer.

The plants identified as potential subsistence species are available from a variety of vegetation communities, including from lower to higher elevations: juniper-savanna, piñon-juniper, ponderosa, and mixed conifer. Many species can be found in multiple vegetation communities, but some species are limited to certain habitats within a plant community, or may be more abundant in certain habitats. For example, riparian and water resources are associated with multiple zones and are found within the canyon bottoms, along the Rio Grande, and in areas with springs and flowing water. Some species found near watered sites include wild grape, bee balm, willows, and cottonwoods.

Burned and disturbed areas also provide unique potential collecting sites within the piñon-juniper, ponderosa pine, and mixed-conifer zones. Tree-ring data indicate that there were frequent fires before 1900, particularly in the ponderosa pine zone (Foxx and Potter 1984). Burning enhances the habitat for species such as wild onion and cheno-ams, but also increases the vigor and vitality of these species for a short time, thus making these species more abundant and larger in burned sites (Foxx and Potter 1984). These areas would provide foraging patches within the ponderosa pine or burned areas within other zones. Disturbed areas can be found through all zones and are often associated with Ceramic period habitation sites. Species such as common purslane, wolfberry, and Rocky Mountain beeweed are commonly found in such sites.

To determine the relative potential use of the plant communities and the individual habitats, we took each species and determined which plant community it might occur in, when the plant would most likely be available, and how common it might be. We also looked at other factors that might influence the availability such as the phenology of the plant or habit.

Figure 75.6 illustrates the relative percentage of plant foods by vegetation community. As can be seen, the piñon-juniper community contains the greatest variety of plant foods followed by ponderosa pine zone. Fewer species are found in the juniper-savanna, mixed conifer, and riparian communities. If the five percent burned area species are target collecting sites primarily in the ponderosa pine plant community, then that community becomes an enhanced site for collecting species such as wild onion and cheno-ams. Therefore, the piñon-juniper and ponderosa pine communities are potentially the most productive areas for plant foods.

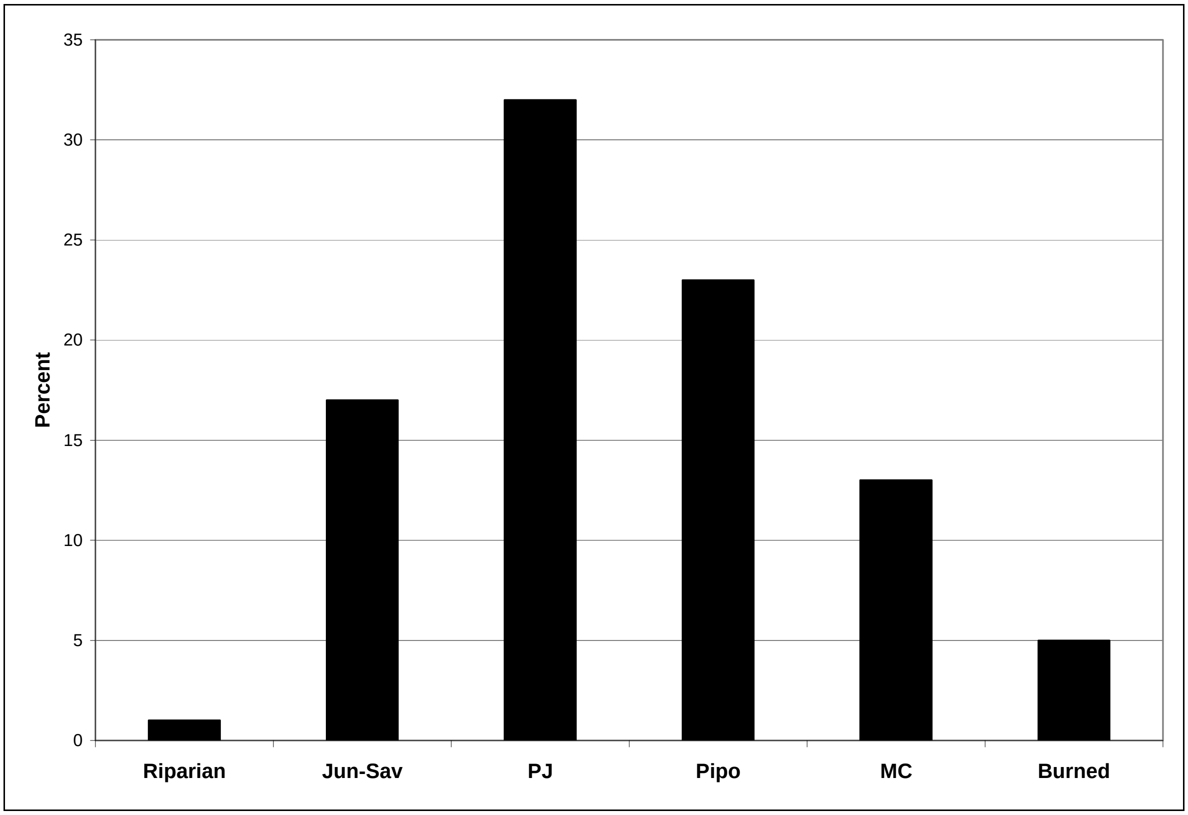


Figure 75.6. Relative percentage of food plants by vegetation community.

Figure 75.7 separates the species by plant group (structure or habit) and vegetation community. There are several important patterns. There is an increase in shrubs with elevation versus a corresponding decrease in annuals with elevation. One factor is the availability of plants as related to the plant structure. Trees, shrubs, and perennial plants will be found in the same locations from year to year because of their long-term longevity. On the other hand, annual plants live only one year and therefore are more dependent on seasonal rainfall patterns and other conditions such as disturbance. Many of the shrubs within the mid-elevation ranges (i.e., piñon-juniper and ponderosa pine) have collectable berries and would be a predictable resource. The increase in diversity of plants within these two zones make the ponderosa pine and piñon-juniper communities more desirable collecting areas.

Figure 75.8 illustrates the seasonal availability of food plant species by vegetation zone. The availability is very dependent on the elevational seasonality. High elevations such as mixed conifer will have a shorter growing season than the lower elevations such as the piñon-juniper woodlands. Warming will begin with the juniper-savannah in early spring providing early-season species such as Indian ricegrass. By May, greening of the mixed conifer and ponderosa pine will begin and species will start to sprout or leaf out. In the fall, the reverse is true. The seasonal cooling begins at high elevations and moves downslope. Therefore, in the fall more species would be available for collecting at lower elevations (i.e., the piñon-juniper woodlands). Overall, there are a variety of plant species available to procure at all elevations and at various seasons.

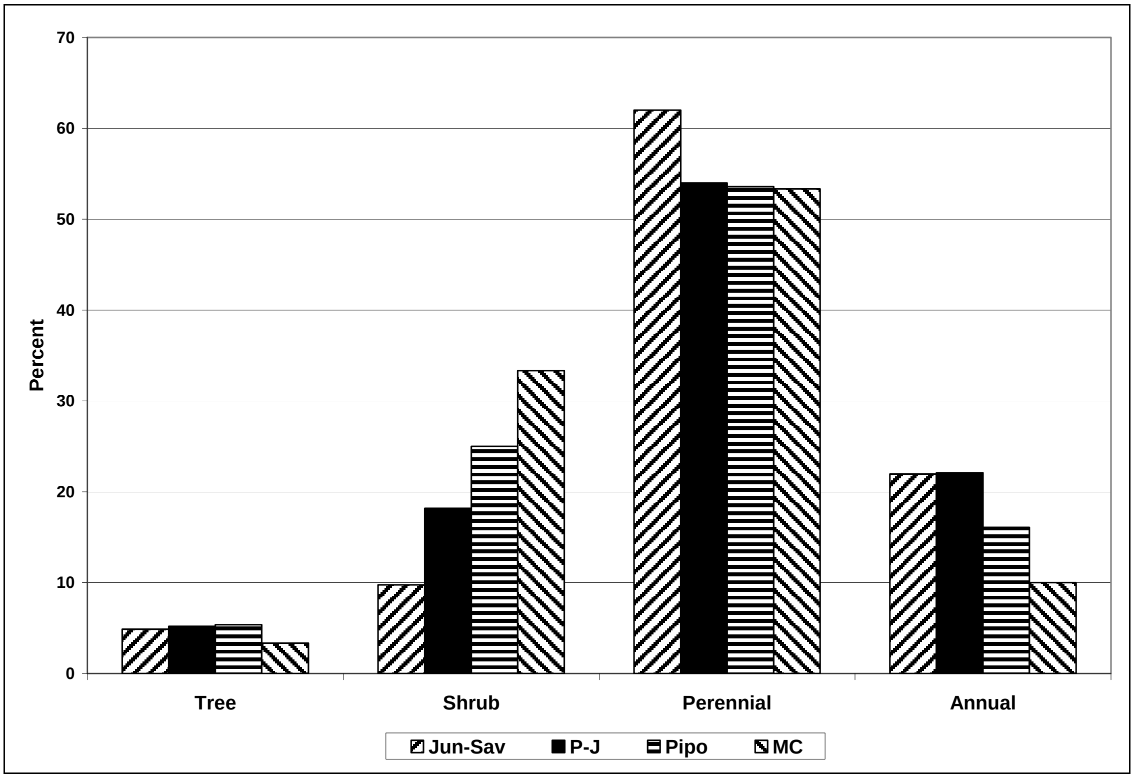


Figure 75.7. Plant groups by vegetation community.

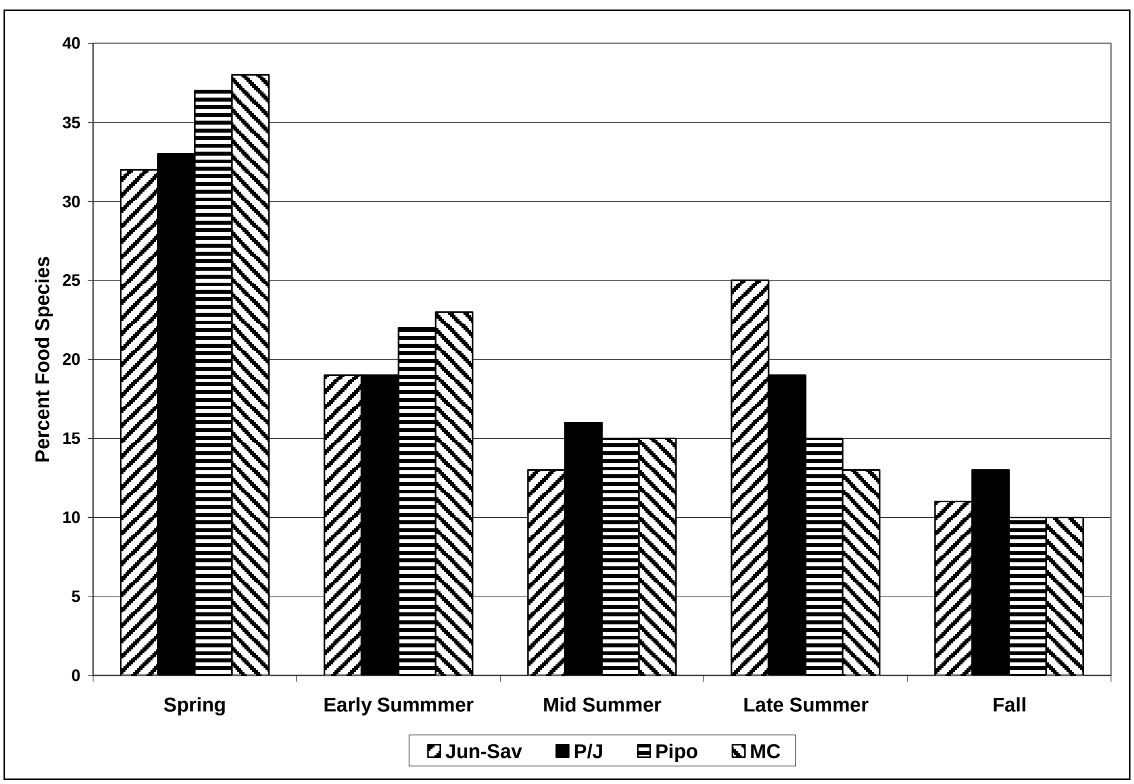


Figure 75.8. Plant seasonality by vegetation zone.

Various portions of a plant can be used at differing times of the year. Many perennial food plants are available for consumption in the springtime and later during the summer. For example, cheno-ams can be used as greens early in the season and seeds harvested later in the summer. Other plants used for the bulb or root crops such as wild onion will be available throughout the growing season. Some plants such as those with nuts and berries will not be used for greens and are therefore most available in mid to late summer or fall.

In this analysis, a number of plants are available in the spring and early summer at higher elevations. The highest number of food species is available during the mid-summer at the higher elevations (mixed conifer and ponderosa pine). In late summer the pattern changes when there is a step-like pattern with decreasing species richness with increasing elevation. In the fall, there are more food plants available in the piñon-juniper community. The drying of soils and south-facing aspect of White Rock Canyon and lack of berry producing shrubs and nut producing trees make the lower juniper-savannah less desirable for collecting except within the riparian zone along the river where berry producing species such as wild grape is found.

However, species richness does not necessarily reflect relative species abundance or evenness. Particular target species within each vegetation zone can be more common and productive than other species. Figure 75.9 provides information related to how common a particular plant is and its availability.

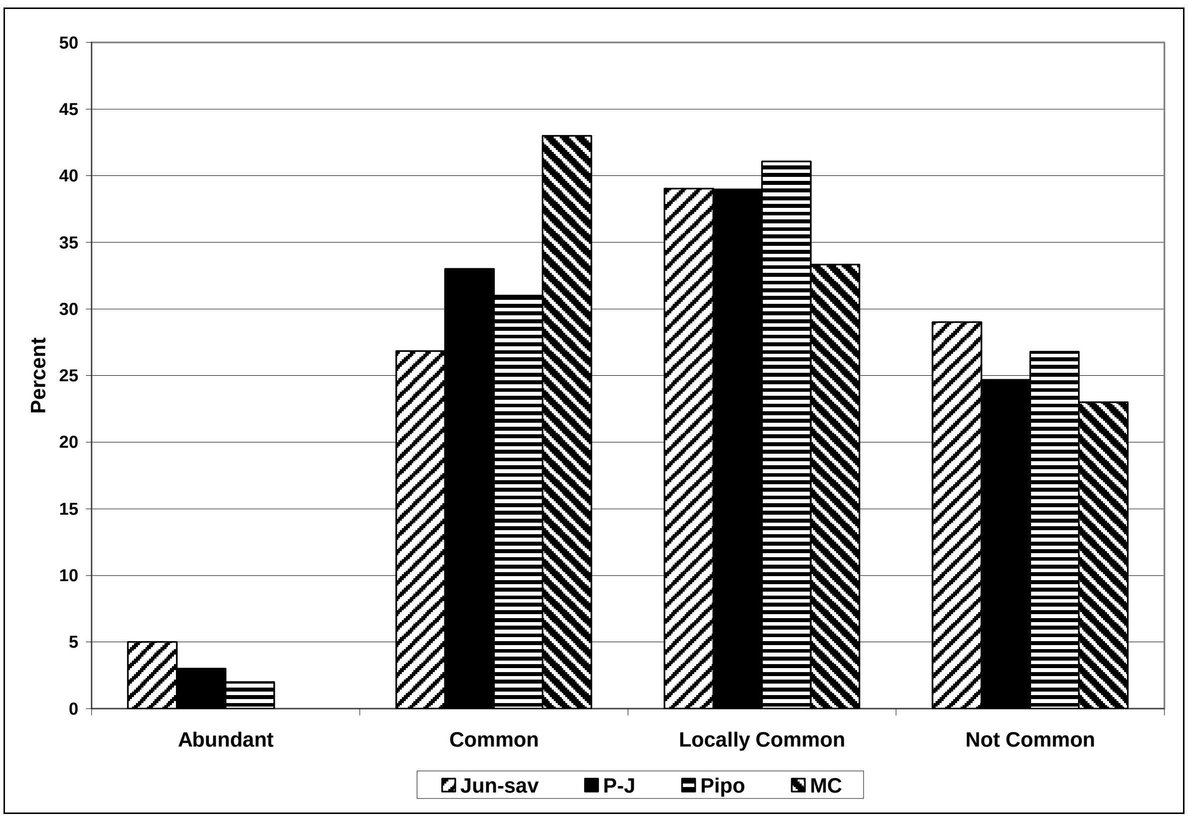


Figure 75.9. Relative plant species abundance by vegetation community.

Based on personal experience, plant collections, and botanical texts, we have divided the plants into four categories: common, locally common, not common, and abundant. Species identified as common are those that are seen throughout an area. Locally common means that plants are found in patches or groups. Not common indicates they are seen as single plants, not in patches and not throughout an area. Abundant usually refers to a dominant species of an area such as the piñon pine in the piñon-juniper plant community. As can be seen from this figure, many of the species are locally common. This means perennial plants that are locally common would be found in patches. Therefore, we would expect particular target species to be collected in these areas.

If we identify a few possible target species that are both common and abundant in these various communities, then we can suggest a possible annual cycle for exploiting these resource areas (see Table 75.2). In the juniper-savanna community, cool-season grasses like Indian ricegrass are abundant, having seeds that are available in the early summer. Species used for greens such as cheno-ams can be found in all disturbed and burned contexts, but their resource patches could be found represented in the ponderosa pine zone and lower mixed conifer early in the summer. In addition, wild onions, berries, and wild potatoes are also available in these areas during the mid to late summer time period. In contrast, acorns, pine nuts, broad leaf yucca, and cacti would be available for consumption during the fall in the piñon-juniper zone. Dropseed grasses and cheno-am and saltbush seeds could have also been exploited during the late summer in this zone. If obsidian raw materials were procured while at high-elevation quarries while foraging, then these materials could have been reduced while camping at the lower-elevation campsites. This model of Late Archaic seasonal mobility is graphically illustrated in Figure 75.10.

Table 75.2. Target plant species in vegetation communities.

Vegetation Community	**Season**			
	Spring	**Early Summer**	**Mid to Late Summer**	**Fall**
Jun-Sav	Greens	Indian ricegrass, wolfberry		Cacti
P-J	Greens		Dropseed, saltbush, cheno-ams, wild potato, purslane	Pine nuts, acorns, broad leaf yucca, cacti
Pipo	Greens		Cheno-ams, wild onions, berries, wild potato	
MC	Greens		Cheno-ams, wild onions, berries	

If we consider that the deep canyons could act as natural travel routes to these upland plateau resource areas, then camping in the piñon-juniper/ponderosa pine ecotone would provide easy access to a wide variety of species within a small catchment area. For example, riparian and some mixed conifer species would be present in the canyon bottoms, ponderosa pine communities along the south-facing canyon slopes, and mixed conifer on the north-facing canyon slopes, and piñon-juniper woodlands on the mesa tops. Indeed, if the typical daily foraging radius around a hunter-gatherer campsite is about 10 km, then almost all of the plateau at LANL would be located within walking distance of a site located in this central zone (Binford 1982; Yellen and Lee 1976).

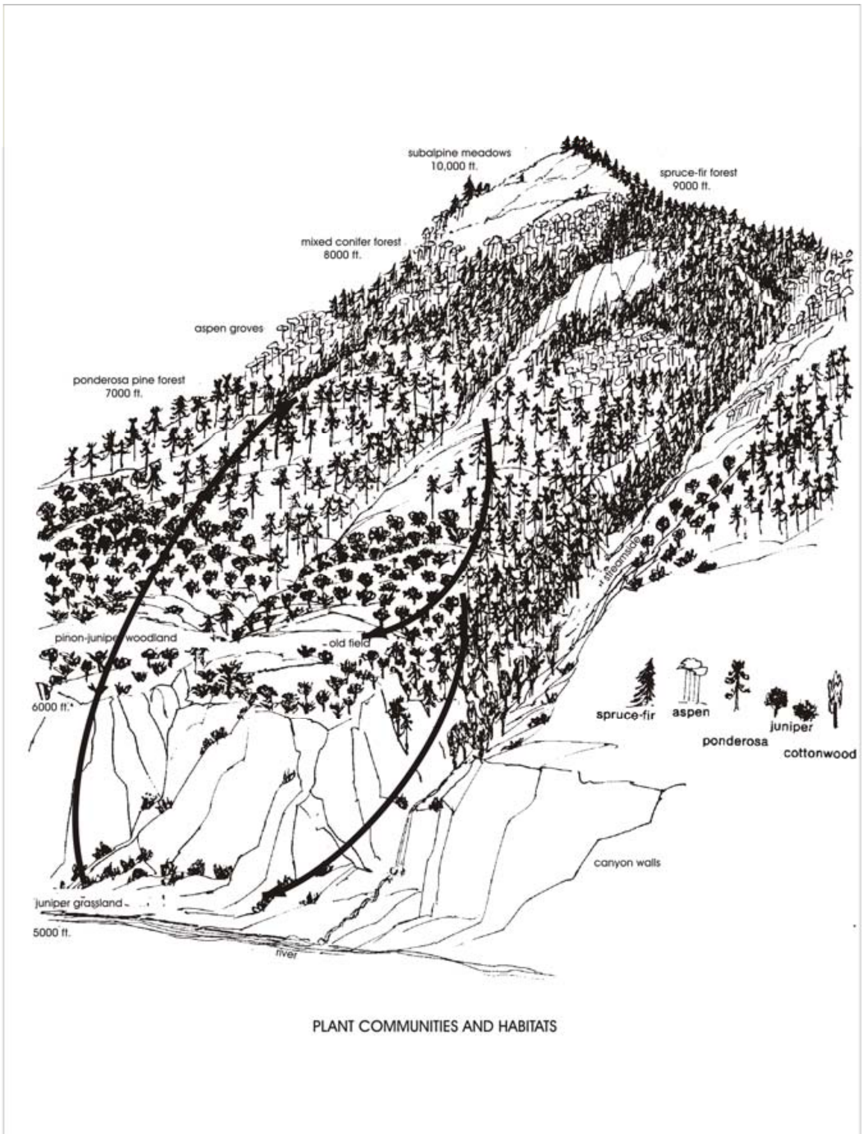


Figure 75.10. Late Archaic seasonal mobility pattern.

Lastly, if these Late Archaic populations were practicing some form of incipient horticulture, then how would this activity have been integrated into the foraging schedule? The evidence from Jemez Cave may help us understand this. Ford (personal communication, 2002) suggests that maize may have been planted in May, and the site abandoned and then reoccupied during September or October to harvest the crop. On occasion, this occurred when the maize was still green, and other times when it was mature. Maize plants were probably grown in the mud flats adjacent to a small lake located behind the Soda Dam. Broad leaf yucca was also procured and used for textiles, and a variety of game species were hunted (e.g., bighorn sheep). The lithic assemblage was dominated by obsidian, with some Pedernal chalcedony/chert. Therefore, some of these early horticulture sites could have been placed in well-watered settings adjacent to piñon-juniper woodlands and fall plant resource areas. This would have reduced any seasonal scheduling conflicts and provided a backup strategy for natural resource shortfalls (e.g., see Minnis 1985).

THE LATE ARCHAIC ARCHAEOLOGICAL RECORD

Seven Late Archaic open-air sites were selected for this study of debitage assemblages. Together, they cover an elevation range from 1700 to 2880 m (5580 to 9450 ft). From lower to higher elevations, this includes a possible winter habitation site near San Ildefonso Pueblo that contains a single structure, with storage pits and an outside activity area (LA 51912; Lent 1991; *n* = 1747). Excavations along Highway 502 at the Los Alamos/Española interchange also identified an extensive Late Archaic site containing multiple hearths and activity areas (LA 65006; Moore et al. 1998; *n* = 5997 for Component 1). Both of these sites were excavated by the Museum of New Mexico and are located in the valley just east and west of the Rio Grande, respectively.

Two sites are situated in the piñon-juniper zone at LANL. LA 12587 (Area 8) is a small lithic scatter situated in the White Rock Tract that was recently excavated by Schmidt (Chapter 15, Volume 2; *n* = 485). Another site is located on Mesita del Buey that was mostly excavated. Although the site consists of an extensive lithic scatter, the sample used for this study included the area around a possible occupation surface (LA 70029; Biella 1992; *n* = 1420). LA 115373 is another lithic scatter site that was recently tested, but is located in the ponderosa pine zone at the upper elevations of LANL (Larson et al. 1997; *n* = 402). Site 03-1172 is an extensive lithic scatter site that was tested by Forest Service archaeologists on Sawyer Mesa near Obsidian Ridge in the higher ponderosa pine zone (Moore 1986; *n* = 1003). Lastly BG-21, is a small lithic scatter located in Redondo Creek Valley along the west side of the Valles Caldera (*n* = 296). It is one of 23 sites excavated by the University of New Mexico (Baker and Winter 1981). All but two of the sites have sample sizes of over 1000 artifacts. However, the remaining two sites have smaller samples of 135 and 402 artifacts. Four of the seven sites were analyzed for this study; whereas, published data were used for the two Museum of New Mexico and the Forest Service sites.

Analysis of the debitage assemblages from these sites indicates that there are some significant differences in the reduction tactics being implemented between riverine versus upland sites. The sites are oriented from left to right, that is, from lower to higher elevations in Figure 75.11. As can be seen, the two riverine sites emphasize core reduction activities with less biface production/maintenance. In contrast, the upland sites emphasize biface production with less core reduction. The exception to this pattern is site 03-1172, which is located within the Cerro Toledo obsidian source area. Here the emphasis is on core reduction activities, which presumably reflects the production of prepared cores and flake blanks for transport to sites at lower-elevation settings. Otherwise, the distinction between core reduction versus biface production appears to reflect differences between lowland habitation versus upland campsites.

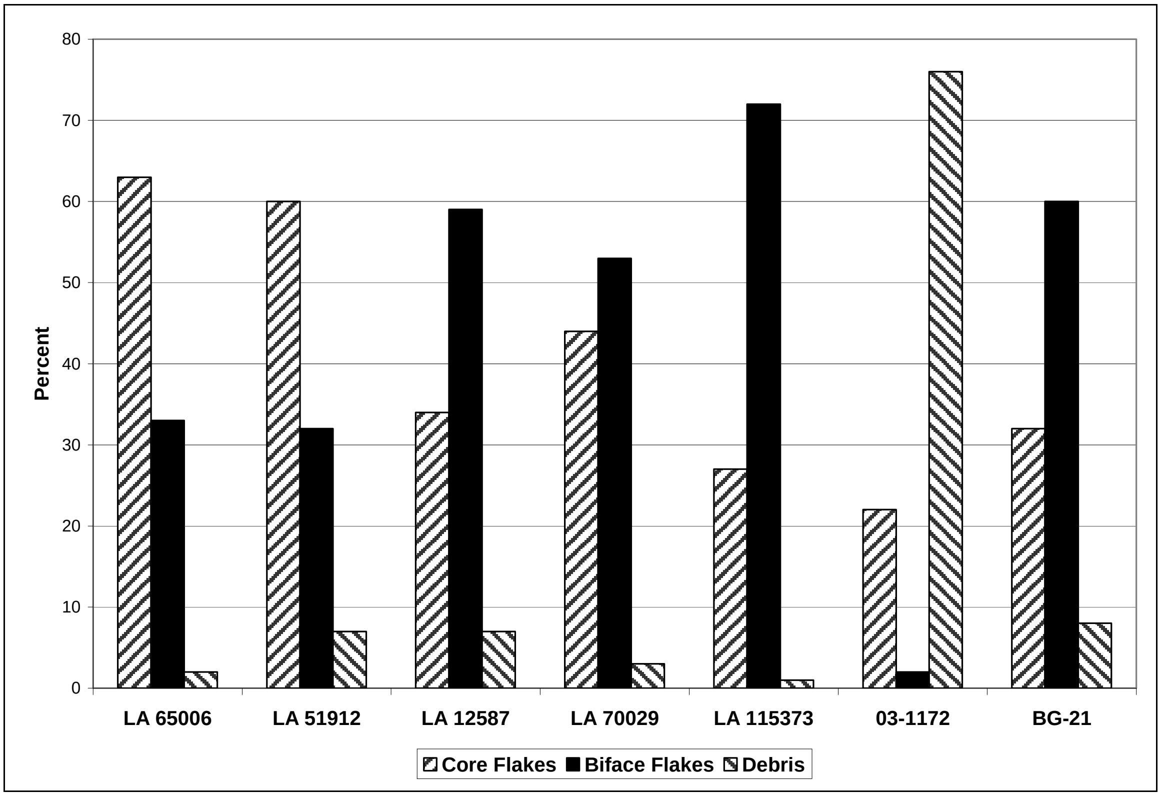


Figure 75.11. Debitage types.

This complementary link between lowland and upland sites is also reflected in the lithic material assemblage. Figure 75.12 illustrates that all the assemblages are dominated by obsidian. However, the four sites situated in the riverine and piñon-juniper settings also contain some chalcedony/chert and other materials. This includes basalt and quartzite in the lowland sites and orthoquartzite at LA 70029. With the exception of the orthoquartzite, these materials are available in gravels along the flanks of the Rio Grande Valley. The presence of waterworn cortex on these materials supports this contention. It is, however, undetermined as to whether the orthoquartzite is also available from this secondary source or was obtained from primary sources to the north near Abiquiu Reservoir. Otherwise, the higher-elevation sites are almost exclusively composed of obsidian that primarily exhibits a natural weathered (i.e., nodular) cortex, indicating that this material was derived from the primary source.

X-ray fluorescence analysis had been conducted on four of the sites identifying the specific obsidian sources utilized by these groups. Samples were analyzed from a lowland habitation site (Lent 1991:40), the LA 12587 and LA 70029 campsites located in the piñon-juniper zone (Chapter 61, Volume 3; Stevenson 1992), and the two higher-elevation sites situated in the ponderosa pine/mixed conifer communities (03-1172: Hughes 1986; BG-21: Sappington and Baker 1981). Three points and four bifaces were analyzed at the lowland habitation site. Four of these artifacts are made of Cerro Toledo, two from Cerro del Medio, and one from El Rechuelos (Polvadera) obsidian. Twenty-six flakes and two retouched tools were analyzed at the piñon-juniper campsites, with 23 made of Cerro Toledo, four from Cerro del Medio, and one from El Rechuelos obsidian. Twenty-one artifacts were analyzed from the campsite located within the

Cerro Toledo obsidian source area, so it is not surprising that 18 of these were derived from this source, with two made of El Rechuelos and one of an undetermined source. Lastly, 100 flakes were analyzed from three sites located in the area of BG-21. All but one of these were derived from the nearby Cerro del Medio source, with a single flake made of El Rechuelos obsidian. Our own analysis indicates that El Rechuelos obsidian was visually identified at both the piñon-juniper campsites and BG-21, in both cases representing 2 percent to 3 percent of the debitage assemblage.

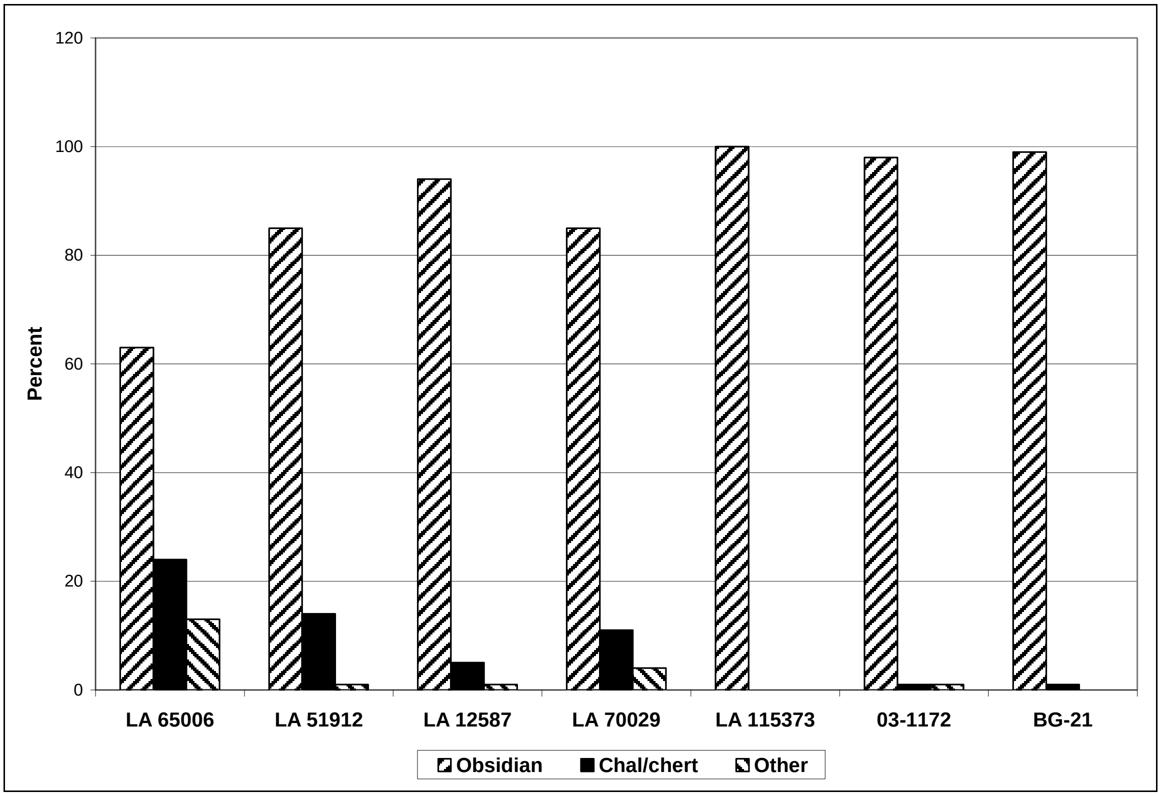


Figure 75.12. Debitage material types.

Overall, we see that the sites in my study are primarily linked to the Cerro Toledo and Cerro del Medio obsidian source areas, with each of the two high-elevation sites being tied to the nearby obsidian source. This supports our contention that obsidian could have been procured at these high-elevation settings during the mid to late summer and later reduced at the lower-elevation sites. The presence of small amounts of El Rechuelos obsidian may also reflect some distant ties to this area further to the north.

SUMMARY AND CONCLUSION

In conclusion, a variety of resources are present as plant foods in all the vegetation communities. Therefore, multiple foraging tactics could have been used by Late Archaic populations depending on seasonal rainfall, plant productivity, and changes in annual resource structure. Nonetheless, we have proposed one possible transhumance pattern, involving seasonal movements from the juniper-savanna to ponderosa pine/mixed conifer and then down to the piñon-juniper zone. It was in the latter community that maize could have also been harvested to reduce seasonal resource shortfalls. Nonetheless, these higher elevation resource settings were critical to Late Archaic foragers, including plant, animal, and obsidian raw material procurement.

The analysis of debitage assemblages from a sample of sites distributed throughout these vegetation zones, indicates that they are all linked by reduction tactic and obsidian procurement patterns. That is, lowland habitation sites are characterized by an emphasis on core reduction while upland campsites are characterized by biface production. Otherwise, obsidian dominated all the lithic assemblages, with sites situated in the juniper-savanna and piñon-juniper communities also containing a small amount of material derived from local river gravels. These data appear to lend some preliminary support to our model of a complementary settlement system that is distributed from river valley to mountaintop.

CHAPTER 76
PAJARITO CULINARY WARE: AN EXAMINATION OF RIM SHERD ATTRIBUTES FROM THREE COALITION AND THREE CLASSIC PERIOD SITES

Diane C. Curewitz

This study of culinary ceramics at six sites on the Pajarito Plateau of north-central New Mexico (Figure 76.1) is part of a larger research program that addresses the role of ritual in effecting changes in ceramic economy, particularly in stimulating increased specialization and value-based exchange during a period of population aggregation and agricultural intensification (Anschuetz 1995; Hill 1998; Hill et al. 1996; Powers and Orcutt 1999a). The overall research program examines five major ceramic types in three sub-regions of the northern Rio Grande: two glazeware types, two biscuitware types, and micaceous culinary ware. Ceramics from the Santa Fe sub-region and the Rio Ojo Caliente area of the Chama sub-region will be analyzed in future studies.

The Pajarito Plateau sites are central to the hypotheses to be tested. This area shows overlapping distribution of contemporaneous but very distinct ceramic wares, thought to denote the pre-contact presence of contemporary ethnic boundaries (Creamer et al. 2002; Futrell 1998; Vint 1999). Creamer (2000) convincingly argues, however, that language groups, commodity exchange networks, and settlement clustering show a variety of possible social boundary configurations. My hypothesis is that these overlapping ceramic distributions show that exchange between sub-regions was essential to the performance of common rituals, including communal feasts, and that the requirements associated with these rituals stimulated specialized production and exchange at the local level.

Analysis of culinary ware is an integral part of the overall research program. While much northern Rio Grande culinary ware shows standardized attributes that may be related to specialist production, micaceous ware is the only culinary ware whose production may be specialized for exchange (Curewitz 2004a). Significant quantities appear in Classic period assemblages at Tyuonyi (Curewitz 2004a; Vint 1999) and Arroyo Hondo (Habicht-Mauche 1993), but was produced only in the Chama-Española area north of Santa Fe (Habicht-Mauche 1993:Table 2; Warren 1981; Vint 1999).

Asymmetry of exchange is apparent between the Chama-Española and Pajarito areas. Little or no sand-tempered or mafic volcanic rock-tempered Pajarito grayware occurs in Chama-Española area assemblages, such as Howiri (Gauthier 1987a:44, Table 7), other sites in the Rio Ojo Caliente valley (Curewitz 2004b), and Te'ewi in the Rio del Oso valley (Gauthier 1987a:45, Table 8; Wendorf 1953). However, micaceous ware most likely produced in these areas occurs at Pajarito sites.

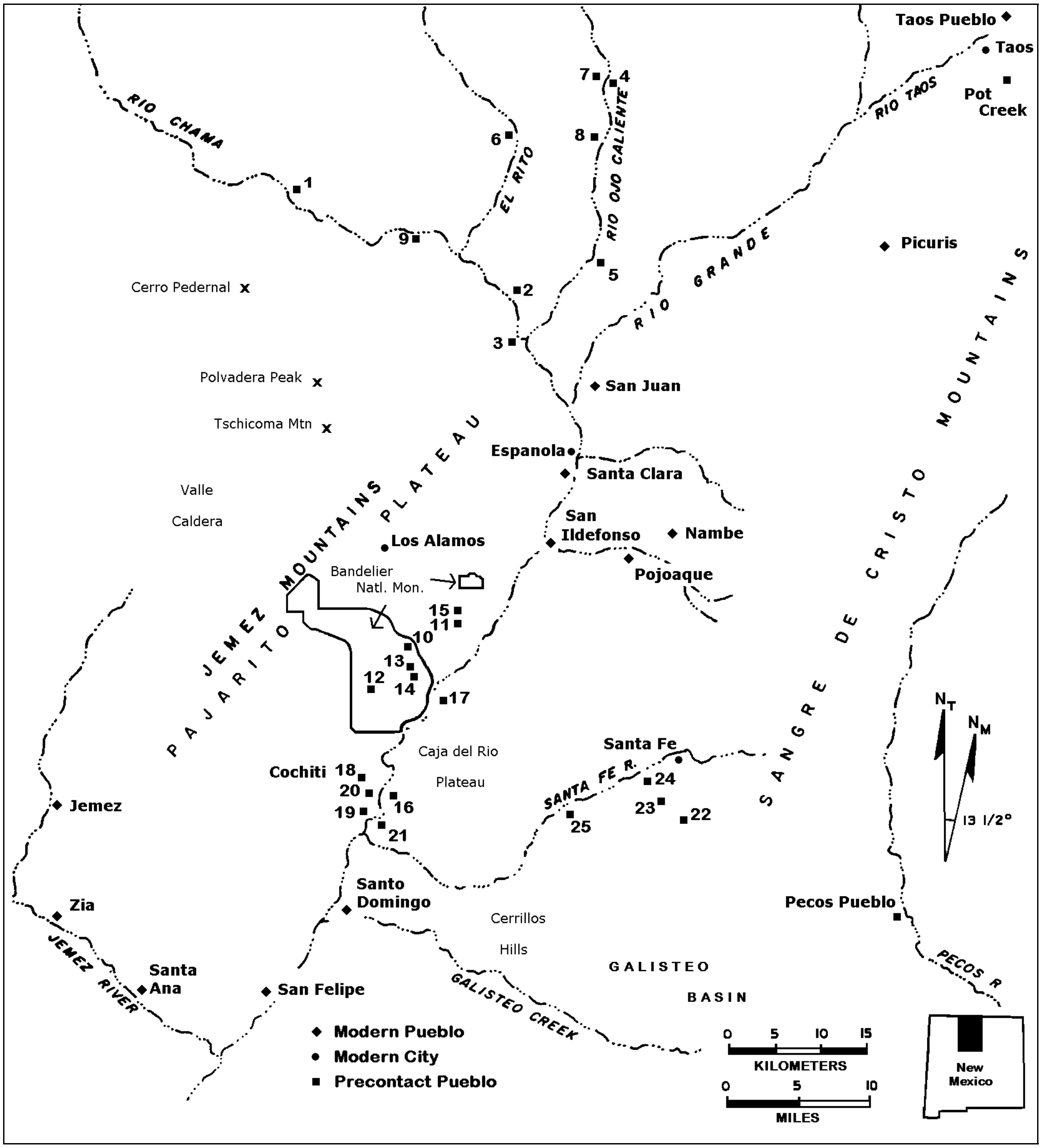


Figure 76.1. Major cities, modern pueblos, and selected archaeological sites of the northern Rio Grande. Precontact sites: 1. Riana (LA 920); 2. Leaf Water (LA 300); 3. Te'ewi (LA 252); 4. Howiri (LA 71); 5. Ponsipa-Akeri (LA 297); 6. Sapawe (LA 306); 7. Hupobi (LA 380); 8. Posi (Pose'uinge) (LA 632); 9. Poshuinge (LA 274); 10. Burnt Mesa (LA 60372.1); 11. White Rock (LA 12587); 12. Shohakka Pueblo (LA 3840); 13. Tyuonyi (LA 82); 14. Tyuonyi Annex (LA 60550); 15. Tsirege (LA 170); 16. Caja del Rio South (LA 5137); 17. Caja del Rio North (LA 174); 18. Cochiti (LA 295); 19. Alfred Herrera (LA 6455); 20. Kuapa (LA 3444); 21. Pueblo del Encierro (LA 70); 22. Arroyo Hondo (LA 12); 23. Pindi (LA 1); 24. Agua Fria Schoolhouse (LA 2); 25. Tzeguma (Cieneguilla) (LA 16). (Adapted from Powers and Van Zandt 1999:Figure 1.6).

Symmetrical, reciprocal exchange of pots is believed to represent reinforcement of existing relationships through gifts, establishment of new relationships through marriage, transportation of resources, circulation during intercommunity gatherings, or all of the above at various times (Zedeño 1998). If pots are associated with different ideological systems, exchange may represent reciprocal gifting between communities practicing similar classes of rituals (i.e., communal feasting), as in the case of biscuitware found at southern Pajarito sites (Mera 1940; Vint 1999). Asymmetrical exchange of relatively standardized undecorated culinary ware, however, may indicate that a barter system is developing.

THE QUESTION OF STANDARDIZATION AND SPECIALIZATION

Research on aspects of northern Rio Grande Classic period production organization using Costin's (1991) parameters (Habicht-Mauche 1993; Vint 1999) suggests that *context* of production was independent. Households continued to produce according to their own perceptions of advantage without control by an elite group. C*oncentration* of production facilities ranged from dispersed to nucleated. Production *scale* was most likely small, kin-based work units, operating in households. *Intensity* of production was probably part-time rather than full-time, since households still needed to produce most of their food. Clark and Parry (1990:320) note that all societies examined in their study of the correlation between craft specialization and cultural complexity, no matter what level of complexity, exhibit some type of craft specialization, usually part-time and independent.

There is little or no direct ceramic production evidence, such as kilns, raw material caches, production debris, and tools, on the Pajarito Plateau and in the northern Rio Grande in general. In this case, comparing attribute variation to arrive at relative standardization is one method of measuring degree of specialization (Arnold and Nieves 1992; Costin 1991, 2001; Crown 1994; Longacre 1999; Roux 2003). Other methods include identifying production sources and defining ceramic distributions (Bishop et al. 1982; Costin and Hagstrum 1995; Shepard 1942; Warren 1979).

Crown (1994:116) and B. Stark (1995:238) use Coefficient of Variation (CV) or Q-test to measure standardization. Based on ethnographic and ethnohistoric research, CVs of 10 percent or less are believed to indicate standardization at a level highly suggestive of specialized production. Stark's (1995:256–257) ethnoarchaeological research suggests that standardization may result when many potters follow customary production methods or a few specialize in production for exchange ("the ratio effect").

Crown's examination of Salado Polychrome production organization (1994:115−122) showed complex, non-repetitive, labor-intensive designs and relatively nonstandard forms for vessels produced for local use. CVs calculated to assess relative vessel height and diameter homogeneity were generally above 10 percent, indicating a low degree of specialization (Crown 1994:Table 7.2). The exception is CVs below 10 percent for height and diameter of very large bowls at one site, suggesting specialized production of vessels for communal feasts.

Schleher (2005) has recently compared the production characteristics of ethnographic ceramic assemblages with those from archaeological sites. In her assessment of whether CVs of 10 percent or less have value as measures of specialization in archaeological assemblages, she notes that time scales, number of producers and production episodes, and sample size variation are not always known for archaeological assemblages, and even when known may not be comparable with ethnographic production parameters.

Hagstrum's (1985) calculation of CV for painted decoration (but not size) of a small sample of Coalition period Santa Fe/Wiyo Black-on-white bowls relative to Classic period Bandelier Black-on-gray (Biscuit B) bowls is the only study to focus on production specialization in the northern Rio Grande. She found more standardized design elements and greater decoration efficiency in the later type, implying an increase in ceramic specialization in decorated service wares.

Motsinger (1997) analyzed the width and placement of framing lines on northern Rio Grande glazeware rim sherds tempered with hornblende latite. He found a decrease in CV for framing line width from early Glaze A through Glaze D and a decrease in CV for distance of the framing line from the vessel lip from late Glaze A through Glaze F. He concluded that earlier glazewares are more specialized than later varieties.

The research reported here represents the first examination of standardization and possible specialization in northern Rio Grande culinary ware production. Vessel thickness and size are used to measure standardization. These are considered production efficiency measures, but may also relate to consumer demand for performance-related functional characteristics (Costin and Hagstrum 1995; Hegmon et al. 1995:35; Rice 1987; Rye 1981; Shepard 1956).

THE PRESENT STUDY

In this study of ceramic attributes, I measured and categorized over 600 culinary jar rim sherds from excavation units at three Coalition period sites and three Classic period sites on the Pajarito Plateau (Figure 76.2). I found changes in surface treatment, temper, size range of jars, ratio of large to small jars, vessel wall thickness, and rim thickness. I found some indications of standardization at Coalition sites and increased standardization between the Coalition (AD 1150 to 1325) and Classic (AD 1325 to 1600) periods.

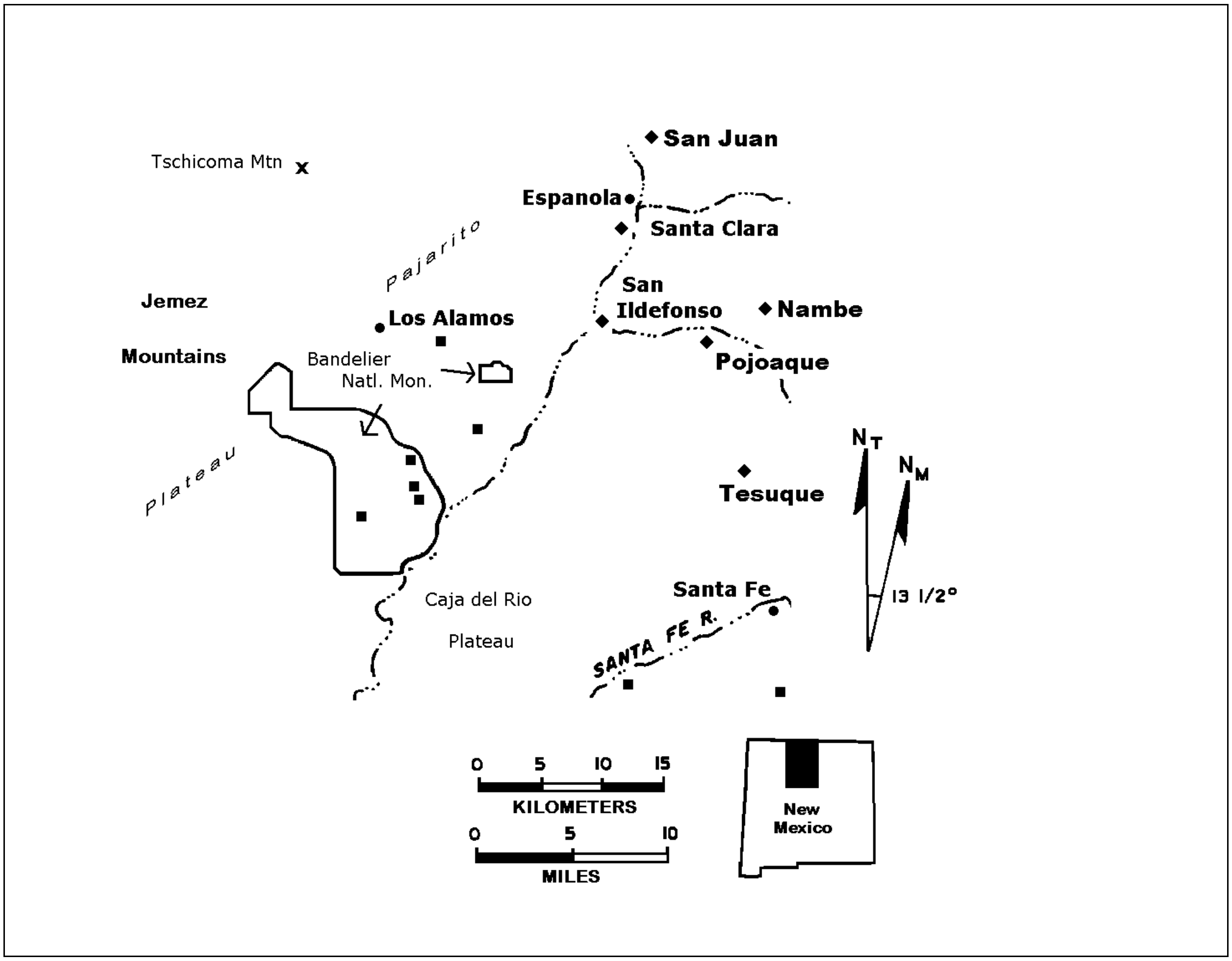


Figure 76.2. Selected archaeological sites on the Pajarito Plateau. A) Shohakka Pueblo (LA 3840); B) Tyuonyi (LA 82); C) Tyuonyi Annex (LA 60555); D) Burnt Mesa Pueblo (LA 60372); E) White Rock (LA 12587); F) Airport (LA 86534).

SITE LOCATION AND DESCRIPTION

Coalition Sites

These sites are presented according to their geographic location from south to north on the Pajarito Plateau (Figure 76.2).

- LA 60372 (Burnt Mesa Pueblo) is a Late Coalition/Early Classic period site located on Burnt Mesa north of Frijoles Canyon at Bandelier National Monument. Area 1 is a plaza pueblo with 65 rooms and a kiva in the plaza. The 93 culinary rims I examined came from a stratified plaza test unit to the west of the kiva (Kohler 1989; Kohler and Root 1992b, 2004). Unit 90S/88E was excavated in 1990 as part of the Bandelier Archaeological Excavation Project and described in Kohler and Root (2004:191–192). A tree-ring date from Stratum 6 of this unit yielded an age of 1271vv, and Kohler and Root

(2004:211) propose that the main construction of Area 1 began in the 1270s or 1280s. Based on tree-ring dates and ceramic assemblage, they estimate the occupation of Area 1 "to have occurred between 1275 and 1325 or slightly later" (Kohler and Root 2004:212).

- LA 12587 (White Rock Site) is a linear roomblock (Vierra et al. 2002:5-2) located just west of the town of White Rock on Mesita del Buey, about 10 km north of LA 60372. One of the 22 rooms is a large room with two hearths that might be a kiva. The 71 culinary rims analyzed came from 60-cm-wide trenches excavated into the midden east of the roomblock. No stratigraphic distinctions were made between levels in these trenches. Wilson and Castro-Reino (2005:1) use ceramics from room and midden units at LA 12587 to date the site "to the early and middle 13th century with some continuation into the 14th century." Radiocarbon dates from hearths in the roomblock suggest that the site was occupied from ca. AD 1180 (870±70 B.P.; two-sigma calibrated result AD 1020–1280; intercept AD 1180; Beta 183747) to ca. AD 1300 (650±40 B.P.; two-sigma calibrated result AD 1280–1400; intercept AD 1300; Beta 183748) (Harmon et al. Volume 2).

- LA 86534 (Airport Site) is located near the Los Alamos Airport and "dates to the early to middle 13th century" (Wilson and Castro-Reino 2005:1; see Vierra et al. 2002:5-1). This site was cut through when NM 502 was built and only eight rooms remain, but one is a kiva cut into the tuff east of the roomblock. The 41 culinary rims analyzed came from the west half of this kiva. Excavators identified rooffall, wallfall, and a post-occupation layer within the kiva. The materials from LA 12587 and LA 86534 studied here constitute samples from different portions of the site than those studied by Wilson and Castro-Reino (2005). Radiocarbon dates from hearths in the roomblock suggest the site was occupied from ca. AD 1190 (860±40 B.P.; 2σ calibrated result AD 1040–1260; intercept AD 1190; Beta 183760) to ca. AD 1280 (730±40 B.P.; 2σ calibrated result AD 1240–1300; intercept AD 1280; Beta 183761) (Schmidt Volume 2).

The three Classic period sites are all located at Bandelier National Monument and are presented here according to geographic location from south to north. No ceramics were examined from Classic sites on the Pajarito Plateau north of Bandelier.

- LA 3840 (Shohakka Pueblo), in Capulin Canyon, about 12 km southwest of Frijoles Canyon, is a horseshoe-shaped roomblock, open to the south, containing about 90 rooms. The plaza contains three kivas. The 63 culinary rims analyzed came from a midden trench excavated south of the roomblock (Kohler 1989; Kohler and Linse 1993; Kohler et al. 2004; Ruscavage-Barz 1999). Tree-ring samples from the site could not be dated. Radiocarbon dates were obtained from beams in Room 1 and Kiva 3 rooffall. An archaeomagnetic date was obtained from the hearth in Room 2. Calibrated ages for these samples, combined with ceramic evidence, yield an occupation range "that begins in the last decade of the 1300s and extends through the first three decades of the 1400s (Linse and Kohler 1993:34). The distribution of ceramics in the midden, which probably contains material deposited over the entire occupation, shows some slight differences with the room and kiva fills, notably a higher proportion of smeared-indented corrugated ware (Kohler and Gray 1993:40–41).

- LA 82 (Tyuonyi) is an enclosed plaza pueblo in Frijoles Canyon with 240 ground floor rooms, three kivas in the northern part of the plaza, and a big kiva to the east. Tree-ring samples from the site date from the 1360s to 1520s. The 293 culinary rims analyzed are from two units excavated in the southern part of the plaza in the early 1970s (Curewitz 2004a; Kohler et al. 2004; Williams and Griggs 1973). These units did not produce any tree-ring or radiocarbon samples, but Mean Ceramic Dates have been calculated (see Curewitz 2004a).

- LA 60550 (called "the unexcavated site" on Park Service maps of Frijoles Canyon) is referred to here as Tyuonyi Annex (Kohler 1989). This 50-room rectangular block is located 60 m southeast of Tyuonyi, between Tyuonyi and the big kiva. The 52 culinary rims analyzed are from a 2- by 2-m unit located about 10 m southeast of the roomblock. The ceramic assemblage suggests occupation relatively late in the Classic sequence, overlapping with the last 75 years of occupation at Tyuonyi (Kohler 1989; Kohler and Linse 1993; Kohler et al. 2004).

WARE AND TYPE DISTRIBUTION CHANGES

Culinary ware makes up 84 percent to 88 percent of the sherds at the Coalition sites (Table 76.1a), but only 61 percent to 72 percent at the Classic period sites (Table 76.1c). Smeared-indented corrugated ware is the dominant culinary type at Coalition period sites, with percentages ranging from 92 to 95 (Table 76.1b). Plain gray is the dominant culinary type at Classic period sites, with percentages ranging from 82 to 90 (Table 76.1d). Micaceous ware makes up a significant proportion of the culinary ware at LA 82 (Tyuonyi), averaging 22 percent in the two excavated units (Table 76.1d). Larger percentages occur in the upper levels of the units (Curewitz 2004a:Table 2). In contrast, only 0.1 percent of the culinary sherds at one Coalition period site (LA 12587) and between 0.6 percent and 1.1 percent at the other two Classic period sites contain any mica (Table 76.1a and 76.1b).

Table 76.1a. Ware and type distribution for selected units at three Coalition period Pajarito sites.

Type/Field Specimen (FS)	LA 12587		LA 86534		LA 60372	
	n	%	*n*	%	*n*	%
Plain body	82	2.0	17	1.0	231	3.7
Plain rim	14	0.4	5	0.4	7	0.1
Clapboard neck	2	0.0	0	0.0	0	0.0
Indented corrugated	122	3.0	37	2.2	34	0.5
Plain corrugated	10	0.2	4	.02	86	1.4
Smeared-indented corrugated (SIC)	2965	73.7	1306	76.4	4887	78.0
SIC rim	146	3.6	61	3.5	218	3.5
Micaceous	5	0.1	0	0.0	0	0.0
Other	25	0.6	15	0.9	44	0.6
Total Culinary Ware	*3371*	*83.8*	*1445*	*84.5*	*5507*	*87.9*

Type/Field Specimen (FS)	**LA 12587**		**LA 86534**		**LA 60372**	
	n	%	*n*	%	*n*	%
Black-on-white body	374	9.3	131	7.7	414	6.6
Santa Fe rims	56	1.4	29	1.7	101	1.6
Kwahe'e body	1	0.0	0	0.0	0	0.0
Kwahe'e rims	3	0.1	0	0.0	1	0.0
Wiyo body	8	0.2	11	0.6	38	0.6
Wiyo rims	5	0.1	0	0.0	8	0.1
Biscuit A body	8	0.2	3	0.2	3	0.0
Biscuit A rim	0	0.0	0	0.0	2	0.0
Biscuit B body	2	0.0	0	0.0	2	0.0
Biscuit B rim	1	0.0	0	0.0	0	0.0
Jar sherds	7	0.2	8	0.5	0	0.0
Santa Fe jar rim	1	0.0	0	0.0	0	0.0
Whiteware nfs	180	4.5	74	4.3	145	2.3
Basket-impressed B/w	1	0.0	1	0.1	4	0.0
Unusual design B/w	1	0.0	0	0.0	0	0.0
B/w int/ext slip	1	0.0	0	0.0	0	0.0
White Mountain redware	1	0.0	0	0.0	0	0.0
Other	0	0.0	8	0.5	6	0.1
Glazeware	0	0.0	0	0.0	33	0.4
Total Service Ware	*650*	*16.2*	*265*	*15.5*	*757*	*12.1*
	4021	100.0	1710	100.0	6264	100.0
Utility sherds <1 cm	621		82		-	-
Total	**4642**		**1792**		**-**	**-**

Table 76.1b. Type distribution as a percentage of ware.

Type/FS	**LA 12587**		**LA 86534**		**LA 60372**	
	n	%	*n*	%	*n*	%
Plain body	82	2.4	17	1.2	231	4.2
Plain rim	14	0.4	5	0.3	7	0.1
Clapboard neck	5	0.1	2	0.1	5	0.1
Indented corrugated	122	3.6	37	2.6	34	0.6
Plain corrugated	10	0.3	4	0.3	86	1.6
Smeared-indented corrugated	2965	88.0	1306	90.4	4887	88.7
SIC rim	146	4.3	61	4.2	218	4.0
Micaceous	5	0.1	0	0.0	0	0.0
Other	25	0.8	15	1.0	44	0.8
Total Culinary Ware	*3371*	*100.0*	*1445*	*100.1*	*5507*	*100.1*
Black-on-white body	374	57.5	131	49.4	414	54.7
Santa Fe rims	56	8.6	29	10.9	101	13.3
Kwahe'e body	1	0.2	0	0.0	0	0.0
Kwahe'e rims	3	0.5	0	0.0	1	0.1
Wiyo body	8	1.2	11	4.2	38	5.0

Type/FS	LA 12587		LA 86534		LA 60372	
	n	%	*n*	%	*n*	%
Wiyo rims	5	0.8	0	0.0	8	1.1
Biscuit A body	8	1.2	3	1.1	3	0.4
Biscuit A rim	0	0.0	0	0.0	2	0.3
Biscuit B body	2	0.3	0	0.0	2	0.3
Biscuit B rim	1	0.2	0	0.0	0	0.0
Jar sherds	7	1.1	8	3.0	0	0.0
Santa Fe jar rim	1	0.2	0	0.0	0	0.0
Whiteware nfs	180	27.7	74	27.9	145	19.2
Basket-impressed B/w	1	0.2	1	0.4	4	0.5
Unusual design B/w	1	0.2	0	0.0	0	0.0
B/w int/ext slip	1	0.2	0	0.0	0	0.0
White Mountain redware	1	0.2	0	0.0	0	0.0
Other	0	0.0	8	3.0	6	0.8
Glazeware	0	0.0	0	0.0	33	4.4
Total Service Ware	*650*	*100.0*	*265*	*100.0*	*757*	*100.0*
	4021		1710		6264	
Utility sherds <1 cm	621		82		-	-
Total	**4642**		**1792**		**-**	**-**

Table 76.1c. Ware and type distribution for selected units at Classic period Pajarito sites.

Ware/Type	3840		82A		82B		60550	
	n	%	*n*	%	*n*	%	*n*	%
Plain gray	1168	51.7	1240	36.3	2575	42.1	1213	57.2
Plain gray rims	67	3.0	89	2.6	172	2.8	57	2.7
Micaceous	8	0.4	389	11.4	1098	18.0	15	0.7
SIC	101	4.5	361	10.6	478	7.8	76	3.6
SIC rims	7	0.3	15	0.4	25	0.4	1	0.0
Coalition nfs	31	1.4	4	0.1	21	0.3	54	2.5
Classic nfs	5	0.2	0	0.0	0	0.0	7	0.3
Total Culinary	*1387*	*61.3*	*2098*	*61.4*	*4369*	*71.5*	*1423*	*67.2*
Kwahe'e Black-on-white	0	0.0	1	0.0	0	0.0	1	0.0
Santa Fe Black-on-white	4	0.2	97	2.8	75	1.2	1	0.0
Santa Fe Black-on-white rim	1	0.0	19	0.6	17	0.3	1	0.0
Galisteo Black-on-white	0	0.0	2	0.1	0	0.0	0	0.0
Wiyo Black-on-white	1	0.0	3	0.1	0	0.0	1	0.0
Wiyo Black-on-white rim	1	0.0	3	0.1	1	0.0	1	0.0
Whiteware nfs	37	1.6	0	0.0	0	0.0	12	0.6
Glaze A	66	2.9	50	1.5	51	0.8	0	0.0
Glaze A-B	8	0.4	1	0.0	1	0.0	0	0.0
Glaze B	2	0.1	1	0.0	0	0.0	1	0.0
Glaze B-C	0	0.0	1	0.0	5	0.1	0	0.0
Glaze C	2	0.1	16	0.5	12	0.2	4	0.2

Ware/Type	3840		82A		82B		60550	
	n	%	*n*	%	*n*	%	*n*	%
Glaze C-D	0	0.0	0	0.0	10	0.2	0	0.0
Glaze D	0	0.0	1	0.0	1	0.0	8	0.4
Glaze D-E	0	0.0	3	0.1	0	0.0	0	0.0
Glaze E	0	0.0	4	0.1	4	0.1	4	0.2
Glaze nfs	711	31.4	772	22.6	1194	19.5	509	24.0
Biscuit A	28	1.2	104	3.0	58	0.9	10	0.5
Biscuit A rims	2	0.1	17	0.5	5	0.1	1	0.0
Biscuit B	3	0.1	157	4.6	215	3.5	61	2.9
Biscuit B rims	0	0.0	20	0.6	29	0.5	13	0.6
Biscuit nfs	1	0.0	43	1.3	54	0.9	19	0.9
Other Service*	7	0.3	4	0.1	9	0.1	49	2.3
Total Service	874	38.7	1319	38.6	1741	28.5	696	32.8
Total	**2261**	**100.0**	**3417**	**100.0**	**6110**	**100.0**	**2119**	**99.6**

*White Mountain Redware, Sankawi Black-on-cream, Potsuii, buffware, Tewa Red

Table 76.1d. Type distribution as a percentage of ware.

Ware/Type	3840		82A		82B		60550	
	n	%	*n*	%	*n*	%	*n*	%
Plain gray	1168	84.2	1240	59.1	2575	58.9	1213	85.2
Plain gray rims	67	4.8	89	4.2	172	3.9	57	4.0
Micaceous	8	0.6	389	18.5	1098	25.1	15	1.1
SIC	101	7.3	361	17.2	478	10.9	76	5.3
SIC rims	7	0.5	15	0.7	25	0.6	1	0.1
Coalition nfs	31	2.2	4	0.2	21	0.5	54	3.8
Classic nfs	5	0.4	0	0.0	0	0.0	7	0.5
Total Culinary	*1387*	*100.0*	*2098*	*100.0*	*4369*	*100.0*	*1423*	*100.0*
Kwahe’e Black-on-white	0	0.0	1	0.1	0	0.0	1	0.1
Santa Fe Black-on-white	4	0.5	97	7.4	75	4.3	1	0.1
Santa Fe Black-on-white rim	1	0.1	19	1.4	17	1.0	1	0.1
Galisteo Black-on-white	0	0.0	2	0.2	0	0.0	0	0.0
Wiyo Black-on-white	1	0.1	3	0.2	0	0.0	1	0.1
Wiyo Black-on-white rim	1	0.1	3	0.2	1	0.1	1	0.1
Whiteware nfs	37	4.2	0	0.0	0	0.0	12	1.7
Glaze A	66	7.6	50	3.8	51	2.9	0	0.0
Glaze A-B	8	0.9	1	0.1	1	0.1	0	0.0
Glaze B	2	0.2	1	0.1	0	0.0	1	0.1
Glaze B-C	0	0.0	1	0.1	5	0.3	0	0.0
Glaze C	2	0.2	16	1.2	12	0.7	4	0.6
Glaze C-D	0	0.0	0	0.0	10	0.6	0	0.0
Glaze D	0	0.0	1	0.1	1	0.1	8	1.1
Glaze D-E	0	0.0	3	0.2	0	0.0	0	0.0
Glaze E	0	0.0	4	0.3	4	0.2	4	0.6

Ware/Type	3840		82A		82B		60550	
	n	%	*n*	%	*n*	%	*n*	%
Glaze nfs	711	81.4	772	58.5	1194	68.6	509	73.1
Biscuit A	28	3.2	104	7.9	58	3.3	10	1.4
Biscuit A rims	2	0.2	17	1.3	5	0.3	1	0.1
Biscuit B	3	0.3	157	11.9	215	12.3	61	8.8
Biscuit B rims	0	0.0	20	1.5	29	1.7	13	1.9
Biscuit nfs	1	0.1	43	3.3	54	3.1	19	2.7
Other Service*	7	0.8	4	0.3	9	0.5	49	7.0
Total Service	874	100.0	1319	100.0	1741	100.0	696	100.0
Total	**2261**		**3417**		**6110**		**2119**	

*White Mountain Redware, Sankawi Black-on-cream, Potsuii, Buff ware, Tewa Red

Service ware types also change from the Coalition to Classic periods. Santa Fe Black-on-white and other thin, hard, ash-tempered varieties of the Pajarito Series (Habicht-Mauche 1993:Table 2; 19–26) are the dominant decorated Coalition period service ware types, making up between 93 percent and 97 percent of all decorated wares (Table 76.1b). Glazewares are the dominant Classic period service wares, ranging from 69 percent at LA 82 (Tyuonyi) to 90 percent at LA 3840 (Shohakka) (Table 76.1d). Only one Coalition site (LA 60372) contains any glazeware (Table 76.1a). Kohler and Root (2004:197) consider the two later glaze rim sherds from Unit 90S/88E to represent late reuse of the site rather than late occupation. Biscuitware makes up less than 0.2 percent or less of any Coalition service ware assemblage, but ranges from 4 percent at LA 3840 (Shohakka) to 23 percent at LA 82 (Tyuonyi) (Table 76.1d).

The Sample

Attributes were recorded for a total of 1108 culinary and service ware rim and body sherds from the six Pajarito sites (Tables 76.2a and 76.2b). The culinary ware sample consists of 618 rim sherds (58.6 percent of all Pajarito rim sherds) and 20 body sherds (37.0 percent of all Pajarito body sherds). The discrepancy between the total percentage and the sample percentage of each type is due in part to the smaller number of culinary ware types and tempers to be sampled. It may also relate to better preservation of service ware rims. Rims make up 7 percent to 12 percent of all service ware sherds but only 5 percent to 7 percent of culinary ware. Within culinary ware categories, the ratio of smeared-indented corrugated rims to body sherds is much smaller than for plain gray. Smeared-indented corrugated rims are generally much thinner and more tapered than plain gray, which may affect their preservation rate.

Table 76.1e. Summary table for whitewares.

	LA 12587		LA 86534		LA 60372		LA 3840		LA 82 (A)		LA 82 (B)		LA 60550	
Kwahe'e	4	0.7	0	0.0	1	0.1	0	0.0	1	0.0	0	0.0	1	0.1
Santa Fe	614	94.4	236	88.7	664	87.7	42	4.8	116	8.8	92	5.3	14	1.9
Wiyo	13	2.0	11	4.2	46	6.1	2	0.2	6	0.4	1	0.1	2	0.2
Biscuit A	8	1.2	3	1.1	5	0.7	30	3.4	121	9.2	63	3.6	11	1.5
Biscuit B	10	1.6	8	3.0	2	0.3	3	0.3	177	13.4	244	14.0	74	10.7
Biscuit nfs	0	0.0	0	0.0	0	0.0	1	0.1	43	3.3	54	3.1	19	2.7
	649	99.9	258	97.0	718	94.9	78	8.8	464	35.1	454	26.1	121	17.1
Galisteo	0	0.0	0	0.0	0	0.0	0	0.0	2	0.0	0	0.0	0	0.0
WMRW	1	0.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Glaze	0	0.0	0	0.0	33	4.4	842	90.3	849	64.4	1278	73.5	538	75.5
Other nfs	0	0.0	8	3.0	6	0.8	7	0.8	4	0.3	9	0.5	49	7.0
	650	100.1	266	100	757	100.1	927	99.9	1319	99.8	1741	100.1	708	99.6

Table 76.2a. Sample distribution for three Coalition Pajarito sites.

Type	LA 12587		LA 86534		LA 60372	
	n	%	*n*	%	*n*	%
Culinary Rims						
Clapboard	5	7.0	2	4.9	5	5.4
SIC	52	73.2	34	82.9	81	87.1
Plain	14	19.7	5	12.2	7	7.5
Total Culinary	71	99.9	41	100.0	93	100.0
Service Rims						
Kwahe'e	3	9.7	0	0.0	0	0.0
Santa Fe	19	61.3	16	69.6	57	63.3
Santa Fe/Wiyo	5	16.1	7	30.4	27	30.0
Wiyo	3	9.7	0	0.0	4	4.4
Biscuit A	0	0.0	0	0.0	0	0.0
Biscuit B	1	3.2	0	0.0	0	0.0
Glaze C	0	0.0	0	0.0	2	2.2
Total Service	31	100.0	23	100.0	90	99.9
Total Rims	102		64		183	
Body Sherds						
Biscuit A	1	20.0	3	100.0	1	10.0
Biscuit B	4	80.0	0	0.0	2	20.0
Glaze nfs	0	0.0	0	0.0	7	70.0
Total Body	5	100.0	3	100.0	10	100.0
Total Sherds	**107**		**67**		**193**	

Table 76.2b. Sample distribution for three Classic Pajarito sites.

Type/Site	3840		82A		82B		60550	
	n	%	*n*	%	*n*	%	*n*	%
Culinary Rims								
Clapboard	0	0.0	1	1.0	6	3.1	0	0.0
SIC	4	6.3	15	14.9	19	9.7	1	1.9
Plain	59	92.2	85	84.2	166	84.7	51	98.1
Washboard	0	0.0	0	0.0	5	2.6	0	0.0
TIA	1	1.6	0	0.0	0	0.0	0	0.0
Total Culinary	64	100.1	101	100.1	196	100.1	52	100.0
Service Rims								
Santa Fe	0	0.0	16	15.4	9	8.3	0	0.0
Santa Fe/Wiyo	0	0.0	3	2.9	8	7.3	0	0.0
Wiyo	1	1.5	3	2.9	1	0.9	1	7.7
Biscuit A	2	3.0	17	16.3	5	4.6	0	0.0
Biscuit B	1	1.5	20	19.2	29	26.6	9	69.2
Biscuit nfs	0	0.0	0	0.0	0	0.0	1	7.7

Sankawi	0	0.0	0	0.0	1	0.9	0	0.0
Glaze A	59	89.4	36	34.6	43	39.4	1	7.7
Glaze B	1	1.5	0	0.0	0	0.0	0	0.0
Glaze C	2	3.0	9	8.7	13	11.9	1	7.7
Total Service	66	99.9	104	100.0	109	99.9	13	100.0
Total Rims	130		205		305		65	
Body Sherds								
Plain Gray	5	41.7	0	0.0	0	0.0	10	45.5
SIC	1	8.3	0	0.0	1	50.0	3	13.6
Biscuit A	4	33.3	0	0.0	0	0.0	2	9.1
Biscuit B	2	16.7	0	0.0	0	0.0	7	31.8
Glaze A	0	0.0	0	0.0	1	50.0	0	0.0
Total Body	12	100.0	0	0.0	2	100.0	22	100.0
Total Sherds	**142**		**205**		**307**		**87**	

Culinary Ware Type/Temper Associations

Several recent studies have used petrographic analysis to identify the sources of Pajarito Plateau ceramics from the Coalition period. These include a study of ceramics at LA 4624, located west of LA 12587 on Mesita del Buey (Castro-Reino and Lavayen 2002; Curewitz and Harmon 2002), and at LA 135290 (Chapter 25, Volume 2) and LA 4618 (Schmidt 2006) as well as rooms and midden units at LA 12587 and LA 86534 (Chapters 14 and 24, Volume 2; Castro-Reino 2005; Wilson and Castro-Reino 2005).

These studies "support previous observations on the distinct nature and uniformity of Coalition period pottery" (Wilson and Castro-Reino 2005:10). Observation of ceramics from the three Coalition period Pajarito sites with a binocular microscope shows similar results (Table 76.3). The dominant temper type for smeared-indented corrugated and plain gray culinary ware at the three sites is "anthill sand," which consists mainly of coarse feldspar and quartz crystals.

The Coalition to Classic period transition from smeared-indented corrugated to plain gray culinary ware occurs at the same time that the thin, hard, ash-tempered Black-on-white Santa Fe varieties in the Pajarito series are replaced by glazeware and by thicker, softer biscuitware (Tables 76.1a through 76.1d). A change in culinary ware tempering material can be observed while smeared-indented corrugated is still the dominant culinary type (Tables 76.3a and 76.3b).

At the earlier Coalition period sites, LA 12587 and LA 86534, smeared-indented corrugated makes up over 90 percent of the culinary ware, and almost all of it is tempered with coarse anthill sand (Figures 76.3a and 76.3b). The temper change to finer material appears first in smeared-indented corrugated ware at Burnt Mesa (LA 60372), which bridges the Coalition to Classic period transition. Petrographic characterization of a sub-sample of smeared-indented corrugated and plain gray sherds (n = 35) shows similar mineral and lithic content, but differences in grain size and sorting (Appendix AA).

Both varieties of anthill sand temper are dominated by sanidine feldspar and monocrystalline quartz, with minor biotite, oxides, and plagioclase occurring in most sherds. Rare pyroxenes, amphiboles, or olivine may also be present. In the coarser anthill sand temper, 67 percent to 100 percent of the dominant grains are very coarse sand-size quartz (1.0-2.0 mm). Only 33 percent to 67 percent of the secondary grains are very coarse. Sorting is bimodal.

In the finer anthill sand temper, 0 to 40 percent of the dominant grains are very coarse; more are fine (0.125 to 0.25 mm), medium (0.25 to 0.50 mm), or coarse (0.50 to 1.0 mm). It is the secondary temper grains that are larger, more often coarse to very coarse. Sorting is poor, but not strongly bimodal as in the earlier type.

Felsic volcanic rock (rhyolite) is the lithic most often found with both anthill sand tempers. Small quantities of intermediate (andesitic) and mafic (basaltic) volcanic rock are present, sometimes as the dominant lithic type, but more often secondary to the felsic rock. Pumice dominates only one sherd but is found as a secondary lithic in about one-third of all sherds. Two sherds contain glassy pumice.

The above suggests that differences in the tempers may be due to a change in the preparation method for anthill sand temper, possibly sieving and selection of a finer fraction. Almost a fifth of the sherds in the sample are tempered with this finer material.

Most plain gray sherds from Coalition sites ($n = 5$) show three different temper varieties: earlier, coarser anthill sand, later, finer anthill sand; two plain gray sherds from LA 60372 contain fragments of disaggregated intermediate and mafic volcanic rock and very little additional sand. My study of culinary ware at Tyuonyi (Curewitz 2004a) found similar rock temper in plain gray sherds in upper levels of the two excavated units. Non-micaceous culinary sherds from Classic period sites were not sampled for petrographic analysis in this study.

At Classic period Shohakka (LA 3840), 89 percent of the culinary ware is plain gray (see Table 76.1d). Eighty-nine percent of it contains fine, angular to sub-angular felsic material and nine percent contains some mica. The small amount of smeared-indented corrugated present also contains finer, angular to sub-angular felsic material rather than coarse anthill sand crystals.

At Tyuonyi, smeared-indented corrugated makes up between 10 percent and 20 percent of the lower levels, dropping to less than 10 percent in the upper levels (Curewitz 2004a:76, Table 2). Roughly equal percentages are tempered with anthill sand crystals and finer, more angular felsic material, with sparse mica flakes in some (Table 76.3b). Most plain grayware is tempered with the finer, more angular, felsic material.

Micaceous sherds make up about 22 percent of the plain-surfaced ware from the two excavation units (Table 76.3b; Figure 76.3). The five micaceous washboard rim sherds found in Unit B appear to have a micaceous paste or added mica temper.

Table 76.3a. Rim and body sherd temper by ceramic type at Pajarito sites.

Temper	LA 12587		LA 86534		LA 60372		LA 3840		LA 82A		LA 82B		LA 60550	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
SIC˜ Anthill	41	38.3	28	41.7	62	32.1	0	0.0	5	2.4	7	2.3	0	0.0
SIC˜ Crushed Igneous	8	7.5	6	9.0	18	9.3	3	2.1	8	3.9	11	3.6	1	1.1
SIC˜ Mica	3	2.8	0	0.0	0	0.0	2	1.4	2	1.0	1	0.3	3	3.4
Plain˜ Anthill	6	5.6	4	6.0	1	0.5	1	0.7	2	1.0	6	2.0	1	1.1
Plain˜ Crushed Igneous	3	2.8	1	1.5	6	3.1	57	40.1	61	29.8	102	33.3	47	54.0
Plain–Sparse Mica	3	2.8	0	0.0	0	0.0	0	0.0	7	3.4	31	10.1	6	6.9
Plain–Dense Mica	0	0.0	0	0.0	0	0.0	6	4.2	15	7.3	27	8.8	6	6.9
Volcanic Ash˜ Santa Fe Paste (11)	21	22.3	22	33.8	61	31.6	1	0.7	15	7.3	11	3.6	0	0.0
Volcanic Ash–Wiyo, Biscuit Paste (11-, 20)	9	9.6	4	6.2	25	13.0	7	4.9	30	14.6	38	12.4	20	23.0
Volcanic Ash–Modified (20+, 22)	0	0.0	0	0.0	0	0.0	1	0.7	8	3.9	3	1.0	0	0.0
Glaze A–I					5	2.6	33	23.2	18	8.8	28	9.2	1	1.1
Glaze A–II					0	0.0	16	11.3	14	6.8	11	3.6	0	0.0
Glaze A–III					2	1.0	10	7.0	1	0.5	4	1.3	0	0.0
Glaze A–IV					0	0.0	0	0.0	3	1.5	0	0.0	0	0.0
Glaze C–I					0	0.0	1	0.7	2	1.0	6	2.0	0	0.0
Glaze C–II					2	1.0	1	0.7	3	1.5	4	1.3	0	0.0
Glaze C–III					0	0.0	0	0.0	1	0.5	1	0.3	1	1.1
Glaze C–IV					0	0.0	0	0.0	0	0.0	2	0.7	0	0.0
	94		65		181		139		195		293		86	
Other	13	12.1	2	3.0	12	6.2	3	2.1	10	4.9	13	4.2	1	1.1
Total	**107**	**100.0**	**67**	**100.0**	**193**	**100.0**	**142**	**100.0**	**205**	**100.0**	**306**	**100.0**	**87**	**100.0**

Table 76.3b. Temper type as a percentage of ware.

Temper	LA 12587		LA 86534		LA 60372		LA 3840		LA 82A		LA 82B		LA 60550	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
SIC˜ Anthill	41	78.8	28	82.4	62	77.5	0	0.0	5	33.3	7	36.8	0	0.0
SIC˜ Crushed Igneous	8	15.4	6	17.6	18	22.5	3	60.0	8	53.3	11	57.9	1	25.0
SIC˜ Mica	3	5.8	0	0.0	0	0.0	2	40.0	2	13.3	1	5.3	3	75.0
	52	100.0	34	100.0	80	100.0	5	100.0	15	99.9	19	100.0	4	100.0
Plain˜ Anthill	6	50.0	4	80.0	1	14.3	1	1.6	2	2.4	6	3.6	1	1.7
Plain˜ Crushed Igneous	3	25.0	1	20.0	6	85.7	57	89.1	61	71.8	102	61.4	47	78.3
Plain–Sparse Mica	3	25.0	0	0.0	0	0.0	0	0.0	7	8.2	31	18.7	6	10.0
Plain–Dense Mica	0	0.0	0	0.0	0	0.0	6	9.4	15	17.6	27	16.3	6	10.0
	12	100.0	5	100.0	7	100.0	64	100.1	85	100.0	166	100.0	60	100.0
Volcanic Ash–Santa Fe Paste (11)	21	70.0	22	84.6	61	70.9	1	11.1	15	28.3	11	21.2	0	0.0
Volcanic Ash–Wiyo, Biscuit Paste (11-, 20)	9	30.0	4	15.4	25	29.1	7	77.8	30	56.6	38	73.1	20	100.0
Volcanic Ash–Modified (20+, 22)	0	0.0	0	0.0	0	0.0	1	11.1	8	15.1	3	5.8	0	0.0
	30	100.0	26	100.0	86	100.0	9	100.0	53	100.0	52	100.0	20	100.0
Glaze A–I	0	0.0	0	0.0	5	55.6	33	54.1	18	42.9	28	50.0	1	50.0
Glaze A–II	0	0.0	0	0.0	0	0.0	16	26.2	14	33.3	11	19.6	0	0.0
Glaze A–III	0	0.0	0	0.0	2	22.2	10	16.4	1	2.4	4	7.1	0	0.0
Glaze A–IV	0	0.0	0	0.0	0	0.0	0	0.0	3	7.1	0	0.0	0	0.0
Glaze C–I	0	0.0	0	0.0	0	0.0	1	1.6	2	4.8	6	10.7	0	0.0
Glaze C–II	0	0.0	0	0.0	2	22.2	1	1.6	3	7.1	4	7.1	0	0.0
Glaze C–III	0	0.0	0	0.0	0	0.0	0	0.0	1	2.4	1	1.8	1	50.0
Glaze C–IV	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	3.6	0	0.0
Total	**0**	**0.0**	**0**	**0.0**	**9**	**100.0**	**61**	**100.0**	**42**	**100.0**	**56**	**100.0**	**2**	**100.0**

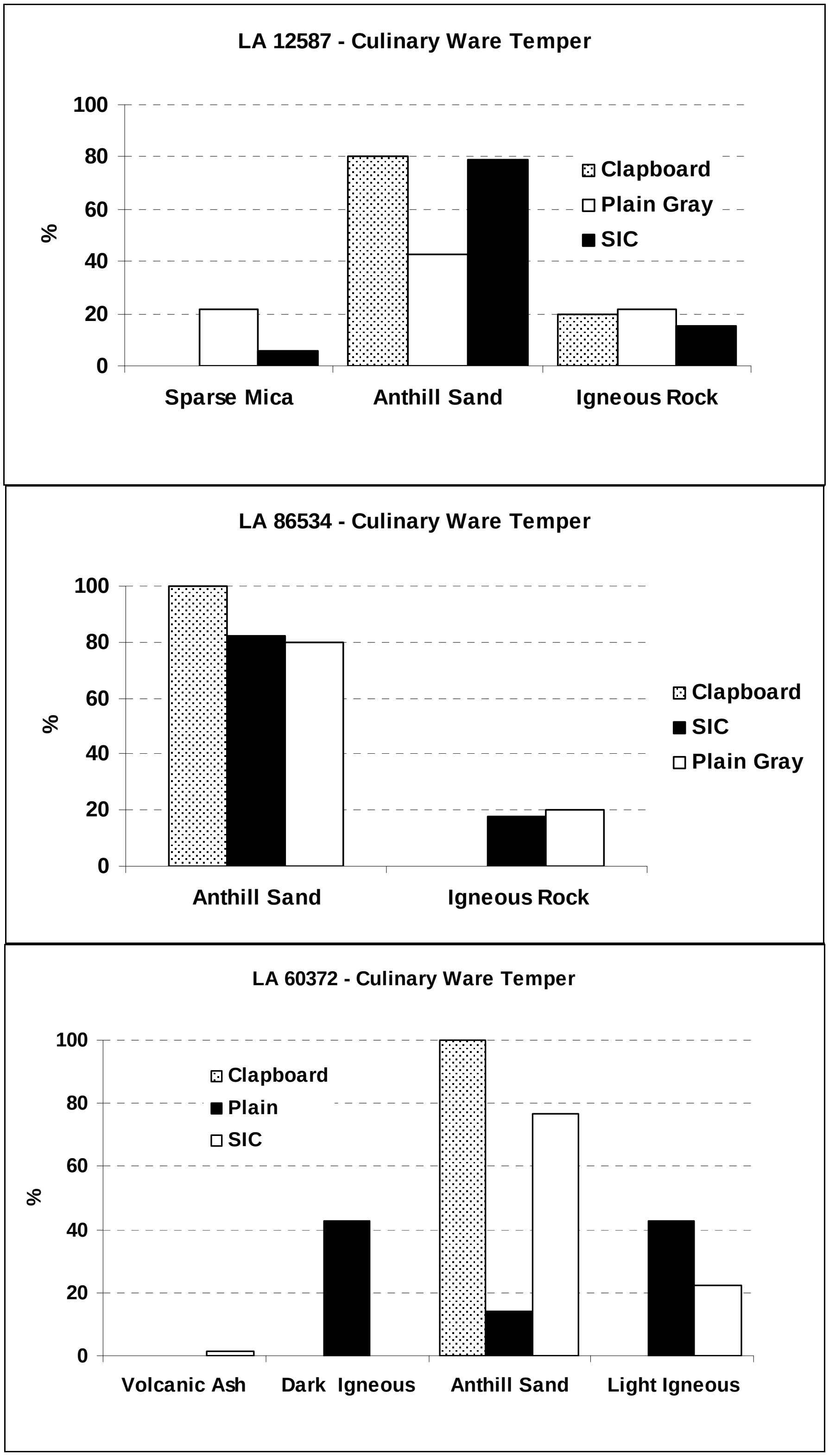


Figure 76.3a. Culinary ware temper at LA 12587 (top), LA 86534 (middle), and LA 60372 (bottom), Coalition period Pajarito sites.

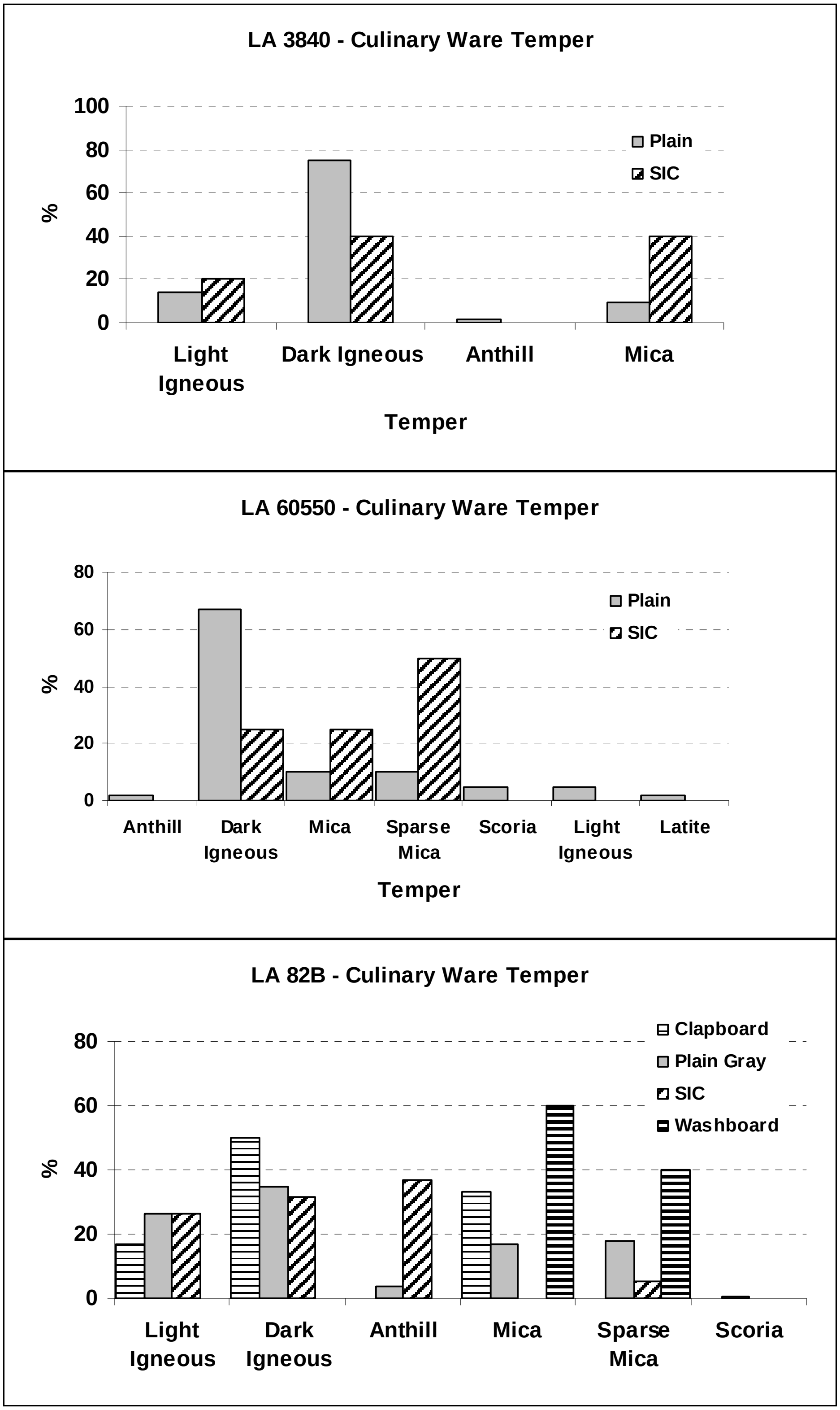


Figure 76.3b. Culinary ware temper at LA 3840 (top), LA 60550, (middle), and LA 82B (bottom), Coalition period Pajarito sites.

The excavation unit at LA 60550, which is contemporaneous with Tyuonyi does not contain any micaceous washboard (Table 76.2b). Ninety percent of the culinary sherds from the excavated midden unit are plain gray (Table 76.1d). Eighty percent contain fine, angular felsic inclusions, and eight percent also contain mica (Table 76.3b). Three of the four smeared-indented corrugated sherds found contain mica. In addition to mica inclusions, one-third of the micaceous sherds are washed with a micaceous solution.

Smeared-indented corrugated sherds containing coarse anthill sand crystals are not found at LA 3840 and LA 60550, nor do these sites contain Santa Fe Black-on-white rims (Table 76.1c). This may relate to the later initial settlement of these sites.

Micaceous Ware on the Pajarito

A small quantity of plain-surfaced micaceous ware, with sparse mica inclusions, is found at LA 12587. Dean Wilson of the Office of Archaeological Studies at the Museum of New Mexico (Blinman and Wilson, OAS workshop notes, December 2001) believes these early micaceous culinary wares first appeared in the Rio Grande along with Red Mesa Black-on-white pottery in the 10^{th} century AD. Mica fragments in the paste may be from granite-derived clays or crushed granitic rock temper.

According to Eric Blinman (Blinman and Wilson, OAS workshop notes, December 2001) true micaceous clays in the northern Rio Grande are weathered from the granites of the Sangre de Cristo Mountains north and east of Santa Fe. Sources of added mica include Rio Grande alluvium, crushed granitic rock, and crushed metamorphic schist. According to Shepard (1956:162), "it may be difficult in some instances to distinguish a residual clay paste [derived from mica granite] from one tempered with sand high in mica, or a mica-bearing rock such as gneiss and schist." She recommends petrographic analysis and precise knowledge of the geology as essential to distinguishing these micaceous pastes. Blinman suggests refiring to distinguish between micaceous clay and added mica temper. Until the distinction can be made with certainty, Shepard (1956:162) recommends that "paste…be described as micaceous rather than as mica-tempered."

Petrographic characterization of micaceous sherds from Coalition period sites is instructive but not conclusive. The three smeared-indented corrugated sherds and one plain gray sherd come from LA 12587 and have similar paste, mineral, and lithic characteristics. The medium to coarse paste has low to moderate birefringence and low grain alignment and void quantity. Paste grains are predominantly monocrystalline quartz with secondary muscovite. Temper is monocrystalline quartz (75%) or microcline. Platy muscovite and biotite are minor minerals. Temper size maximum is very coarse, but most grains are coarse. The lithic type is mica granite containing microcline. There are no volcanic or mica schist (metamorphic) lithic grains present (Appendix BB).

One micaceous smeared-indented corrugated sherd from each Classic period site was examined. The medium-texture paste shows low to moderate birefringence, moderate grain alignment and void quantity. The dominant paste grain is monocrystalline quartz. Two sherds have secondary mica in the paste, and one does not. Each sherd has a different dominant temper mineral:

muscovite, monocrystalline quartz, or microcline feldspar. The two sherds with dominant quartz or feldspar contain minor muscovite and biotite. Grain size maximum is coarse, but most grains are medium size. All lithics are mica granite, with no volcanics or mica schist.

A sub-sample of 42 Classic period micaceous sherds was characterized using a petrographic microscope. The sub-sample consists of plain gray (n = 32), washboard (n = 5), smeared-indented corrugated (n = 3), and clapboard neck (n = 2) sherds. Under the binocular microscope, the sherds initially appeared to have different densities and/or sizes of mica flakes. Two tempers were identified, Type 5, with flakes appearing larger and more numerous, and Type 5-, which appeared to contain sparser concentrations and/or smaller grains. Higher proportions of Type 5- sherds are washed with a mica solution (Table 76.4c).

Type 5 (Dense Mica) sherds at all three sites show high-moderate to high birefringence, moderate to high-moderate alignment and void quantity. Dominant paste grains are 79 percent quartz, 21 percent muscovite. Half the sherds have fine-textured paste. Dominant temper mineral at LA 82 is muscovite 65 percent of the time, whereas none of the sherds at LA 3840 or LA 60550 have muscovite as dominant mineral. Maximum grain size for the dominant mineral ranges up to granule size (>2.0 mm) but most grains are coarse. Mica granite is the dominant lithic type; two have added mica schist and one includes volcanics and mica schist. One sherd contains only mica schist. Paste characteristics of Type 5- sherds (Sparse Mica) are much more variable. There is a wide range of birefringence, but most trend to high-moderate to high. Alignment is moderate to high-moderate, and voids are low-moderate to moderate in quantity. Eighty-seven percent of the sherds have monocrystalline quartz as the dominant grain in the paste. Only 20 percent of sherds have fine paste. Sixty percent of the sherds have monocrystalline quartz as the dominant grain; 26 percent have feldspar (microcline or plagioclase) as the dominant grain; only 13 percent have muscovite as the dominant temper mineral. Maximum grain size for the dominant temper mineral is 40 percent medium and 40 percent coarse sand-size. Secondary and minor muscovite and biotite also tend to fall into the medium to coarse sand size category. Lithic grains in the sherds at LA 3840 (n = 3) are all mica granite. At LA 60550, lithic grains are mica granite plus mica schist. Lithics at LA 82 are both variable and mixed: some are entirely volcanic, while others consist of mica granite or mica schist plus andesite or basalt. Only one sherd consists of mica granite and no other lithic type.

At the Chama-area sites, which are possible sources for these micaceous vessels, 20 percent to 50 percent of dense mica sherds and 46 to 68 percent of sparse mica sherds in excavated units are finished with a mica wash (Table 76.4a). Much of the culinary ware at Chama sites has a washboard exterior surface (Table 76.4b).

Micaceous culinary sherds at Classic period Pajarito sites are mainly plain-surfaced, rather than washboard. The five micaceous washboard sherds found in LA 82 Unit B represent less than three percent of the culinary ware rim sample from both excavation units. The lack of sources for micaceous clay or mica temper on the Pajarito suggests that these vessels were brought to Tyuonyi from the Chama area. Comparison of the paste composition of the sherds at Tyuonyi with those from Chama-area sites should further refine the possible production location of these jars.

Table 76.4a. Mica-washed sherds as a proportion of all mica-tempered sherds.

Site and Unit	Mica Sherds	Mica Wash	%	Sparse Mica	Mica Wash	%
LA 16 B	1	0	0.0	7	0	0.0
LA 16 SFAS	1	0	0.0	2	1	50.0
LA 82 A	14	0	0.0	9	1	11.1
LA 82 B	32	1	3.1	30	7	23.3
LA 174	1	0	0.0	4	0	0.0
LA 252*	0	0	0.0	2	2	100.0
LA 297 A	16	3	18.8	11	5	45.5
LA 297 C	52	26	50.0	53	33	62.3
LA 380 D	8	3	37.5	93	63	67.7
LA 380 WSI	13	0	0.0	27	4	14.8
LA 632 B	10	2	20.0	42	24	57.1
LA 632 WSI	25	3	12.0	31	4	12.9
LA 3840	8	0	0.0	0	0	0.0
LA 5137	5	0	0.0	13	0	0.0
LA 12587	0	0	0.0	6	0	0.0
LA 60372	0	0	0.0	0	0	0.0
LA 60550	7	3	42.9	8	2	25.0
LA 86534	0	0	0.0	0	0	0.0

*biased sample

Table 76.4b. Micaceous washboard at all sites.

	Total Culinary	Plain	SIC	Washboard	% Washboard
LA 16	19	15	4	0	0.0
LA 82	298	252	34	5	2.0
LA 174	38	9	26	0	0.0
LA 252*	3	1	0	2	66.7
LA 297	141	66	15	51	36.2
LA 380	142	70	2	70	49.3
LA 632	112	58	7	46	41.1
LA 3840	962	58	4	0	0.0
LA 5137	54	44	10	0	0.0
LA 12587	68	13	50	0	0.0
LA 60372	93	7	81	0	0.0
LA 60550	51	50	1	0	0.0
LA 86534	41	5	34	0	0.0

*biased sample

Table 76.4c. Mica-washed culinary sherds at Pajarito sites.

Site and Unit	Mica Sherds	Mica Wash	%	Sparse Mica	Mica Wash	%
LA 12587	0	0	0.0	6	0	0.0
LA 60372	0	0	0.0	0	0	0.0
LA 86534	0	0	0.0	0	0	0.0
LA 3840	8	0	0.0	0	0	0.0
LA 82 A	14	0	0.0	9	1	11.1
LA 82 B	32	1	3.1	30	7	23.3
LA 60550	7	3	42.9	8	2	25.0

CULINARY JAR SIZE

Each jar rim sherd in the sample was measured between the rim and shoulder using a template fitted into the curve of the jar throat. These aperture measurements are recorded as radii in centimeters. Based on the jar aperture size distribution histograms, small jars are defined as less than or equal to 12 cm.

Measurements taken on a small sample (*n* = 11; *n* = 9) of whole Classic period culinary jars excavated from rooms at Tonque Pueblo (LA 240) strongly suggest that vessel aperture may serve as proxy for vessel diameter (Barnett 1969:Table XXV and XXVI) (Tables 76.5a and 76.5b). The scatter plots and associated R^2 values (Figure 76.4) demonstrate that the ratio of aperture diameter to vessel diameter for each defined type of culinary jar but remains constant for both large and small vessels (Barnett 1969:181–185).

Table 76.5a. Rio Grande-style culinary jars from Tonque Pueblo (LA 240): globular with flared rims and rounded bottoms.

Orifice Diameter (inches)	Vessel Diameter (inches)	Vessel Height (inches)	Orifice Diameter (cm)	Radius (cm)
4.75	9.13	6.25	12.1	6
5.50	9.50	7.00	14.0	7
6.75	10.50	8.25	17.1	9
7.00	10.88	7.75	17.8	9
7.25	10.50	8.25	18.4	9
8.25	11.50	8.63	21.0	10
8.50	11.88	9.13	21.6	11
9.00	14.25	9.50	22.9	11
9.50	14.00	11.75	24.1	12
9.75	15.00	12.50	24.8	12
16.25	21.63	20.00	41.3	21

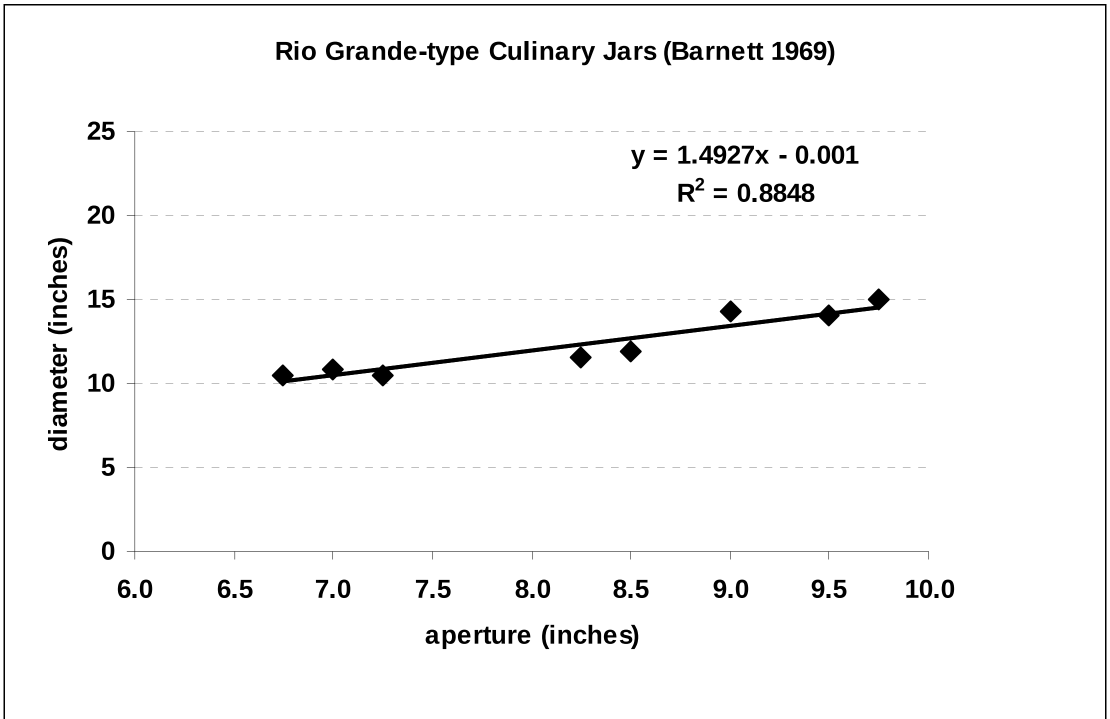
The two smallest vessels have an ovoid shape and lugs at the rim; the largest vessel is an oversized storage vessel.

Table 76.5b. Sankawi-style culinary jars from Tonque (LA 240) with thicker walls and an elongated neck.

Orifice Diameter (inches)	Vessel Diameter (inches)	Vessel Height (inches)		Orifice Diameter (cm)	Radius (cm)
4.25	6.00	5.25	w. handles	10.8	5
6.00	8.25	6.25		15.2	8
7.50	12.13	9.63		19.1	10
8.25	9.75	7.38		21.0	10
9.00	12.50	10.63		22.9	11
9.25	13.75	9.00		23.5	12
9.75	14.75	12.50		24.8	12
11.75	16.75	13.00		29.8	15
12.75	16.75	14.00		32.4	16

The smallest vessel is ovoid with handles

It should be noted that there are few very large jars at Tonque (Figure 76.5) compared with the six Pajarito sites (Figure 76.6a, b, and c). The difference may be that Barnett's sample represents *de facto* or primary refuse, whole vessels abandoned on room floors, rather than the secondary refuse, generally found in middens (Schiffer 1972:161–162). Very large jars may not have been stored in these rooms, or may have been removed before abandonment, especially if they were more difficult to replace.



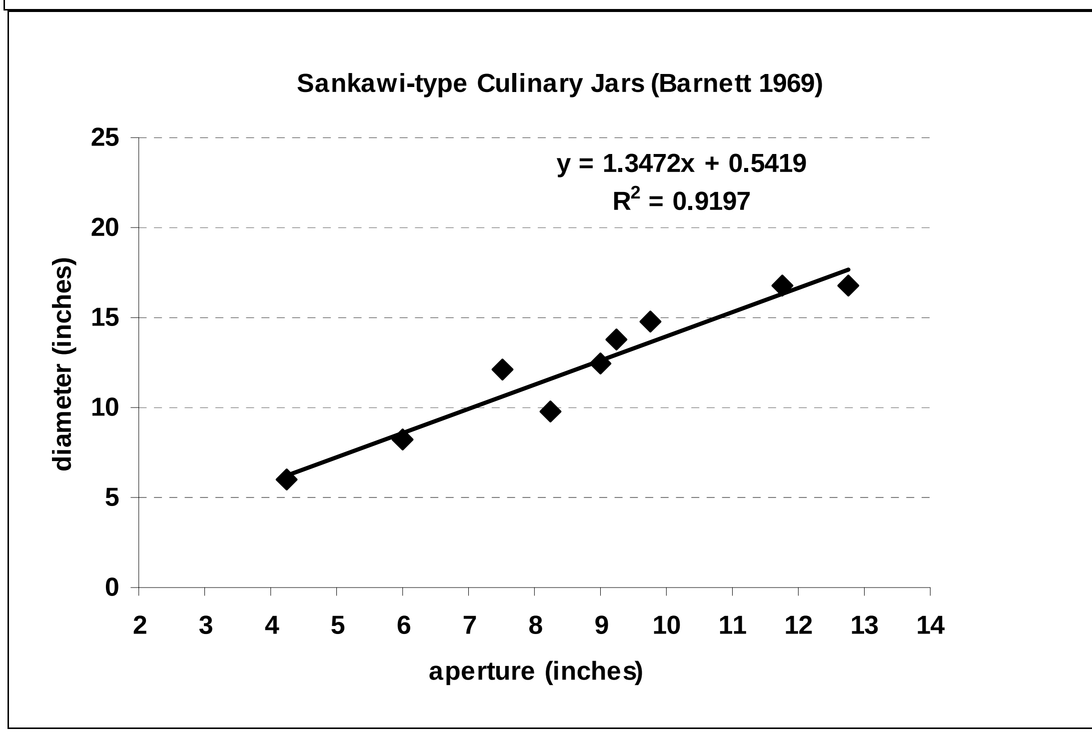


Figure 76.4. Ratio of jar aperture to jar diameter for culinary jars at Tonque Pueblo (LA 240) (from Barnett 1969).

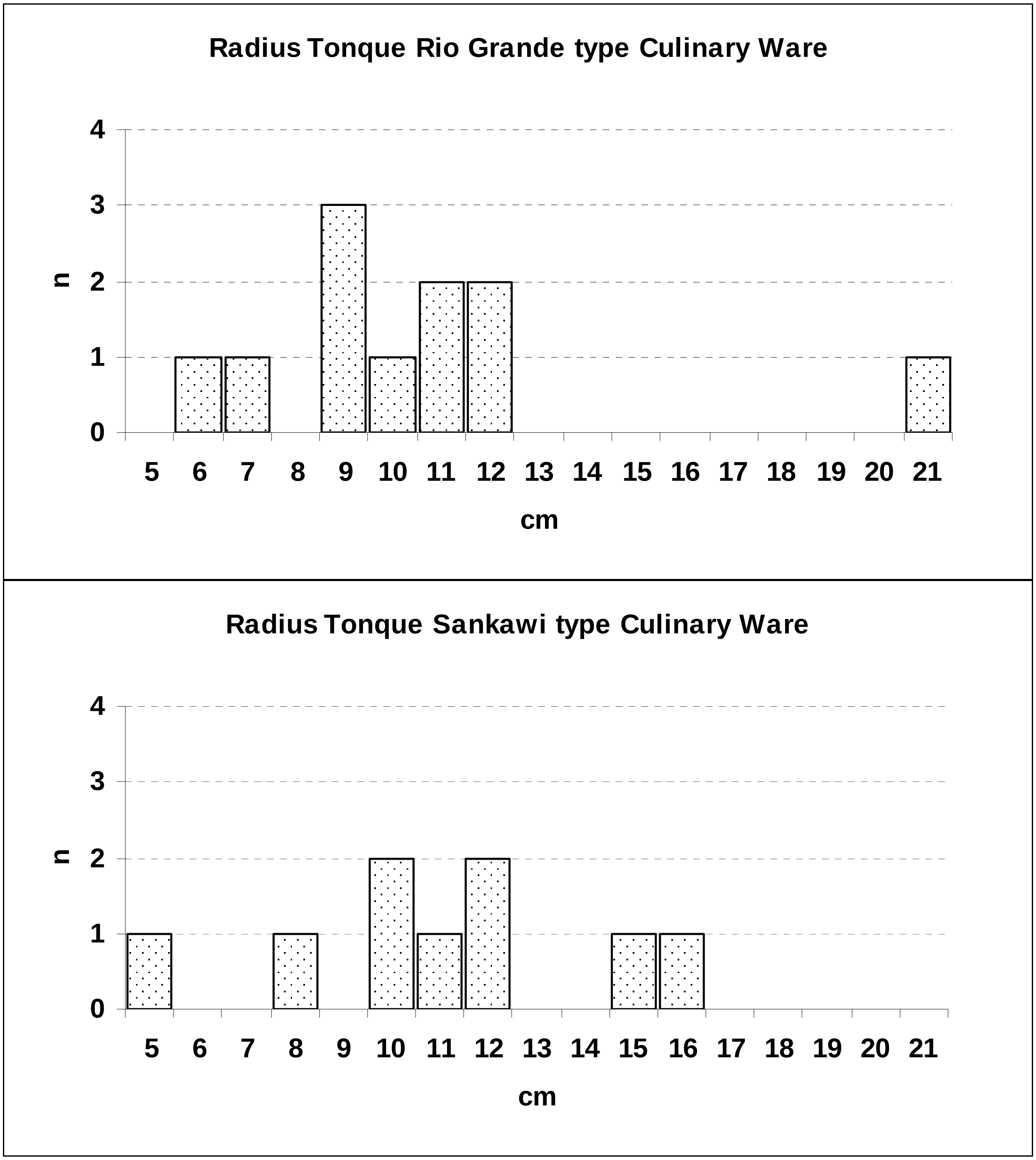


Figure 76.5. Culinary jars from Tonque Pueblo.

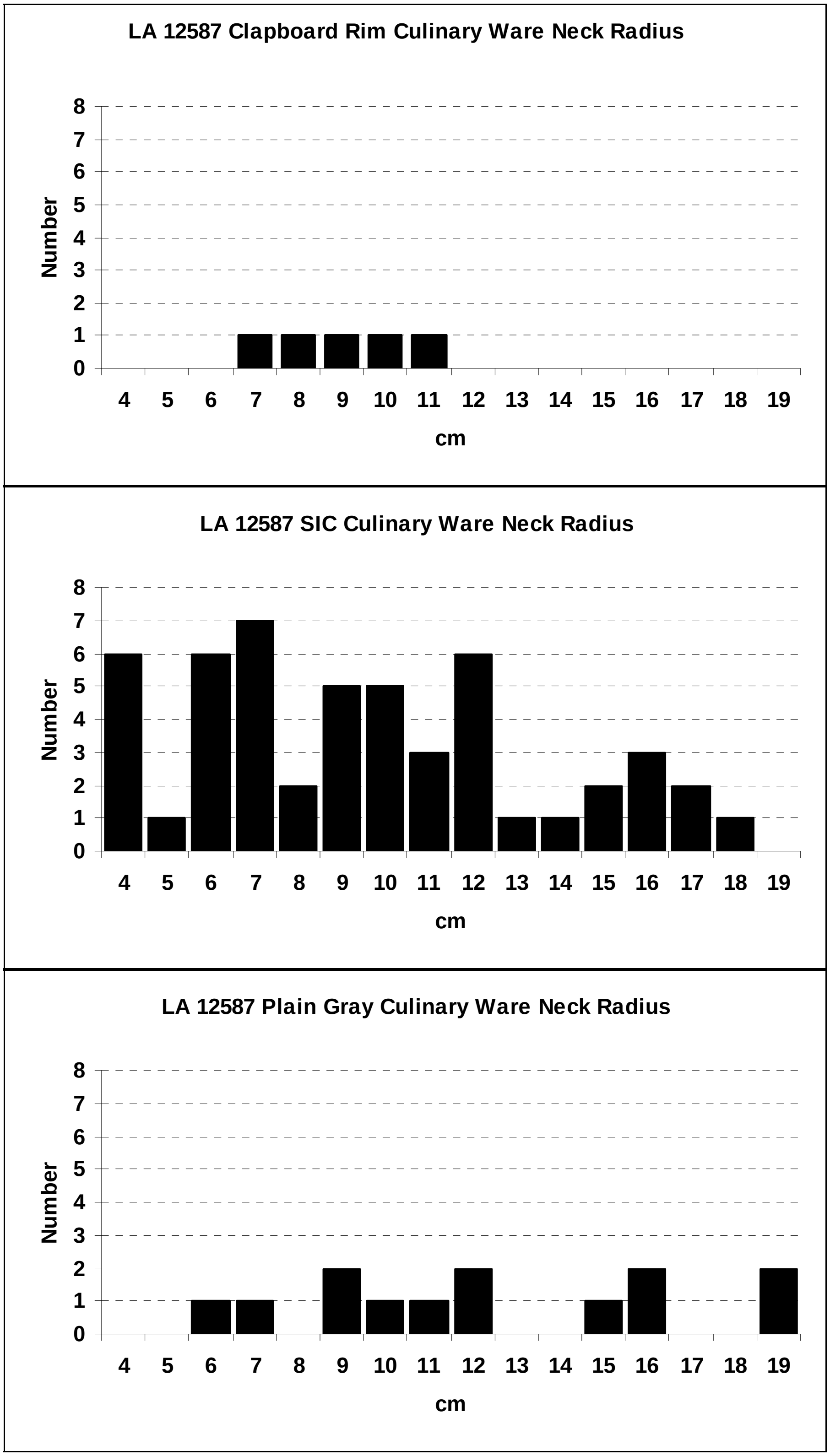


Figure 76.6a. Summary of culinary ware data from LA 12587.

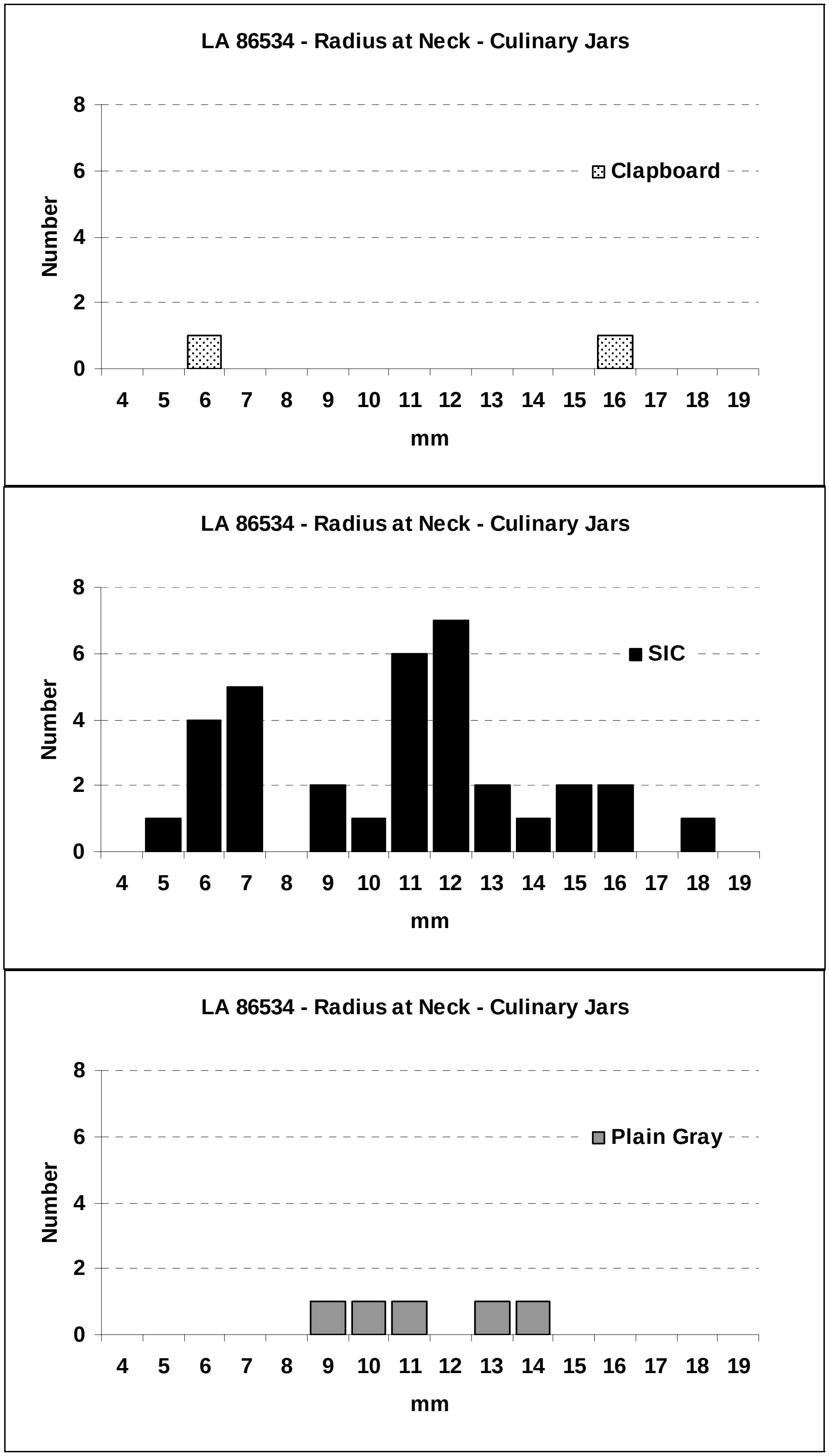


Figure 76.6b. Summary of culinary ware data from LA 86534.

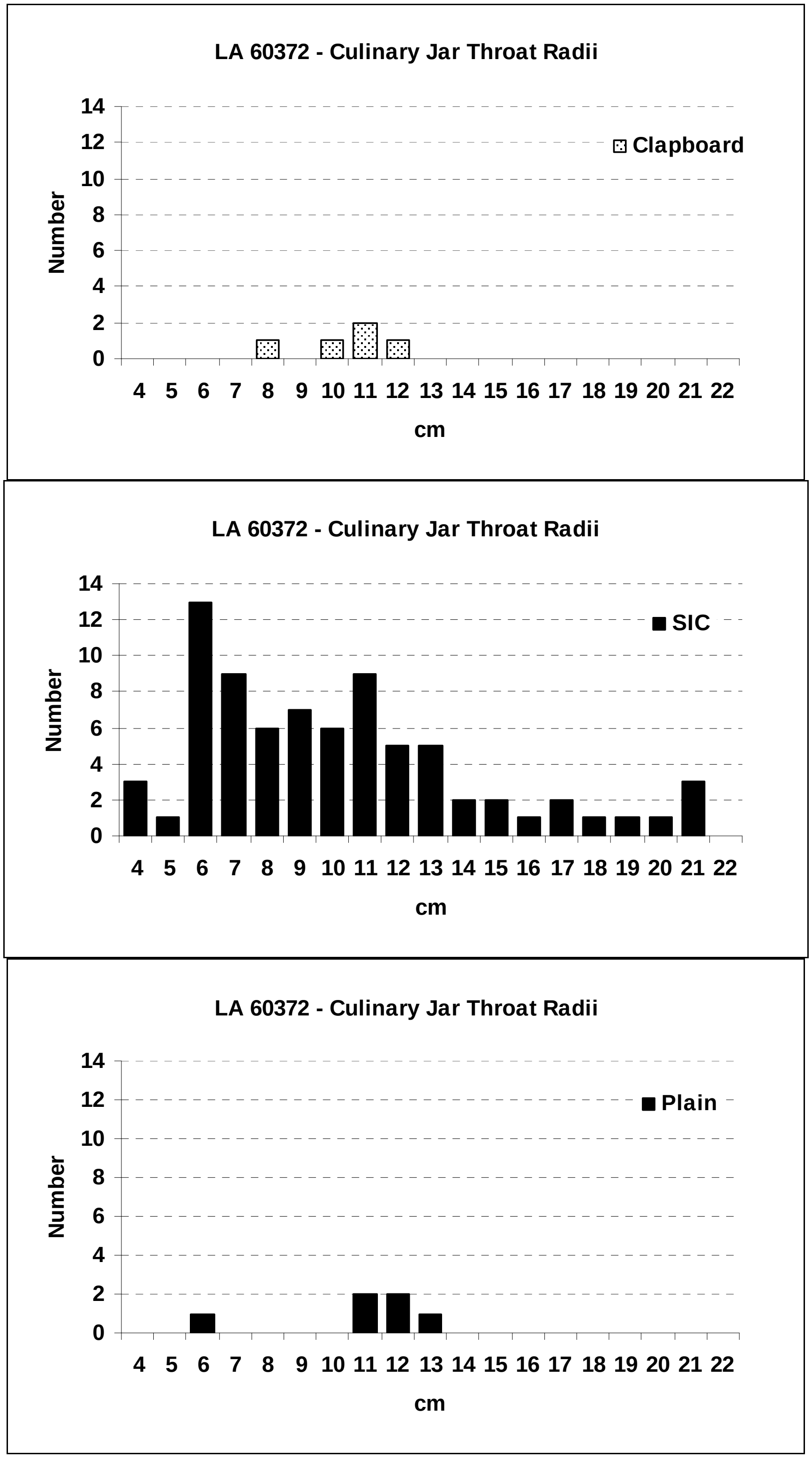


Figure 76.6c. Summary of culinary ware data from LA 60372.

Coalition Sites

The range of jar sizes and the ratio of small to large jars both change over time (Tables 76.6a and 76.6b) (Figures 76.6a, b, and c). At each of the three Coalition sites, 77 to 80 percent of smeared-indented corrugated jars have aperture radii less than or equal to 12 cm (Table 76.6b).

Table 76.6a. Culinary vessel aperture for selected types at Pajarito sites. Vessel aperture is measured at the throat, below the vessel rim interior.

	LA 12587	LA 86534	LA 60372	LA 3840	LA 82A	LA 82B	LA 60550
SIC ≤12 cm							
n =	41	26	59	2	7	10	1
Mean	8	9.3	8.3	9	8.7	8.5	8
Median	8	10.5	8.0	9	10.0	9.0	8
Std. Dev.	2.7	2.5	2.3	-	3.9	2.8	-
CV	33.1	27.0	27.8	-	44.3	32.9	-
Range	4–12	5–12	4–12	7–11	3–12	5–12	8
SIC ≥13 cm							
n =	10	8	18	2	5	2	-
Mean	15.7	15	16.2	15.5	15.8	15	-
Median	16.0	15	15.5	15.5	16.0	15	-
Std. Dev.	1.5	1.7	3.0	3.5	2.8	-	-
CV	9.5	11.3	18.8	22.8	17.6	-	-
Range	13–18	13–18	13–21	13–18	13–19	15	-
Plain Gray							
n =	-	-	6	-	-	-	-
Mean	-	-	10.8	-	-	-	-
Median	-	-	11.5	-	-	-	-
Std. Dev.	-	-	2.5	-	-	-	-
CV	-	-	22.9	-	-	-	-
Range	-	-	6–13	-	-	-	-
Plain Gray ≤12 cm							
n =	8	3	5	28	31	66	24
Mean	9.5	10.0	10.4	9.4	9.7	9.9	8.7
Median	9.5	10.0	11.0	9.0	11.0	10.0	8.5
Std. Dev.	2.2	1.0	2.5	1.8	2.6	2.1	1.8
CV	23.2	10.0	24.1	18.9	26.5	21.5	20.2
Range	6–12	9–11	6–12	6–12	4–12	4–12	6–12
Plain Gray ≥13 cm							
n =	5	2	1	9	31	42	13

	LA 12587	LA 86534	LA 60372	LA 3840	LA 82A	LA 82B	LA 60550
Mean	17.0	13.5	13.0	16.8	16.6	15.3	14.5
Median	16.0	13.5	13.0	17.0	15.0	15.0	14.0
Std. Dev.	1.9	0.7	-	1.9	3.4	1.9	1.4
CV	11.0	5.2	-	11.1	20.2	12.4	9.6
Range	15–19	13–14	13	14–20	13–25	13–20	13–18
Clapboard							
n =	5	2	5	-	1	4	-
Mean	9.0	11.0	10.4	-	7.0	13.25	-
Median	9.0	11.0	11.0	-	7.0	13.0	-
Std. Dev.	1.58	7.1	1.5	-	-	3.0	-
CV	17.6	64.3	14.6	-	-	22.5	-
Range	7–11	6–16	8–12	-	7	10–17	-
Washboard							
n =	-	-	-	-	-	5	-
Mean	-	-	-	-	-	13.0	-
Median	-	-	-	-	-	13.0	-
Std. Dev.	-	-	-	-	-	1.2	-
CV	-	-	-	-	-	9.4	-
Range	-	-	-	-	-	12–15	-

Table 76.6b. Proportion of small jars at Pajarito sites.

Type/Site	All jars ≤12 cm	Non-micaceous jars ≤13 cm	Micaceous jars ≤14 cm	Large jars
Smeared-indented corrugated				
LA 12587	80.3			19.7
LA 86534	76.5			23.5
LA 60372	76.6			23.4
Plain Gray				
LA 3840	75.7			24.3
LA 82A	50.0	61.0	59.6	50-39-44
LA 82B	61.1	73.9	68.4	38.9-26-32
LA 60550	64.9			35.1

Table 76.6c. T-test results for mean jar aperture between Coalition and Classic period (Pooled Method, Equal Variances except for clapboard neck).

Type/Size	*n* =	*df* =	*t*	Pr>|t|
SIC–small	7	5	0.04	0.9724
SIC–large	6	4	-0.48	0.6580
Plain Gray–small	7	5	-1.43	0.2128
Plain Gray–large	7	5	1.05	0.3408
Clapboard Neck	4	2	-2.64	0.1182

The size distribution of large jars differs at the three Coalition sites. The maximum radius for any smeared-indented corrugated jar aperture for LA 60372 is 21 cm, 3 cm greater than the 18 cm maximum for LA 12587 (White Rock) and LA 86534 (the Airport) (Table 76.6a). Five of the 18 large smeared-indented corrugated jars at LA 60372 (28 percent) exceed the maximum radius found at the other two sites (see Figures 76.6a through 76.c). T-tests comparing the vessel aperture radius sample means for large and small smeared-indented corrugated and plain gray jars at Coalition and Classic period sites showed no significant differences between large and small vessels, types, or time periods (Table 76.6c).

Coefficients of Variation (CV) are uniformly high for small smeared-indented corrugated jars and noticeably lower for large ones, indicating that while there are fewer large jars, their sizes are more uniform. The CV for large smeared-indented corrugated jars at LA 12587 is 9.5 percent (*n* = 10), suggesting standardized production. The larger size range at LA 60372 affects the CV, which is between 10 percent and 20 percent.

Small plain gray jars at Coalition sites show larger mean radii than small smeared-indented corrugated jars. For large jars, both maximum vessel size (19 cm) and mean radius (17 cm) at LA 12587 are larger than at LA 86534 and LA 60372, with a CV of 11 percent. CVs at or below 10 percent at LA 86534 are for samples of three or fewer rim sherds.

Classic Sites

The Classic period sample of smeared-indented corrugated rims is considerably smaller. Mean aperture radii for small and large jars are similar to those from Coalition sites. CVs are high, particularly for the small jars (Table 76.6a).

The proportion of large jars increases at Classic period sites (Table 76.6b). Ratios of large to small plain gray jars at the two smaller sites, however, are closer to those for smeared-indented corrugated at Coalition sites, with 76 percent and 65 percent small jars, respectively (Table 76.6b). Small jars make up 50 percent of plain gray rims in LA 82 Unit A and 61 percent in Unit B.

Jars are larger overall in the Classic than in the Coalition. The largest jar in the sample has a radius of 20 cm, with a 25 cm outlier at Tyuonyi. CVs are generally higher for small jars. CV for large plain gray jars at LA 60550 (Tyuonyi Annex) (*n* = 13) is 9.6 percent, and for washboard micaceous jars from LA 82 Unit B (*n* = 5) CV = 9.4 percent (Table 76.6a), with the rest between 10 percent and 20 percent.

SHERD THICKNESS

Sherd thickness (Table 76.7a) is the median wall thickness of the four sides of a body sherd or the three non-rim sides of a rim sherd (Rocek 2002). Sherds with no measurable body wall below the rim were not included in the calculation.

Table 76.7a. Univariate statistics: Culinary sherd thickness at Pajarito sites by vessel aperture.

	LA 12587	LA 86534	LA 60372	LA 3840	LA 82A	LA 82B	LA 60550
SIC ≤12 cm							
n =	41	26	59	2	7	10	1
Mean	4.8	4.3	4.5	4.9	4.5	4.4	4.3
Median	4.9	4.2	4.4	4.9	4.2	4.5	4.3
Std. Dev.	0.7	0.5	0.7	0.6	0.9	0.5	-
CV	13.7	11.6	16.4	13.1	20.1	10.8	-
Range	3.1–6.4	3.4–5.5	3.1–7.1	4.4–5.3	3.6–6.0	3.5–5.1	4.3
SIC ≥13 cm							
n =	10	8	18	2	5	2	0
Mean	5.0	4.9	4.7	4.9	5.6	4.4	-
Median	4.9	5.2	4.7	4.9	5.5	4.4	-
Std. Dev.	0.6	0.6	0.5	1.8	0.7	0.4	-
CV	11.9	12.7	10.2	37.5	12.6	8.1	-
Range	4.1–5.9	4.0–5.6	4.0–6.0	3.6–6.2	4.7–6.6	4.1–4.6	-
Plain Gray ≤12 cm							
n =	8	3	5	28	31	66	24
Mean	4.8	5.1	4.9	5.0	5.1	5.0	5.3
Median	4.8	5.2	4.8	5.1	5.2	5.0	5.3
Std. Dev.	0.6	0.3	0.4	0.6	0.7	0.9	1.1
CV	12.1	6.0	8.4	11.6	14.2	17.6	20.2
Range	3.8–5.7	4.8–5.4	4.6–5.6	3.4–5.9	3.3–6.5	3.3–7.2	3.6–7.6
Plain Gray ≥13 cm							
n =	5	2	1	9	31	42	13
Mean	5.2	5.5	5.1	5.1	5.2	5.1	5.9
Median	5.2	5.5	5.1	5.2	5.2	5.1	5.6
Std. Dev.	0.4	1.6	-	0.6	0.8	0.7	0.9

	LA 12587	LA 86534	LA 60372	LA 3840	LA 82A	LA 82B	LA 60550
CV	8.1	28.3	-	12.3	15.2	14.1	15.8
Range	4.7–5.8	4.4–6.6	5.1	4.0–5.8	3.7–7.3	3.5–7.0	4.2–7.1
Clapboard Neck							
n =	5	2	5	-	1	6	-
Mean	4.3	4.2	4.4	-	4.8	5.0	-
Median	4.5	4.2	4.4	-	-	4.7	-
Std. Dev.	0.6	0.2	0.3	-	-	0.8	-
CV	14.8	5.1	6.0	-	-	16.5	-
Range	3.3–4.9	4.0–4.3	4.1–4.7	-	-	4.2–6.3	-
Washboard							
n =	-	-	-	-	-	5	-
Mean	-	-	-	-	-	4.8	-
Median	-	-	-	-	-	4.9	-
Std. Dev.	-	-	-	-	-	0.5	-
CV	-	-	-	-	-	10.9	-
Range	-	-	-	-	-	4.1–5.4	-

Plain gray jars have a greater mean thickness than smeared-indented corrugated jars, whether at Coalition or Classic period sites (Table 76.7b). Smeared-indented corrugated sherds are thicker at Classic sites, and the mean thickness range overlaps for large plain gray and smeared-indented corrugated. T-tests comparing the sherd thickness sample means for large and small smeared-indented corrugated and plain gray jars at Coalition and Classic period sites showed no significant differences between large and small vessels, types, or time periods. It is very likely, however, that there is a significant difference in mean rim thickness for the small sample of clapboard neck jars ($n = 5$; $df = 3$; $t = 5.69$; $Pr > t = 0.0107$) (Table 76.7c).

Table 76.7b. Mean culinary sherd thickness of major types at Pajarito sites.

	Smeared-indented Corrugated	Plain Gray
Coalition Sites–Small Jars	4.3–4.8	4.8–5.1
Coalition Sites–Large Jars	4.7–5.0	5.1–5.5
Classic Sites–Small Jars	4.3–4.9	5.0–5.3
Classic Sites–Large Jars	4.4–5.6	5.1–5.9

Table 76.7c. T-test results for mean sherd thickness from Coalition to Classic period (Pooled Method, Equal Variances).

Type/Size	*n* =	*df* =	*t*	Pr>|t|
SIC–small	7	5	-0.04	0.9680
SIC–large	6	4	0.28	0.7944

Type/Size	***n* =**	***df* =**	***t***	**Pr>|t|**
Plain Gray–small	7	5	1.49	0.1954
Plain Gray–large	7	5	0.23	0.8245
Clapboard Neck	5	3	5.69	0.0107
All Coalition SIC	6	4	1.96	0.1214
All Classic SIC	7	5	1.34	0.2386
All Coalition Plain	6	4	2.24	0.0890
All Classic Plain	8	6	1.09	0.3159

With the exception of large plain gray jars at LA 86534 (*n* = 2; CV = 28.3 percent), CVs for Coalition period sherd thickness fall below 20 percent (Table 76.7a). Large smeared-indented corrugated jars at LA 60372 (*n* = 18) have a CV of 10.2 percent, otherwise only small samples of plain gray and clapboard neck fall at or below 10 percent.

Likewise, CVs for sherd thickness at Classic period sites fall at or below 20 percent, with the exception of large smeared-indented corrugated jars at LA 3840 (*n* = 2; CV = 37.5 percent). Only two small samples at LA 82 Unit B fall below 10 percent (Table 76.7a).

RIM THICKNESS

Rim thickness (Table 76.8a) is measured ~2 mm below the vessel lip. Plain gray jars have a greater mean rim thickness than smeared-indented corrugated jars, whether at Coalition or Classic period sites. The upper end of the range for smeared-indented corrugated rims overlaps with the lower end of the plain gray range at Coalition sites, but not at Classic sites (Table 76.8b). The differences in mean rim thickness, however, are not significant. T-tests comparing the rim thickness sample means for large and small smeared-indented corrugated and plain gray jars at Coalition and Classic period sites showed no significant differences between large and small vessels, types, or time periods. There is a small likelihood of a significant difference in mean rim thickness for the small sample of clapboard neck jars (*n* = 5; *df* = 2; *t* = 4.36; *Pr > t* = .0488) (Table 76.8c).

Table 76.8a. Univariate statistics: Culinary rim thickness at Pajarito sites by vessel aperture.

	LA 12587	**LA 86534**	**LA 60372**	**LA 3840**	**LA 82A**	**LA 82B**	**LA 60550**
SIC ≤12 cm							
n =	41	26	59	2	7	10	1
Mean	3.8	3.5	3.5	3.5	3.9	3.3	3.1
Median	3.8	3.4	3.4	3.5	3.6	3.4	3.1
Std. Dev.	0.7	0.6	0.6	0.4	1.1	0.6	-
CV	18.5	16.6	17.9	12.1	27.4	17.3	-
Range	2.5–5.3	2.7–5.1	2.5–5.5	3.2–3.8	3.1–6.1	2.6–4.3	3.1
SIC ≥13 cm							
n =	10	8	18	2	5	2	0

	LA 12587	LA 86534	LA 60372	LA 3840	LA 82A	LA 82B	LA 60550
Mean	4.0	3.6	3.6	4.1	4.7	3.1	-
Median	4.0	3.5	3.6	4.1	4.8	3.1	-
Std. Dev.	0.9	0.4	0.7	0.7	0.7	0	-
CV	23.0	11.6	18.9	17.2	15.6	0	-
Range	2.9–5.6	3.2–4.4	2.2–5.3	3.6–4.6	3.8–5.4	3.1	-
Plain Gray ≤12 cm							
n =	8	3	5	28	31	66	24
Mean	4.3	3.7	4.1	4.2	4.5	4.2	4.2
Median	4.3	3.8	4.2	4.2	4.6	4.1	4.0
Std. Dev.	0.5	0.3	0.8	0.7	0.6	0.8	1.1
CV	10.8	8.2	19.4	15.6	13.9	19.6	27.1
Range	3.4–4.7	3.4–4.0	2.7–4.7	2.9–5.7	3.2–5.8	2.9–6.7	2.7–7.7
Plain Gray ≥13 cm							
n =	5	2	1	9	31	42	13
Mean	3.9	3.9	5.1	4.2	4.5	4.3	4.9
Median	3.8	3.9	5.1	4.2	4.4	4.3	4.8
Std. Dev.	0.5	1.3	-	0.6	0.7	0.7	0.9
CV	12.5	34.9	-	14.6	15.7	16.2	18.8
Range	3.2–4.4	2.9–4.8	5.1	3.4–5.4	3.4–6.4	3.0–5.7	3.3–6.5
Clapboard Neck							
n =	5	2	5	-	1	6	-
Mean	3.4	3.1	3.6	-	4.0	4.0	-
Median	3.5	3.1	3.9	-	4.0	3.9	-
Std. Dev.	0.6	0.2	0.7	-	-	0.5	-
CV	16.6	7.0	19.3	-	-	11.6	-
Range	3.0–4.4	2.9–3.2	2.4–4.1	-	4.0	3.5–4.8	-
Washboard							
n =	-	-	-	-	-	5	-
Mean	-	-	-	-	-	4.2	-
Median	-	-	-	-	-	4.2	-
Std. Dev.	-	-	-	-	-	0.7	-
CV	-	-	-	-	-	16.7	-
Range	-	-	-	-	-	3.5–5.4	-

Table 76.8b. Mean culinary rim thickness for major types at Pajarito sites.

	Smeared-indented Corrugated	Plain Gray
Coalition Sites–Small Jars	3.5–3.8	3.7–4.3
Coalition Sites–Large Jars	3.6–4.0	3.9–5.1
Classic Sites–Small Jars	3.1–3.9	4.2–4.5
Classic Sites–Large Jars	3.1–4.1	4.2–4.9

Table 76.8c. T-test results for mean rim thickness from Coalition to Classic periods (Pooled Method, Equal Variance except for clapboard neck).

Type/Size	*n* =	*df* =	*t*	Pr>|t|
SIC–small	7	5	-0.69	0.5233
SIC–large	6	4	0.48	0.6558
Plain Gray–small	7	5	1.40	0.2194
Plain Gray–large	7	5	0.46	0.6657
Clapboard Neck	5	2	4.36	0.0488
All Coalition SIC	6	4	0.80	0.4685
All Classic SIC	7	5	1.18	0.2928
All Coalition Plain	6	4	0.61	0.5748
All Classic Plain	8	6	1.16	0.2891

With two exceptions (large smeared-indented corrugated jars at LA 12587 [*n* = 10; CV = 23.0 percent] and large plain gray jars at LA 86534 [*n* = 2; CV = 34.9 percent]), CVs for rim thickness at Coalition sites are below 20 percent. One very small sample of clapboard neck jars at LA 86534 (*n* = 2) has a CV of 7.0 percent. This same sample also has a CV below 10 percent for sherd thickness (Table 76.8a).

With one exception (small smeared-indented corrugated jars at LA 82 Unit A [*n* = 7; CV = 27.4 percent]) all CVs for rim thickness at Classic sites are between 10 percent and 20 percent.

COEFFICIENTS OF VARIATION AND PASTE COMPOSITION

Table 76.9a compares CVs for jar aperture, sherd thickness, and rim thickness at each site for large and small jars by exterior surface treatment (smeared-indented corrugated, plain, clapboard neck, and washboard).

Table 76.9a. Coefficients of variation for Pajarito sites – all paste types.

	LA 12587	LA 86534	LA 60372	LA 3840	LA 82 (A)	LA 82 (B)	LA 60550
SIC							
n =	41	26	59	2	7	10	1
radius ≤12 cm	33.1	27.0	27.8	-	44.3	32.9	-
body thickness	13.8	11.6	16.4	13.1	20.1	10.8	-
rim thickness	18.5	16.6	17.9	12.1	27.4	17.3	-
SIC							
n =	10	8	18	2	5	2	0
radius ≥13 cm	9.5	11.3	18.8	22.8	17.6	-	-
body thickness	11.9	12.7	10.2	37.5	12.6	8.1	-
rim thickness	23.0	11.6	18.9	17.2	15.6	0	-
Plain Gray							
n =	8	3	5	28	31	66	24

	LA 12587	LA 86534	LA 60372	LA 3840	LA 82 (A)	LA 82 (B)	LA 60550
radius ≤12 cm	23.2	10.0	24.1	18.9	26.5	21.5	20.5
body thickness	12.1	6.0	8.4	11.6	14.2	17.6	20.2
rim thickness	10.8	8.2	19.4	15.6	13.9	19.6	27.1
Plain Gray							
n =	5	2	1	9	31	42	13
radius ≥13 cm	11.0	5.2	-	11.1	20.2	12.4	9.6
body thickness	8.1	28.3	-	12.3	15.2	14.1	15.8
rim thickness	12.5	34.9	-	14.6	15.8	16.2	18.8
Clapboard							
n =	5	2	5	1	0	4	0
radius	17.6	64.3	14.6	-	-	22.5	-
body thickness	14.8	5.1	6.0	-	-	16.5	-
rim thickness	16.6	7.0	19.3	-	-	11.6	-
Washboard							
n =	0	0	0	0	0	5	0
radius	-	-	-	-	-	9.4	-
body thickness	-	-	-	-	-	10.9	-
rim thickness	-	-	-	-	-	16.7	-

Coalition Sites

Few CVs at Coalition sites are lower than 10 percent for vessel aperture and rim thickness, and these may be the effect of sample size.

Large smeared-indented corrugated jars at LA 12587 (*n* = 10) have a CV of 9.5 percent for aperture. This suggests that these jars may have been produced to certain size specifications. Large smeared-indented corrugated jars at LA 86534 (*n* = 8) and LA 60372 (*n* = 10) are between 10 percent and 20 percent.

Plain gray jars at Coalition sites show a higher degree of standardization, but these samples are quite small. Large plain jars at LA 12587 (*n* = 5) have a CV of 8.1 percent for sherd thickness. Large plain gray jars at LA 86534 (*n* = 3) have a low CV for aperture (CV = 10.0) as do small plain gray jars (*n* = 2; CV = 5.2). The small jars also have low CVs for both sherd thickness (CV = 6.0) and rim thickness (CV = 8.2). Small plain jars at LA 60372 (*n* = 5) have a low CV for sherd thickness (CV = 8.4).

Low CVs for most plain gray and clapboard neck rims at all three Coalition sites may reflect small sample size (Costin 2001; Schleher 2005). Thirteen out of 14 samples (93%) have CVs lower than 20 percent for sherd thickness even in the six cases (43%) when CV for vessel aperture is high.

Classic Sites

Classic period samples initially show very few low CVs. These are for small samples at LA 82 Unit B (large smeared-indented corrugated jars [*n* = 2; CV = 8.1% for sherd thickness]; micaceous washboard jars [*n* = 5; CV = 9.4% for jar aperture]). CVs for all attributes of plain gray jars are higher than 10 percent, but 16 of the 18 values (89%) fall below 20 percent

Micaceous and non-micaceous culinary jars at LA 82 Units A and B were analyzed separately to ascertain whether CV differed based on presumed production locale. The micaceous rim samples at LA 3840 and LA 60550 were too small for a separate analysis. Histograms of plain gray micaceous and non-micaceous samples at Tyuonyi (Figures 76.7a through 76.7c) show a higher breakpoint between large and small vessels for non-micaceous plain gray jars (≤13 ≥14), and an even higher breakpoint for micaceous jars (≤14 ≥15).

There are four times as many non-micaceous smeared-indented corrugated jars at Tyuonyi as micaceous (Tables 76.9b and 76.9c), but the samples are still quite small and CV calculations may be affected by sample size. However, 10 of the 12 jars (83 percent) have aperture radii less than or equal to 13 cm. Five of the six CVs are below 20 percent; two are below 10 percent.

Table 76.9b. Coefficients of variation for non-micaceous culinary vessels at Classic period Pajarito sites.

	LA 3840*	LA 82 (A)	LA 82 (B)	LA 60550*
SIC				
n =		4	6	
radius ≤13 cm		4.6	26.8	
body thickness		7.1	13.2	
rim thickness		20.2	12.1	
n =		1	1	
radius ≥14 cm		-	-	
body thickness		-	-	
rim thickness		-	-	
Plain Gray				
n =		25	51	
radius ≤13 cm		24.0	22.8	
body thickness		11.8	15.4	
rim thickness		13.2	17.6	
n =		16	18	
radius ≥14 cm		16.8	10.4	
body thickness		12.9	11.8	
rim thickness		13.1	10.6	
Clapboard				
n =		-	2	
radius		-	12.9	
body thickness		-	0	
rim thickness		-	9.4	

	LA 3840*	LA 82 (A)	LA 82 (B)	LA 60550*
Washboard				
n =		-	-	
radius ≤14		-	-	
body thickness		-	-	
rim thickness		-	-	
n =		-	-	
radius ≥15		-	-	
body thickness		-	-	
rim thickness		-	-	

*see Table 76.10a

Table 76.9c. Coefficients of variation for micaceous culinary vessels at Classic period sites.

	LA 3840*	LA 82 (A)	LA 82 (B)	LA 60550**
SIC				
n =		2	1	
radius ≤14 cm		64.3	-	
body thickness		23.0	-	
rim thickness		16.2	-	
n =		0	0	
radius ≥15 cm		-	-	
body thickness		-	-	
rim thickness		-	-	
Plain Gray				
n =		9	26	
radius ≤14 cm		22.9	20.1	
body thickness		10.2	14.8	
rim thickness		10.4	14.6	
n =		7	12	
radius ≥15 cm		8.9	9.1	
body thickness		16.8	14.3	
rim thickness		18.5	13.0	
Clapboard				
n =		1	1	
radius		-	-	
body thickness		-	-	
rim thickness		-	-	
Washboard				
n =			4	
radius ≤14			4.6	
body thickness			7.8	
rim thickness			19.3	
n =			1	
radius ≥15			-	

	LA 3840*	LA 82 (A)	LA 82 (B)	LA 60550**
body thickness			-	
rim thickness			-	

* only one micaceous rim found at LA 3840; **only two micaceous rims found at LA 60550

The non-micaceous plain gray sample for both units (*n* = 110) includes 76 jars with aperture radii ≤13 cm (69 percent). CVs are just above 20 percent for aperture and between 10 percent and 20 percent for sherd and rim thickness. For large jars, CVs are between 10 percent and 20 percent. A very small sample of non-micaceous clapboard neck jars has one CV just above 10 percent and one just below (one attribute did not return a CV).

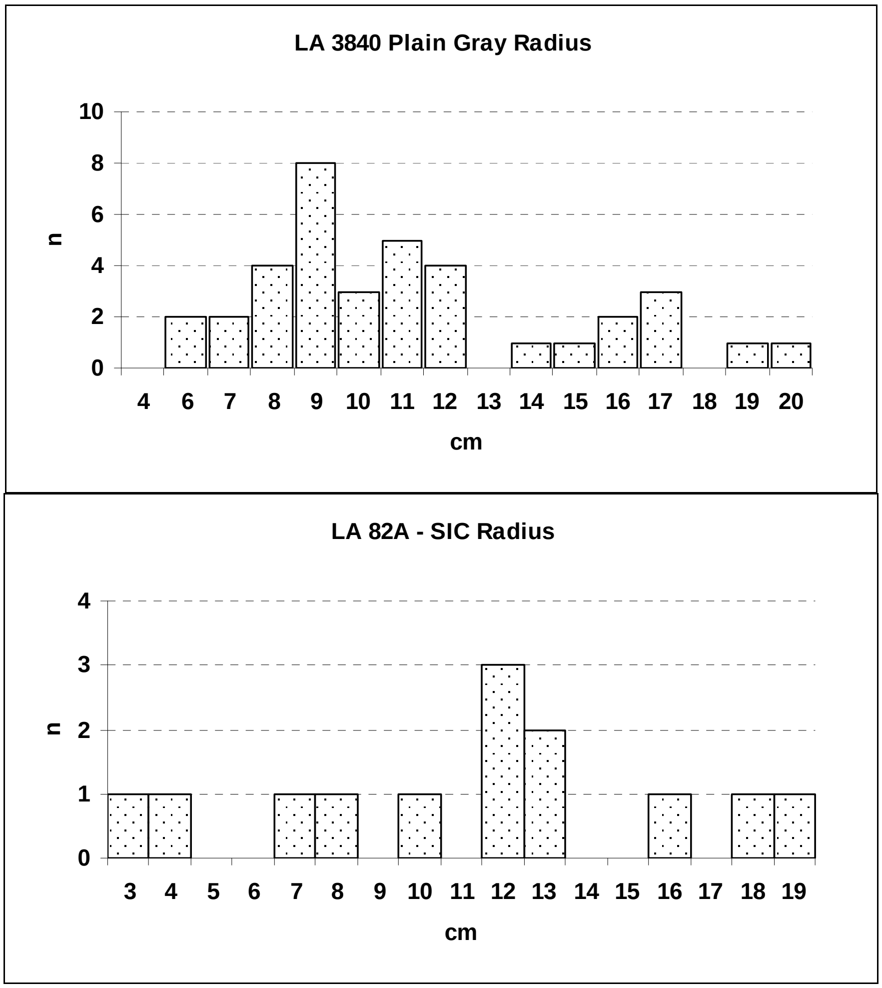


Figure 76.7a. Aperture radii for jars from LA 3840 and LA 82A.

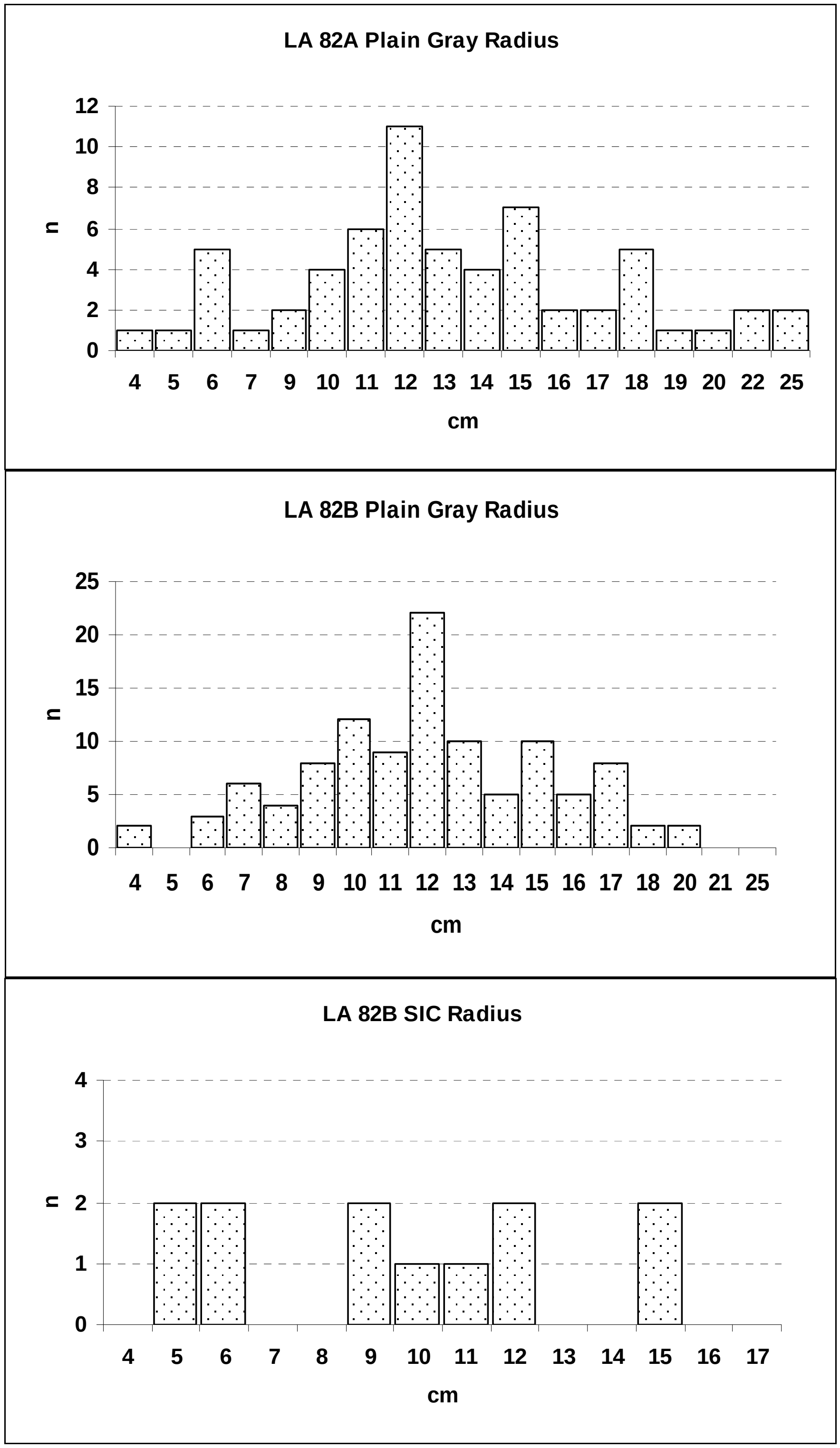


Figure 76.7b. Aperture radii for jars from LA 82A and LA 82B.

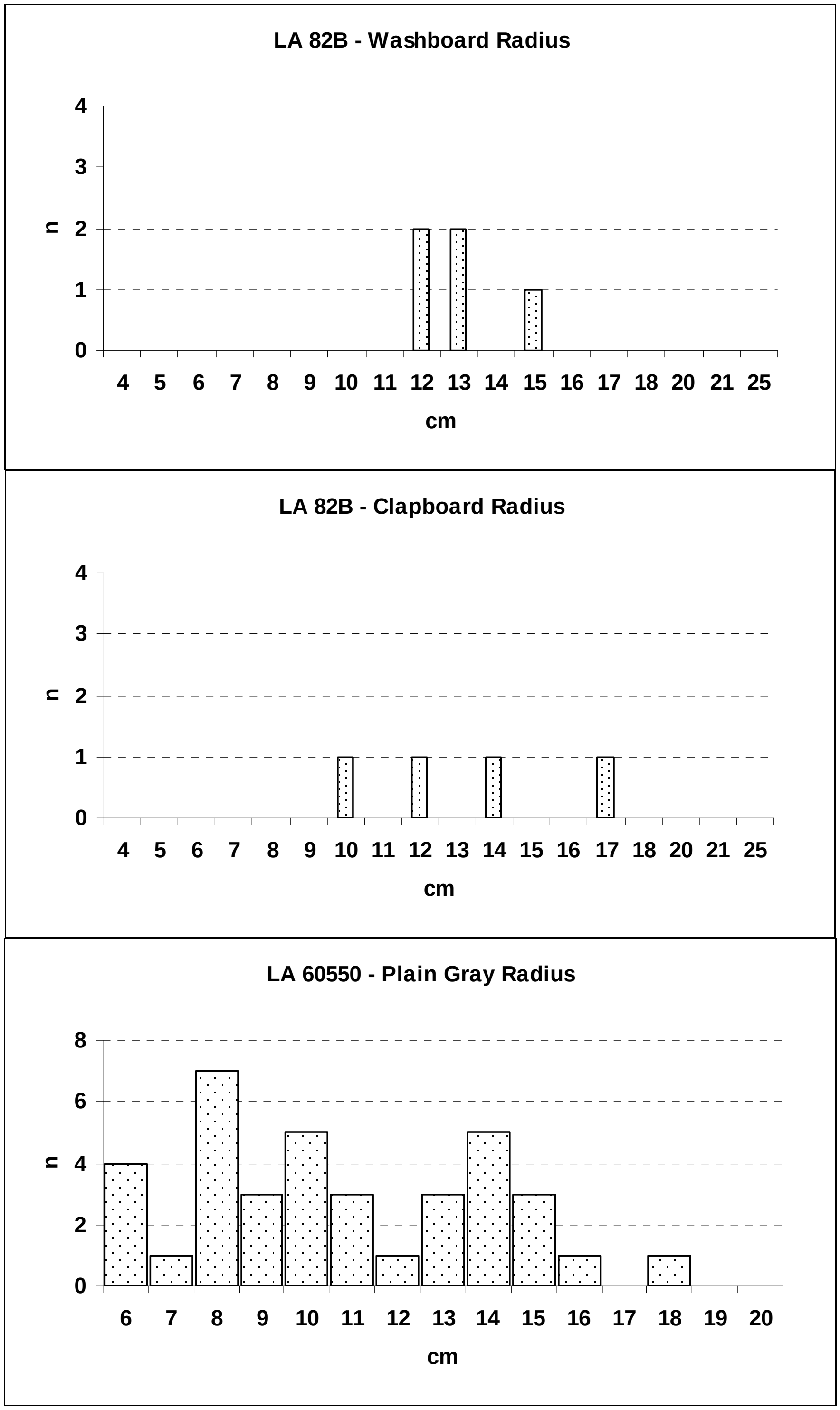


Figure 76.7c. Aperture radii for jars from LA 82B and LA 60550.

The sample of micaceous plain gray jars for both units (n = 54) includes 35 jars with aperture radii ≤14 cm (65 percent). Small micaceous jars, like the non-micaceous jars, have CVs just above 20 percent for aperture radii. In this case, however, CVs for sherd and rim thickness are between 10 percent and 15 percent, slightly lower than for the small non-micaceous plain gray vessels. CVs for large micaceous plain gray jar apertures are below 10 percent, with CVs for sherd and rim thickness between 10 percent and 20 percent, slightly higher than for large non-micaceous plain gray. Micaceous washboard jars return values for small jars only. CVs for aperture and sherd thickness go down slightly for the smaller sample, while CV for rim thickness goes up slightly.

TESTING EQUALITY OF VARIANCE

How reliable are the CVs calculated from these archaeological samples? Sample sizes are relatively small and the samples are not normally distributed. Occupation dates are imprecise and range from ca. 40 years for LA 3840 to ca. 160 years for LA 82. The number of producers, production episodes, and number of vessels produced are unknown. Dividing samples into vessel size classes magnifies the effect of these conditions.

CVs calculated in this study were compared with CVs calculated for controlled ethnoarchaeological and archaeological samples, using an Excel® algorithm provided by Jelmer Eerkens (personal communication, December 2005). The method is discussed fully in Eerkens and Bettinger (2001). It tests the equality of CVs and describes "how far sample CVs lie from the estimate of the overall population CV" (Eerkens and Bettinger 2001:499). A *p*-value less than 0.05 indicates that CVs for two samples are statistically distinct.

The controlled ethnoarchaeological samples are from studies done in the Philippines (Kvamme et al. 1996) and India (Roux 2003). Potters in the village of Dangtalan, Luzon, Philippines, produce meat and vegetable cooking pots (two-*chupa oppaya*) "primarily for household use and restricted exchange" (Kvamme et al. 1996:118). Although these are the least specialized of the potters studied in three Philippine communities, CVs for aperture, circumference, and height are below 10 percent (Kvamme et al. 1996:123; Table 4). Seasonal potters in Andhra Pradesh, India, produce *ralla catti* for cooking lentils and spinach. Each potter produces roughly 6000 vessels per year for barter or trade. Roux (2003:777; Table 4) pooled measurements taken for six individual potters for height, maximum diameter, and vessel aperture.

The archaeological samples are from a study of fine-ware bowl wasters at Tell Leilan, Syria (Blackman et al. 1993) and medium size, globular, Early Matsaki buffware jars from protohistoric Zuni Pueblo villages in New Mexico (Mills 1995). The fine-ware bowl wasters are from a single production episode dating to approximately 2300 BC (Blackman et al. 1993:63). Data are from Table 5 in Blackman et al. (1993:73). The Zuni buffware jars are dated from the 1400s−1500s through "formal and stylistic attributes" (Mills 1993:205−208). Data are from Table 8.5 in Mills (1995:222).

Eerkens' algorithm compares two samples using sample mean, standard deviation, and sample number. In this case, I held sample 1 constant, using one of the four control data sets as sample 1, and used the measurements from each of the 16 Pajarito grayware data sets as sample 2.

Pajarito Gray Ware versus Ethnoarchaeological Samples: Aperture

In the first comparison (Table 76.10a), sample 1 is aperture measurements for Dangtalan *two-chupa oppaya* and sample 2 is aperture measurements for Pajarito gray ware jars. Five samples of Pajarito grayware jars return *p*-values above 0.05. The CVs for these archaeological samples range from 8.9 to 11.3. A second comparison, made with sample 1 equal to aperture measurements for Andhra Pradesh *ralla catti*, returns only three samples with *p*-values above .05. CVs for these samples range from 8.9 to 9.5. The difference between the two ethnoarchaeological samples are 1) a slightly smaller CV for the Andhra Pradesh vessels (7.35 versus 7.47) and 2) a sample size for the Andrha Pradesh vessels, which is three times as large as that from Dangtalan.

Pajarito Grayware versus Archaeological Samples: Aperture

In the second comparison (Table 76.10b), sample 1 consists of aperture measurements for Tell Leilan fine-ware bowl wasters and sample 2 consists of aperture measurements for Pajarito grayware jars. The same five samples, with a CV range of 8.9 percent to 11.3 percent, return *p*-values greater than 0.05. A second comparison, using aperture measurements for Zuni Early buffware jars as sample 1, returns *p*-values greater than 0.05 for the same five samples of Pajarito grayware jars. Comparison of the range of *p*-values for the two sets of calculations shows that *p*-values are much higher in the two cases where sample 1 archaeological samples are used as the basis for comparison.

Pajarito versus Ethnoarchaeological and Archaeological Samples: Thickness

Only the Tell Leilan data include measurements and CVs for vessel thickness. These data and the aperture measurements for the Dangtalan vessels were used to compare CVs for vessel thickness (Table 76.10c). None of the CVs for thickness for the Pajarito Plateau vessels are below 10 percent, however, the first case returned nine *p*-values greater than 0.05. CV values for these samples range from 10.2 to 12.9. The second case returned only three *p*-values greater than 0.05. CV values for these samples range from 10.2 to 10.8. The differences between the two data sets used for sample 1 are 1) the CV for the Dangtalan apertures is lower (7.47 versus 8.14) and 2) there are twice as many vessels in the Dangtalan sample.

Examination of these comparisons indicates that the algorithm is effective in comparing CVs from less precisely controlled Pajarito Plateau archaeological samples and more precisely controlled archaeological and ethnoarchaeological samples. I can reliably report CVs for samples as small as seven vessel rims and expect that the overall population would return a similar result. However, results are affected by control sample size, mean, and standard deviation, and any interpretations should factor these in.

Table 76.10a. Coefficients of variation for vessel aperture of Pajarito Plateau archaeological samples compared with selected ethnoarchaeological samples using D'AD.

Site/Type/Size	*n* =	CV	D'AD Dangtalan Aperture (*n* = 55; CV = 7.47)	*p* =	D'AD Andhra Pradesh Aperture (*n* = 166; CV = 7.35)	*p* =
Coalition vessels						
LA 12587 SIC small	41	33.1	83.17445514	7.51222E-20	293.3623485	9.20334E-66
LA 86534 SIC small	26	27.0	64.599789	9.17652E-16	177.1148406	2.06726E-40
LA 60372 SIC small	59	27.8	64.9743775	7.58783E-16	227.7237487	1.86967E-51
LA 82B SIC small	10	32.9	75.92290679	2.94958E-18	157.8622795	3.31691E-36
LA 12587 SIC large	**10**	**9.5**	**0.883598443**	**0.347217991**	**1.94673415**	**0.162939285**
LA 86534 SIC large	**8**	**11.3**	**2.552654416**	**0.110109153**	4.501394103	0.033867237
LA 60372 SIC large	18	18.8	28.49075516	9.4147E-08	59.45313669	1.25241E-14
LA 82B SIC large	2	-	-	-		
Classic vessels						
LA 82A Plain small	25	24.0	54.49601182	1.55764E-13	140.6434166	1.92538E-32
LA 82B Plain small	51	22.8	50.35034703	1.28607E-12	156.5938166	6.27924E-36
LA 82A Mica small	9	22.9	35.78095284	2.20796E-09	64.02665064	1.22747E-15
LA 82B Mica small	26	20.1	36.53209985	1.50173E-09	87.66204056	7.76504E-21
LA 82A Plain large	16	16.8	20.68653242	5.40951E-06	40.62530606	1.84403E-10
LA 82B Plain large	**18**	**10.4**	**3.105968432**	**0.078005843**	**6.616864498**	**0.010101753**
LA 82A Mica large	**7**	**8.9**	**0.320027286**	**0.571591251**	**0.80050273**	**0.370943107**
LA 82B Mica large	**12**	**9.1**	**0.393570275**	**0.530428659**	**1.141682766**	**0.285297272**

Table 76.10b. Coefficients of variation for vessel aperture of Pajarito Plateau archaeological samples compared with selected archaeological samples using D'AD.

Site/Type/Size	*n* =	CV	D'AD Tell Leilan Aperture (*n* = 23; CV = 9.19)	p =	D'AD Zuni Aperture (*n* = 58; CV = 9.3)	*p* =
Coalition vessels						
LA 12587 SIC small	41	33.1	24.27886338	8.33487E-07	66.28767067	3.89689E-16
LA 86534 SIC small	26	27.0	19.80558652	8.57317E-06	44.68048053	2.31958E-11
LA 60372 SIC small	59	27.8	19.40715426	1.05611E-05	49.96130509	1.56808E-12
LA 82B SIC small	10	32.9	26.48407062	2.6572E-07	49.85739683	1.65336E-12
LA 12587 SIC large	**10**	**9.5**	**0.019357526**	**0.889346373**	**0.000939989**	**0.975541301**
LA 86534 SIC large	**8**	**11.3**	**0.508634728**	**0.475730472**	**0.36851476**	**0.543814967**
LA 60372 SIC large	18	18.8	9.177494868	0.002450092	14.78688178	0.00012037
LA 82B SIC large	2	-	-	-	-	-
Classic vessels						
LA 82A Plain small	25	24.0	16.92572181	3.88713E-05	35.62569391	2.39113E-09
LA 82B Plain small	51	22.8	14.97103764	0.000109174	34.53075347	4.1957E-09
LA 82A Mica small	9	22.9	13.4422984	0.000246014	19.91941361	8.07759E-06
LA 82B Mica small	26	20.1	11.24420822	0.000798719	20.93789955	4.74415E-06
LA 82A Plain large	16	16.8	6.61856232	0.010092127	9.561559364	0.001986943
LA 82B Plain large	**18**	**10.4**	**0.368711009**	**0.543707719**	**0.229035914**	**0.632239607**
LA 82A Mica large	**7**	**8.9**	**0.004191625**	**0.948378814**	**0.046938056**	**0.828479618**
LA 82B Mica large	**12**	**9.1**	**0.025936519**	**0.872055447**	**0.13658629**	**0.711698567**

Table 76.10c. Coefficients of variation for sherd thickness of Pajarito Plateau Archaeological samples compared with both archaeological and ethnoarchaeological samples using D'AD.

Site/Type/Size	***n* =**	**CV Thickness**	**D'AD Tell Leilan Thickness (*n* = 28; CV = 8.14)**	***p* =**	**D'AD Dangtalan Aperture (*n* = 55; CV = 7.47)**	***p* =**
Coalition vessels						
LA 12587 SIC small	41	13.7	5.621391	0.017743	19.25117	1.15E-05
LA 86534 SIC small	**26**	**11.6**	**1.265595**	**0.260595**	6.720567	0.009531
LA 60372 SIC small	59	16.4	7.547367	0.00601	24.68787	6.74E-07
LA 82B SIC small	**10**	**10.8**	**0.583866**	**0.444801**	**3.14447**	**0.076185**
LA 12587 SIC large	**10**	**11.9**	**0.967775**	**0.325236**	4.2179	0.04
LA 86534 SIC large	**8**	**12.7**	**0.961696**	**0.32676**	**3.868941**	**0.049188**
LA 60372 SIC large	**18**	**10.2**	**0.378967**	**0.538157**	**3.262354**	**0.070887**
LA 82B SIC large	2	-	-	-	-	-
Classic vessels						
LA 82A Plain small	**25**	**11.8**	**0.964706**	**0.326004**	5.732862	0.01665
LA 82B Plain small	51	15.4	7.136111	0.007555	23.45271	1.28E-06
LA 82A Mica small	**9**	**10.2**	**0.23433**	**0.628332**	**1.907642**	**0.167225**
LA 82B Mica small	26	14.8	6.50357	0.010766	20.33092	6.51E-06
LA 82A Plain large	**16**	**12.9**	**1.769164**	**0.183486**	7.192918	0.007319
LA 82B Plain large	**18**	**11.8**	**2.119792**	**0.145406**	8.363774	0.003828
LA 82A Mica large	7	16.8	5.409731	0.020025	13.59401	0.000227
LA 82B Mica large	12	14.3	4.401229	0.035913	12.93412	0.000323

DISCUSSION

Surface Treatment Change

The dominant culinary ware type changes from smeared-indented corrugated at Coalition sites to plain gray at Classic sites, as service ware types are also changing. The proportion of culinary sherds decreases at Classic sites.

Temper Change

Most smeared-indented corrugated sherds contain coarse, subangular feldspar and quartz sand-sized crystals from anthills. About one-fifth of the smeared-indented corrugated at the later Coalition site, LA 60372, appears to have inclusions of finer, more angular feldspar and quartz. The small quantities of smeared-indented corrugated at Classic sites, as well as the plain gray jars that dominate the Classic assemblages, are mainly tempered with this finer material (see also Wilson and Castro-Reino 2005:6).

Micaceous ware, which is rare in any Coalition assemblage, becomes an important part of the ceramic assemblage at LA 82, the largest Classic site, especially in the upper levels of the two excavation units. There is much less micaceous culinary ware at the two smaller Classic sites. Five micaceous washboard jar rims, likely to have come from the Chama-Española area, appear washed with a mica solution. These occur only in one unit at LA 82. This suggests that although micaceous washboard jars may have been brought to Tyuonyi, none were brought to the Annex.

Size Change

More than three-quarters of all jars at Coalition sites are small, with aperture radii less than or equal to 12 cm.

Large smeared-indented jars at LA 12587 show a peak size distribution at 16 cm and have a CV of 9.5 percent, strongly suggesting production by a small number of skilled potters. The large plain gray jars at this site have a CV just above 10 percent. There is some suggestion of short-distance whiteware exchange, based on the composition of the volcanic lithic fragments (Wilson and Castro-Reino 2005:8), but culinary ware temper composition does not differ from other sites on the Pajarito. This would suggest specialized local production of this ware.

The presence of very large smeared-indented corrugated jars at LA 60372, the plaza pueblo, suggests cooking for larger groups, either extended families or communal feasts. The CV for these jars, however, is higher.

The mean size of plain gray jars at Coalition sites is greater than for smeared-indented corrugated. This could indicate a temporal trend toward larger jars. While samples of plain gray are small, several have low CVs, which might represent the work of one potter.

Classic period assemblages have a larger proportion of jars with openings ≥13 cm, and the upper end of the size range is greater. The breakpoint between large and small jars appears to shift upward in the Classic period. Four samples of large jars have low CVs: LA 82 Unit B micaceous washboard (*n* = 5; CV = 9.4%) and plain micaceous in Unit A (*n* = 7; CV = 8.9%) and Unit B (*n* = 12; CV = 9.1%). LA 60550 has 13 large plain gray jar sherds with CV = 9.6 percent.

Thickness

Plain gray jars are always thicker than smeared-indented corrugated. Increased wall thickness would increase resistance to mechanical stress and would transfer heat more slowly, possibly indicating a change in food preparation methods to longer, slower cooking (Skibo 1994). Reduction in breakage might account for the lower proportion of culinary sherds in Classic period assemblages.

Most CVs for Coalition types of both sizes are less than 20 percent. When the Classic period sample is subdivided by type and temper, CVs for both micaceous and non-micaceous plain gray jar sherds and rim thickness are less than 20 percent.

Rim Thickness

Plain gray jar rims are thicker in the Classic than the Coalition, and always have a greater mean rim thickness than smeared-indented corrugated. Rim thickness may be more of a stylistic attribute than a functional attribute, but a thicker rim may add to the strength of the vessel and increase its use-life. Most CVs for rim thickness fall between 10 percent and 20 percent in both the Coalition and Classic periods.

Coefficients of Variation

A large number of CVs for size, body thickness, and rim thickness fall between 10 percent and 20 percent in both the Coalition and the Classic. The number of CVs below 10 percent is greater in the Classic period, especially when the sample is subdivided according to the presence or absence of mica in the paste.

Many Coalition CVs below 10 percent may be an effect of the small sample size. While a small sample with a low CV might indicate the output of a single potter, a larger sample with a low CV could indicate size standardization. The former may be the case at LA 86534, where the sample is small, while the larger sample of large smeared-indented corrugated jars at LA 12587 may indicate the latter. Because corrugations and smearing create additional variability in thickness, smeared-indented corrugated jars show little standardization of this attribute except possibly at LA 60372.

CVs for Classic period jars are mainly between 10 percent and 20 percent, with exceptions for very small samples. However, when the Classic period jars at LA 82 are analyzed based on presence or absence of mica in the paste, the CVs for all attributes are lower. Here many samples are large enough to suggest attribute standardization rather than a lower number of producers.

CONCLUSION

This preliminary examination of Pajarito culinary ware shows changes from the Coalition to the Classic period in surface treatment, inclusions, size range, ratio of large to small vessels, and vessel wall and rim thickness. These changes are not in lock-step; they differ in timing according to settlement size and type and may be part of an overall increase in large-group feasting activities.

The presence of much larger jars at LA 60372 in the Late Coalition may indicate food preparation in larger quantities, suggesting larger family groups or communal feasting. There is evidence of a trend toward standardization at LA 12587 and at LA 60372, which could indicate either specialized production for local exchange at those sites, or trade with specialists from another community. Standardization in the smaller samples may indicate output by a few skilled domestic specialists.

Vessel size range, the proportion of large jars, and the degree of size standardization increases from the Coalition to the Classic period at these Pajarito sites. Production of large jars requires a higher degree of skill, and these may have been made by fewer potters, resulting in a more standardized size range. If large jars were being produced for special functions or events, then size range may have also been prescribed (B. Stark 1995).

Vessel thickness and rim thickness also increase from Coalition period smeared-indented corrugated to Classic period plain gray. This may relate to changes in cuisine, cooking practices, or in fuel available for cooking and/or firing (see Curewitz 2004b for discussion). Thickness of plain versus smeared-indented corrugated may be related to the change in temper material, but may also relate to vessel size.

Micaceous sherds make up 23 percent of the culinary ware at LA 82, but only 0.4 percent and 0.7 percent, respectively of the culinary ware at LA 3840 and LA 60550. These vessels were not produced on the plateau. They clearly show attribute standardization and may have been produced for exchange by specialist potters. The quantities present suggest that they were an important item of exchange for the inhabitants of the large plaza pueblo but not for those of the two smaller Classic period sites.

CHAPTER 77
CERAMIC ANALYSIS AND INTERPRETATION OF CLASSIC PERIOD PUEBLOS ON LOS ALAMOS NATIONAL LABORATORY LAND COLLECTED BY THE PAJARITO ARCHAEOLOGICAL RESEARCH PROJECT

Samuel Duwe

INTRODUCTION

Archaeological questions of identity, technology, and craft specialization have preoccupied researchers over the past 25 years. By understanding the methods and use-life of craft (such as pottery) it becomes possible to delineate interesting patterns in the material record. These can be used to infer group identity and modes of social cohesion, social boundaries, and interactions and relationships at an inter- and intra-site level. This research also is important to descendent communities of prehistoric people whose material culture is being analyzed. These lines of inquiry make it possible to not only understand the presence and location of a prehistoric society in culture historic terms, but also create ways in explaining this behavior.

The above questions are especially pertinent in the American Southwest where a detailed culture history has been devised, making it possible to ask detailed and somewhat abstract questions. The reason for the precision of knowledge of the archaeological record owes much from the over 100 year history of investigation and inquiry. The northern Rio Grande is no exception. In fact, much of the early work in the Southwest was performed near or amongst the modern Rio Grande pueblos. This area was also subject to many ethnographic analyses, which has given researchers the ability to use analogies of Pueblo behavior as an effective middle-range theory in interpreting prehistoric ruins and artifacts.

Even with this excellent knowledge of the archaeological record, as well as a firm base in the ethnographic and ethnohistoric literature, certain large portions of prehistory have yet to be addressed, or if already addressed, more completely understood. This includes Classic period (AD 1325–1600) prehistoric Tewa populations on the Pajarito Plateau. Although a general understanding of their location and material culture are understood, questions of chronology, identity, and the degree of craft specialization and pottery technology have not been successfully answered. Another problem that plagues the entire field of archaeology is the collection of artifacts that remain unanalyzed. This too is true of many collections of northern Rio Grande sites currently housed in museums but never examined to their full potential (or in many cases, not at all).

This report examines ceramics collected from two Classic Period sites on the Pajarito Plateau by the Pajarito Archaeological Research Project (PARP): Otowi (LA 169) and Tsirege (LA 170). These collections have never been fully analyzed and their analysis promises answers to a broad range of questions, including those mentioned above. I will first briefly describe the study area and the history of archaeological research. After laying out a research design for analyzing these collections, I analyze multiple attributes of pottery sherds (both painted and utilitarian wares) including not only basic visual properties but also microscopic temper/paste characteristics and the results of refiring oxidation experiments. These results are interpreted using a theoretical and methodological approach that addresses questions of chronology, identity, technology, and craft specialization.

Of course, ceramics from the surface of two sites can only reveal so much information about regional patterns of exchange, specialization, and identity. Near the end of this report, the results of this analysis are compared with existing data from other pueblos in the northern Rio Grande region to make preliminary hypothesis of regional interaction during the Classic period. Further directions for future research are suggested to fully incorporate these results into the larger culture history of northern New Mexico.

THE PAJARITO PLATEAU NATURAL ENVIRONMENT AND CULTURE HISTORY

The Pajarito Plateau is defined as the high mesas that slope eastward from the Jemez Mountains to the Rio Grande Valley in north-central New Mexico, ranging from Puye ruins on the Santa Clara Pueblo Reservation to the north to Canada de Cochiti near present day Santa Fe in the south (Steen 1977). The magnitude of this area both in size and environmental diversity is represented in the change of elevation: 1590 m (5217 ft) above sea level at the Rio Grande to 3526 m (11,568 ft) at Tschicoma Peak in the Jemez (Allen 2004). Geologically, the landscape is formed by the explosion and collapse of a great volcano (1.4 and 1.1 million years ago), which created the Valles Caldera to the west and whose remnants formed the Jemez Mountains and canyon-dissected tuff plateaus on their eastern flank. The area experiences a semi-arid climate with a mean annual precipitation of 40.7 cm (Allen 2004)—a climate that can reasonably be extended into prehistory (Dean and Robinson 1977). Vegetation ranges from juniper (*Juniperus monosperma*) grasslands in the lowlands, juniper and piñon pine (*Pinus edulis)* woodlands on the raised mesas, and ponderosa pine (*Pinus ponderosa*) in the mountains (Allen 2004).

Although the natural landscape can be separated into three unique and easily identifiable categories, the cultural landscape is more difficult to discern. The earliest human occupants in the region were Paleoindian foragers (9500–5500 BC) who most likely ventured across the plateau during hunting expeditions or raw material procurement endeavors. The evidence lies in projectile points: a Folsom point was found during the Los Alamos National Laboratory (LANL) survey (Steen 1977:7) and Clovis, Folsom, and Plainview points were identified in the general study area (Acklen 1993, 1997; Lent et al. 1986; Traylor et al. 1990; Wiseman 1992).

Archaic period (5500 BC–AD 600) foragers appear to have occupied the plateau at least seasonally, hunting small and large game (rabbits and deer) and procuring nearby lithic materials. Evidence takes the form of projectile points, obsidian lithic tools, and stone chipping debris (Vierra et al. 2002). Summer sites used for pine nut harvesting, hunting, and rock collection were recorded and interpreted (Baker and Winter 1981; Biella 1992; Moore et al. 1998), as were winter sites nearer the Rio Grande in the piñon grasslands (Lent 1991).

The first Pueblo occupation was during the Developmental period (AD 600–1150). Although there are few sites with corresponding diagnostic Kwahe'e Black-on-white ceramics, those that are found are small pithouses and lithic and ceramic scatters (Vierra et al. 2002). Because of this low frequency of sites, it can be interpreted that there was a minor Pueblo presence during the Developmental period and that these people were practicing a mixed subsistence: that of mostly foraging with some maize horticulture.

During the Coalition period (AD 1150–1325), the plateau saw a large increase in the number of sites. Year-round settlement appeared in the uplands and there was an increased reliance on agriculture as evidenced by agricultural features such as check dams and gravel mulch gardens (Vierra et al. 2002). This rapid population growth has been attributed to migration (Wendorf and Reed 1955) or population explosion (Steen 1982).

The Classic period (AD 1325–1600) saw an even greater increase in the reliance on agriculture and populations aggregated into multiple large centers. At these centers were large pueblos with various other corresponding sites such as fieldhouses, shrines, and smaller pueblos. These main pueblos were Tsirege, Tsankawi, and Otowi and are typed by the presence of biscuitware (Vierra et al. 2002). At this time there was also the apparent solidification of a Tewa group, defined by pottery and settlement patterns. To the south, this aggregation had created tightly definable regions as well, especially along traditional cultural lines. This is seen most spectacularly with the change in ceramic assemblage between the northern Pajarito Plateau and pueblos to the south. These pueblos were specializing in the manufacture of Rio Grande glazewares and the Tewa groups were producing their own distinct biscuitware vessels.

HISTORY OF PAST ARCHAEOLOGICAL RESEARCH

Although the area was visited and sites were mentioned by early explorers, the first true archaeological investigation of the Pajarito Plateau was by Adolph Bandelier who collected artifacts from the major sites of Otowi and Tsirege (Bandelier 1892). The first large publications of the major sites were by Edgar Lee Hewett and Lucy Wilson. Hewett (1904, 1905, 1906, 1908a) recorded and sketched some of the largest Classic Pueblo ruins located on LANL property, including Otowi and Tsirege (Figure 77.1). Wilson led excavations at Otowi from 1915 to 1917 and produced information in the northern roomblocks of the site (Wilson 1916a, 1916b, 1917, 1918a, 1918b). Harry Mera surveyed the Plateau in the 1920s and 30s, recording some of the same large Classic period pueblos and collecting ceramics in which he constructed an initial chronology that dated the sites of Tsirege and Otowi to the 14th and 15th centuries (Mere 1932, 1934). Through the mid-part of the century, further work on the plateau was performed by archaeologists working under the auspices of LANL (Steen 1977, 1983; Worman and Steen 1978) and Bandelier National Monument (Turney 1955). These included test excavations and extensive survey projects.

The PARP was the first systematic survey of the region. Conducted from 1977 to 1985, the project was lead by James Hill of the University of California, Los Angeles (UCLA). The survey recorded 935 sites, 445 which were multi-room masonry dwellings ranging from one- to three-room fieldhouses to large multi-storied plaza pueblos (Hill et al. 1996). Small test excavations were performed on the smaller sites, whereas large-scale collection of artifacts was performed on the large Classic period sites (Otowi and Tsirege). Much of this material, including ceramics, remains unanalyzed at the UCLA. The main theoretical framework of the project was the understanding of settlement patterns and demographics of sites to interpret prehistoric people of the plateau's adaptation to environmental and social stress. This included preliminary dating, mapping, and collection at all accessible sites.

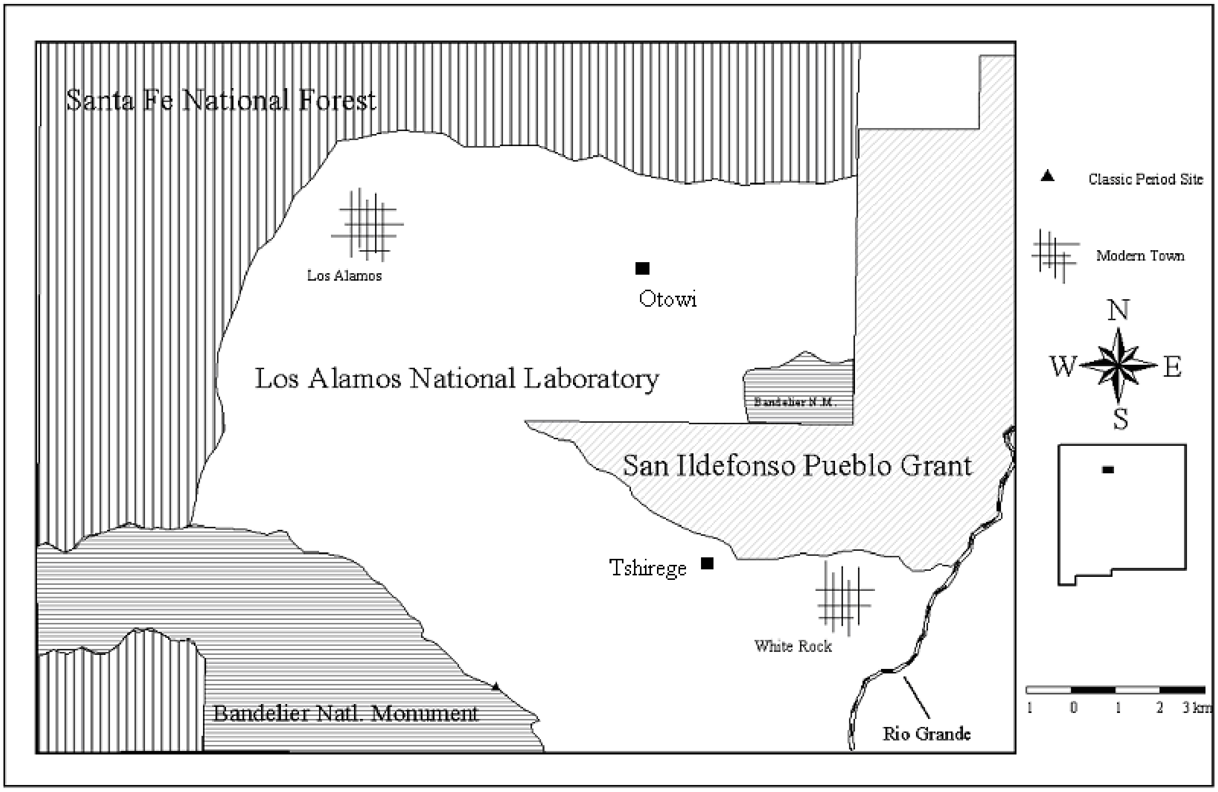


Figure 77.1. Classic period sites at LANL selected for analysis.

Up until the present, various LANL archaeologists have performed culture resource management work across the northern Pajarito Plateau in which LANL (United Stated Department of Energy) owns much of the land. The most important of these projects was the survey and synthesis of LANL data. As of this report, 16,000 acres of LANL lands have been 100 percent surveyed, with another 5,500 acres unsystematically examined. A total of 1595 sites have been recorded (Vierra et al. 2002). Currently, LANL archaeologists are completing the Land Conveyance and Transfer Project in which a multitude of smaller one- to three-room Coalition and Classic period fieldhouses have been excavated. This data will help in understanding chronology, settlement, and subsistence patterns during these periods on the Pajarito Plateau.

STUDY AREA AND SAMPLE

Otowi (LA 169)

Otowi (LA 169) is a very large Classic period pueblo with 700 or more ground floor rooms, including five rubble mounds and several kiva and midden areas. Both tree-ring and ceramic samples have dated the site tentatively to the AD 1400s (see Chapter 7, Volume 1). The pueblo is divided into five roomblocks and seven kivas. The roomblocks are estimated to be two to three stories tall (Hewett 1953). The site was first excavated by Hewett (1906, 1953) and reported by Lucy Wilson (1916a, b), where the first detailed maps and analyses were presented. PARP crews in the 1970s parceled the site into 12 units (A–H and J–M) and surface collected 100 percent of the ceramic assemblage within these units (PARP 1978) (Table 77.1). The site was again revisited in 1999 by LANL archaeologists who performed infield analyses of surface ceramics (LANL 1999) (see Figure 77.2 for a map of the sites as well as the location of collection units from both PARP and LANL analyses).

Table 77.1. PARP collection units at Otowi and their associated sizes and reasons for collection (from PARP 1978).

Unit	Location	Size	Reason Collected
A	Central mound (backdirt?)	3- by 3-m grid square	For midden and backdirt samples (from previous excavations)
B	Primary midden	2- by 2-m grid square	For midden and backdirt samples (from previous excavations)
C	Central mound (backdirt?)	2- by 3-m grid square	For midden and backdirt samples (from previous excavations)
D	Primary midden	2- by 2-m grid square	For midden and backdirt samples (from previous excavations)
E	South of Roomblock A	3- by 3-m grid square	To obtain ceramics from earlier occupations
F	South of Roomblock A	1- by 2-m grid square	Revealed glazeware
G	South of Roomblock A	1- by 1-m grid square	Revealed glazeware
H	Roomblock A	2- by 2-m grid square	As a check to make sure no important components were missed
J	West of Roomblock B	2- by 2-m grid square	As a check to make sure no important components were missed
K	West of Roomblock B	2- by 2-m grid square	To obtain ceramics from earlier occupations
L	Adjacent to Roomblock B	2- by 2-m grid square	As a check to make sure no important components were missed
M	South of Roomblock A	0.5- by 0.5-m grid square	Revealed glazeware

The excavations by Wilson (1916a, b) revealed that Roomblock A was most likely the oldest occupation of the site, which she called the "old pueblo." However, very little information is known on the extent of these excavations as well as by those of Hewett (1906). In fact, there is debate whether the central earthen mound is backdirt from these early excavations (as proposed by PARP crews) or a "burial mound" (Hewett 1906). Most likely it is a mixture of both, although this has been difficult to prove using surface collections alone. This problem points to the complexity of both natural and cultural transformation processes (Schiffer 1976) that affect the composition of ceramic assemblages in surface contexts.

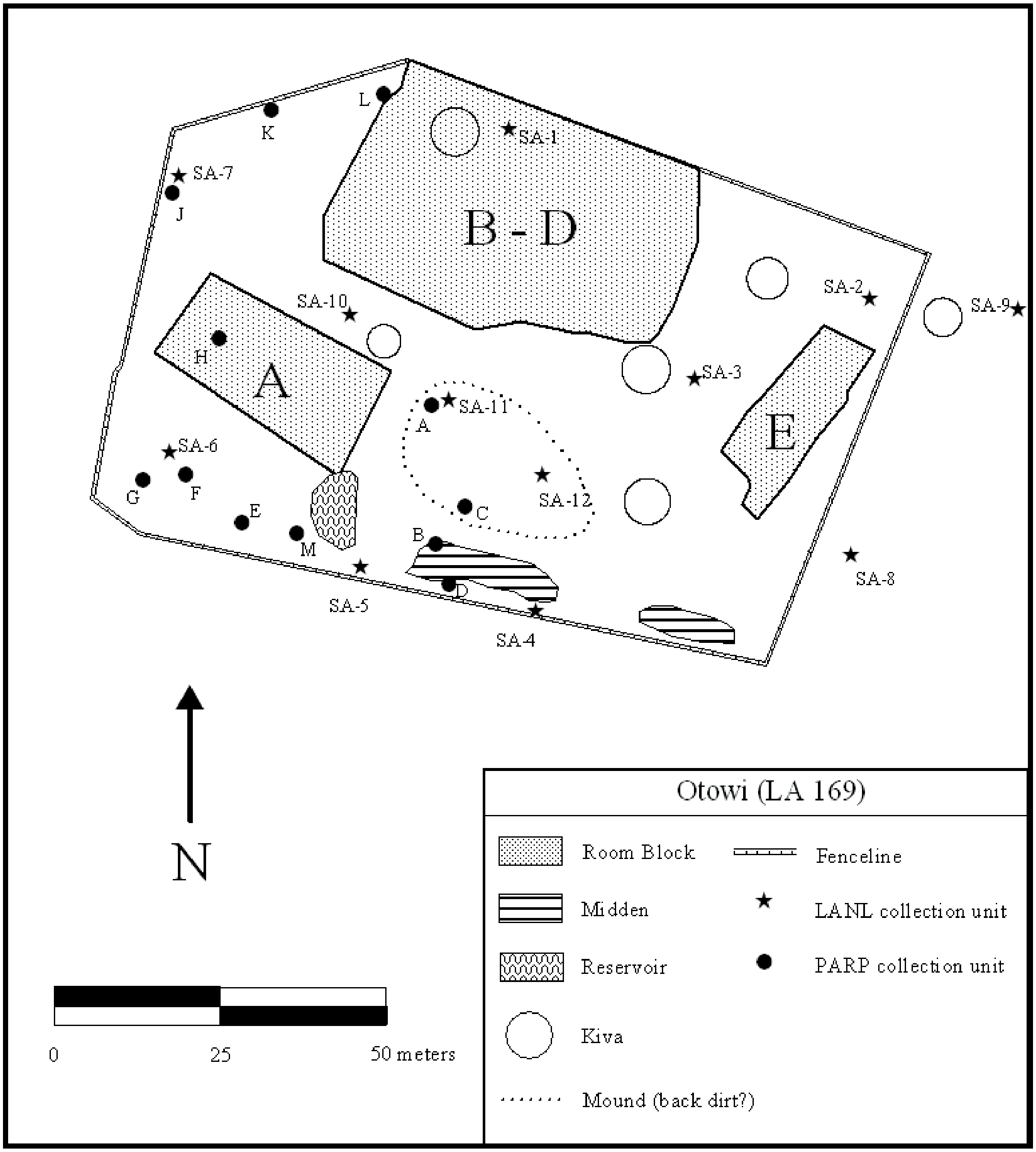


Figure 77.2. Map of Otowi (LA 169) with both PARP and LANL collection units.

Otowi is an important site to many groups for it is claimed as an ancestral home for the modern Pueblo residents of San Ildefonso Pueblo. It also holds a great deal of interest to archaeologists because of its location on the southern edge of the historic Tewa language (and ethnic) area. The analysis of ceramic at the site may aid researchers in understanding the occupational sequence of the site and its relationship with Keres speaking groups to the south, a perennial and still debated question to the nature of this historic ethnic boundary that possibly extended back into prehistory.

Tsirege (LA 170)

Tsirege is a large Classic period site located on the north side of Pajarito Canyon near the modern town of White Rock. Limited tree-ring samples have dated it to the AD 1500s (see Chapter 7, Volume 1), although no ceramic cross-dating has been performed. The site has many large features that include the masonry pueblo, kivas, middens, a reservoir, and numerous small cavates in the surrounding canyon (Hewett 1938). The original excavations were performed by Edgar Hewett in the early 20th century and the site has been studied by LANL archaeologists since mid-century. PARP crews sectioned the pueblo into six horizontal spatial units (A-F) and collected each (Figure 77.3). Tsirege has the largest ceramic assemblage of the sites collected by PARP (Table 77.2).

Table 77.2. PARP collection units at Tsirege and their associated sizes and reasons for collection (from PARP 1979).

Unit	Location	Size	Reason for Collection
A	Southeast of east roomblock, near (or part of) midden	7- by 5-m grid square	Representative of east roomblock
B	South of Plaza 1 in primary midden	5- by 5-m grid square	Representative of west roomblock
C	Center of Plaza 1	5- by 5-m grid square	Representative of main plaza
D	North of north roomblock in midden	5- by 5-m grid square	Representative of north roomblock
E	Near primary midden	1- by 1-m grid square	Pothunter's cache
F	Southeast of east roomblock	1- by 1-m grid square	Pothunter's cache
G	Southeast of east roomblock	1- by 1-m grid square	Pothunter's cache
H	Southern portion of east roomblock	1- by 1-m grid square	Pothunter's cache
J	Plaza 2	5- by 5-m grid square	Representative of Plaza 2
K	East roomblock	1- by 1-m grid square	Pothunter's cache
L	Plaza 1	1- by 1-m grid square	Pothunter's cache
M	East roomblock midden	1- by 1-m grid square	not specified
N	Near east roomblock midden	1- by 1-m grid square	not specified
O	Southwestern corner of west roomblock	1- by 1-m grid square	not specified
P	Northwest of north roomblock (near reservoir)	1- by 1-m grid square	not specified
Q	Northwest of north roomblock (near reservoir)	1- by 1-m grid square	not specified

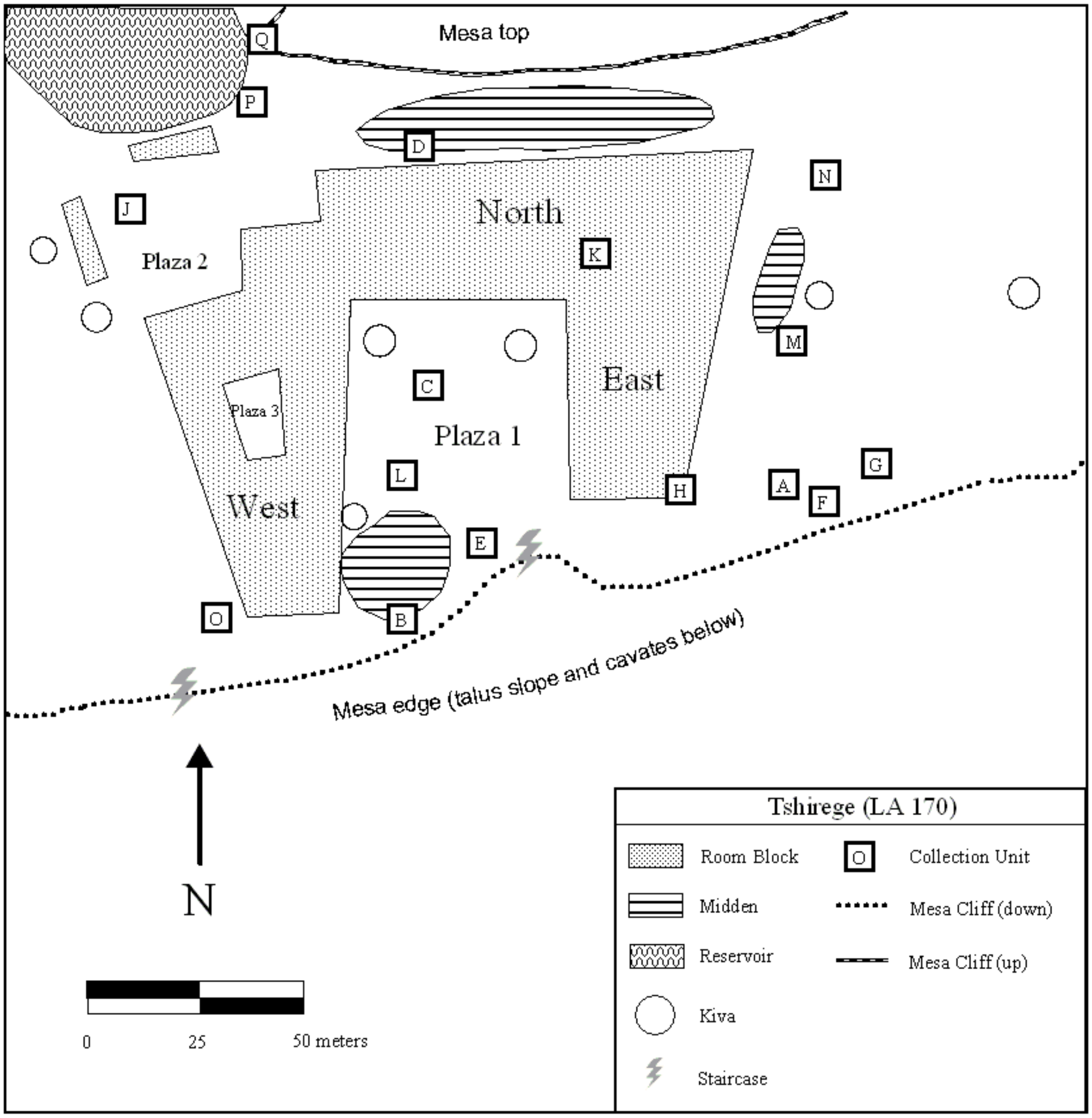


Figure 77.3. Map of Tsirege (LA 170) and PARP collection units.

Tsirege consists of three large connected roomblocks (described in this analysis as the Eastern, Western, and Northern roomblocks) surrounding a main plaza. Each roomblock has an associated midden that was the focus of testing for much of the PARP collection units. In the northeastern portion of the site, there are two small roomblocks with a plaza and two associated kivas. Although no official midden is documented, the plaza contains a great deal of sheet trash (PARP 1979). It is likely that this area represents an older (or first) occupation of the site, a question that will be tested in this subsequent analysis.

Tsirege is an important site because, like Otowi, it is regarded as an ancestral home to the residents of San Ildefonso Pueblo. It also holds a great deal of interest to archaeological researchers for it is regarded as a Late Classic period site near the border of the traditional Tewa/Keres boundary. It is also a pueblo that was likely recorded by early Spanish explorers associated with Coronado's exploration up the Rio Grande (Schroeder and Matson 1965).

THE NORTHERN RIO GRANDE CERAMIC ASSEMBLAGE

Tewa Series

The Pajarito Plateau has traditionally been classified as part of the "biscuitware" area that also includes the Chama drainage to the north. The region correlates with the spatial extent of historic Pueblo linguistic groups; the Tewa pueblos are most likely the descendants of these archaeological communities. The area is unique from other regions in the northern Rio Grande for while areas to the south began to produce glaze-painted pottery, a black-on-white ceramic tradition continued and evolved. The first systematic study of ceramics from the region was by A. V. Kidder (1915) who later chronologically seriated the entire region's pottery from ceramics found in the deeply stratified contexts of Pecos Pueblo (1936). Formal names were given to these types in Kidder's monograph (1936) as well as in the seminal work by H. P. Mera (1932, 1935). Numerous other syntheses and chronological reevaluations took place mid-century (see Wendorf and Reed 1955) but in an important work, Harlow (1973) laid out the general date ranges for the ceramics from the biscuitware pueblos, also known as the Tewa series. In the past 30 years, several periods of refinement have come to bare, and the dating that is used in this report is described in Table 77.3.

Table 77.3. Types of Tewa Series pottery and associated date ranges.

Type	Dates	References
Kwahe'e Black-on-white	1075–1175	Habicht-Mauche 1993
Santa Fe Black-on-white	1175–1425	Habicht-Mauche 1993
Wiyo Black-on-white	1250–1475	Habicht-Mauche 1993; Wendorf 1953:45
Abiquiu Black-on-gray	1375–1450; to 540(?)	Breternitz 1966:69; Habicht-Mauche 1993
Bandelier Black-on-gray	1400–1550	Breternitz 1966:70
Cuyamungue Black-on-cream	1475–1600	Harlow 1973
Sankawi Black-on-cream	1550–1650	Breternitz 1966:94; Harlow 1973; Smiley et al. 1953:58
Tewa Red/Polychrome	1650–1730?	Harlow 1973; C. Schaafsma 2002:149

Kwahe'e Black-on-White

Dating from the 11th and 12th centuries, Kwahe'e Black-on-white was the dominant ware across the Rio Grande region. This also includes the Taos Region to the north and east, which has a local variety termed Taos Black-on-white (Fowles 2004). It appears to be an indigenous phenomenon that marks the beginning of a long tradition of black-on-white painted pottery production unique to the region (Habicht-Mauche 1993:15). Although the paste is similar to the succeeding Santa Fe Black-on-white ceramics (quartz sand and volcanic ash), the paint is mineral based versus the carbon (organic) based paints of later traditions (Habicht-Mauche 1993). Ending at the end of the 12th century, the type correlates with the later part of the Developmental period (AD 600–1150), although the type is found among the surface contexts (rarely) of Coalition period sites on the Pajarito Plateau (de Barros 1981).

Santa Fe Black-on-White

During the 13th century, this ware spread rapidly over the entire northern Rio Grande region, dominating the ceramic assemblage of all sites through the 14th century. The type is easily distinguished by its carbon paint and distinctive blue-gray paste (Mera 1935). Santa Fe Black-on-white has been described as remarkably uniform in both color and texture (Habicht-Mauche 1993:20), although recent petrographic work suggests that regional variations in tempering material exist (Wilson and Castro-Reino 2005). Regardless, it appears that the type was made locally by potters across a wide region who probably shared in some sort of regional identity (Futrell 1998; Graves and Eckert 1998). Although it is believed that this type was replaced by Wiyo Black-on-white (and later Abiquiu Black-on-gray) by the beginning of the 15th century, Habicht-Mauche (1993:19) argues that there is evidence (both tree-ring and archaeomagnetic) that Santa Fe Black-on-white was being produced up through the first quarter of the 1400s, at least after AD 1410.

Wiyo Black-on-White

Compared to its predecessor, Santa Fe Black-on-white, Wiyo Black-on-white has a limited geographic area restricted to the Tewa region (lower Chama River drainage, Espanola, Valley, and the northern Pajarito Plateau). The type has a dark black organic paint on a polished (sometimes slipped) surface with design elements that resemble the earlier Santa Fe Black-on-white ceramics. The real difference that distinguishes this type is the clay body composition, with a trend toward fine-grained tuff and smaller amounts of sand/silt inclusions. It is this quality that caused both Kidder and Amsden (1931) and Mera (1935) to call this type "biscuitoid." Wiyo Black-on-white is widely believed to be the predecessor of the later biscuitwares. The type is associated with Late Coalition/Early Classic period sites.

Abiquiu Black-on-Gray (Biscuit A)

Also referred to as Biscuit A, Abiquiu Black-on-white ceramics have thick walls and fine textures and light paste, hence looking like unfired porcelain, or *bisque*. This type is restricted almost entirely to bowl forms where the exterior is rough and unpolished and the interior is polished, often slipped, and has striking dark organic paint painted in broad lines. The production area for these wares appears to be centered on the Española and Chama Valleys, and perhaps the northern Pajarito Plateau, although this has not been substantially tested (Habicht-Mauche 1993:26). The distinguishing features of the biscuitwares are their thick, porous, and light clay body and paste. Previous analyses have indicated that these wares are untempered, with fine tuff paste. Abiquiu Black-on-white sherds from Arroyo Hondo, however, had 20 percent of the sherds with quartz sand inclusions (Habicht-Mauche 1993). Clearly, the range of diversity in both temper material and paste has yet to be fully explored. Technologically, it appears that the clay used to manufacture the biscuitwares is difficult to work and fire (Shepard 1936), thus raising some interesting technological questions of procurement and production. The wares were traded in moderate quantities to the glazeware producing areas to the south (Kidder 1936).

Bandelier Black-on-Gray (Biscuit B)

This type is nearly identical to Abiquiu Black-on-white in terms of technological considerations of paste and temper, although Shepard (1936) identified through oxidation experiments differences in clay procurement between the two types. Bandelier Black-on-gray, unlike Abiquiu Black-on-gray, was made as both bowls and jars. Bowls are polished and sometimes slipped on both sides. Design elements are similar to that of Abiquiu Black-on-gray with dark organic paints painted in broad lines, although the painting appears to be less exact (Kidder 1936). This type, although overlapping with Abiquiu Black-on-white, is generally believed to have been produced later in time, until the middle part of the 16th century.

Cuyamungue Black-on-Tan (Biscuit C)

Cuyamungue Black-on-white is described by Harlow (1973) as a third type of biscuitware, postdating Bandelier Black-on-white, ending near the turn of the 17th century. It is generally tan in color versus the white-gray of the earlier biscuitwares, with a more upright, square rim form. The design elements are generally less precise than Bandelier Black-on-white.

Sankawi Black-on-Cream

Sankawi Black-on-cream is the next in the Tewa Series and was produced in the same area and replacing the biscuitwares. Produced as both bowls and jars, vessels are generally tan in color with thin, hard walls (Wendorf 1953). Bowls are polished and slipped on both sides, and jars are polished and slipped on the exterior, with smoothed interiors. Paint is organic and uses the same design elements as the biscuitwares, although line width is thinner and less complex (Harlow 1973).

Potsuwi'i Incised

Potsuwi'i Incised is technically an utilityware that dates from AD 1450–1550 (Jeancon 1923; Mera 1932). Although unpainted, the surface is incised with rectangular geometric designs. Vessel forms are predominantly jars or ollas; bowls are rare. The type is thought to be produced somewhere in the Tewa area, most likely at Classic period sites in the Rio Chama drainage. The temper and consistency of paste most resembles that of Sankawi Black-on-cream with both tuff and quartz sand inclusions.

Glaze Series

The classification of the Rio Grande Glaze Series is based on Mera's (1933) revision of Nelson's (1914) and Kidder and Kidder's (1917) analyses of rim form and surface treatments from stratified, datable contexts. Six types (A–F) that seriate through time have been securely established by petrographic analyses (Shepard 1942; Warren 1979). Rio Grande glazeware was produced widely across the region from the southern portion of the Pajarito Plateau south to Socorro. Unlike the whiteware tradition of the Tewa area, during the Late Coalition/Early Glaze periods, glazeware replaced earlier traditions. Becoming widespread across the Rio Grande Valley and beyond, it appears that the ware was produced in many different localities, with each large Pueblo producing and exchanging glaze pottery (Habicht-Mauche 1993). Interestingly, although biscuitware and later ceramics were imported from the Tewa area, very low percentages of glazewares were imported north into the region. Glazewares vary across time, but a unifying characteristic is glaze paint (mineral-based paint with the addition of a flux, such as galena [Habicht-Mauche et al. 2000]) on a red or yellow clay body.

The current project examines two large Classic period pueblos that most likely span a large time period. Therefore, all Glaze Series types are relevant, from early Glaze A to later, historic Glaze F. The dates of each type and their associated characteristics are listed in Table 77.4. Kidder's (1936) rim seriation used in typing is displayed in Figure 77.4.

Table 77.4. Types of Rio Grande Glaze Series pottery and associated date ranges.

Glaze Series	Type	Characteristics	Dates	References
Glaze A	Agua Fria	Direct parallel-sided rimes, red surfaces inside and out, design elements simple, crushed sherd or rock temper	1315–1425	Schaafsma 2002:195; Vint 1999:391,
	Cienegulla	Same but polychrome, with glaze outline by red matte design elements		
Glaze B	Largo	Thickened expanded rim, crushed rock temper, cream or white slip on both sides, can be polychrome	1415–1450	Schaafsma 2002:195
Glaze C	Espinoso	Shorted everted or beveled rim, crushed rock temper, polychrome	1450–1500	Schaafsma 2002:195
Glaze D	San Lazaro	Long thickened rims (everted), crushed rock temper, polychrome	1490–1525	Schaafsma 2002:195
Glaze E	Puaray	Long thickened rims, crushed rock temper, polychrome, late types have runny paints	1515–1625	Vint 1999:391; Schaafsma 2002:195
Glaze F	Kotyiti	Long parallel sided rims, runny glaze paint	1625–1700	Harlow and Lanmon 2003:32; Schaafsma 2002:195

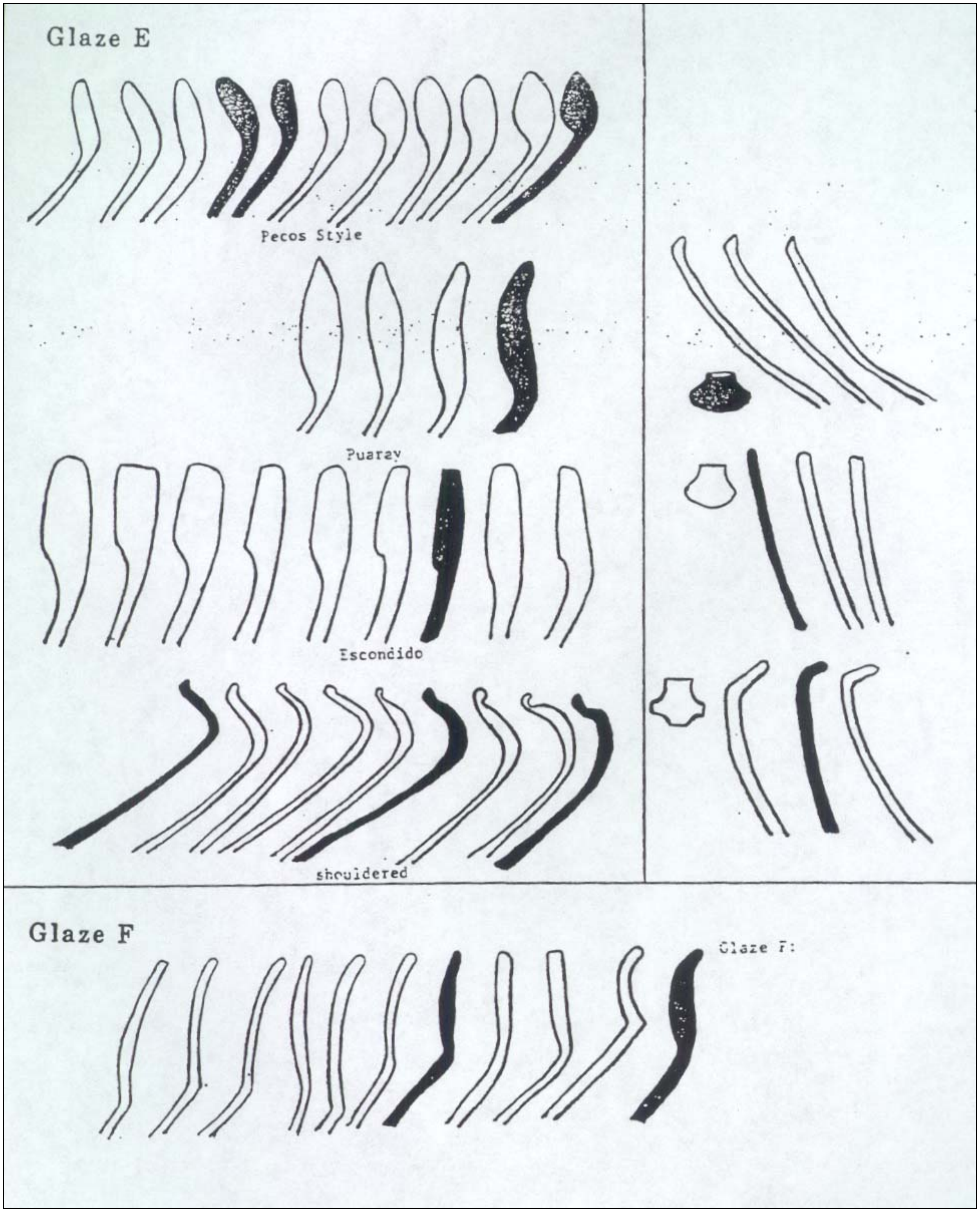


Figure 77.4. Kidder's (1936) Glaze Series rim seriation chart.

Utilitywares

As for vessel function, ethnographic and archaeological evidence has shown that painted ceramic vessels were mostly used as serving vessels and articles for gifts and exchange. Unpainted utilitywares are generally considered to have fulfilled the role of cooking and storage of food products. In the Tewa area generally and on the Pajarito Plateau more specifically, these ceramics took the form of graywares.

The literature dealing with these wares is frustratingly silent and ambiguous. Throughout time and depending on who was publishing the data, the grayware from the Pajarito Plateau has taken on a variety of names based on surface treatment (plain, indented corrugated, smeared-indented corrugated, obliterated corrugated) and presence of mica. Some researchers have been splitters creating many different types, whereas other have been lumpers. For this project, a middle ground is taken in which two general types of grayware are defined and whose primary distinguishing feature is the presence/absence of a mica slipped exterior. Although many more attributes were recorded (see full data table), these two categories appear to be most faithful to past research and the present ceramic assemblage (Table 77.5).

Table 77.5. Types of Utility grayware and associated date ranges.

Type	Dates	References
Tesuque Gray	1250–1500	Habicht-Mauche 1993; McKenna and Powers 1986; Mera 1935
Sapawe Washboard	1425–1600	McKenna and Powers 1986; Mera 1935
Potsuwi'i Incised	1550–1650	Harlow 1973
Kapo Black	1680–1760	Mera 1939:14; Harlow 1973:40; Schaafsma 2002:150

Besides sherds that fall into other categories such as plain and clapboard surface treatment, two major types were delineated amongst the Pajarito Plateau graywares. Tesuque grayware is a general description of smeared-indented corrugated ware that can have either the presence or absence of micaceous inclusions (Habicht-Mauche 1993; McKenna and Powers 1986; Mera 1935). It has been proposed that the Tesuque grayware samples with mica inclusions date later than pots with no mica, although this is highly untested (National Park Service 1991). From personal observations this type can and does vary tremendously across a single large pot, with the neck being clapboard and the body alternating between smeared and obliterated indentations.

Sapawe Washboard is a type of this smeared to obliterated corrugated construction, with thin walls and a mica wash or slip creating a brilliant gold color. Dating from AD 1425–1600, it has been widely thought to have originated and possibly produced in the Chama River valley north of the Pajarito Plateau (McKenna and Powers 1986; Mera 1935). It is also thought to be a later ware than the Tesuque Gray although there is a large chronological overlap in contemporaneity.

Historic Wares

Tewa Red/Polychrome

Tewa Red/Polychome, a historic ware produced between the mid-16th and mid-17th centuries (Harlow 1973; Schaafsma 2002:149), has an orange-tan paste slipped with either red or red and white (on polychrome) and is decorated with a black organic paint. Both bowls and jars are present. Both the red and polychrome varieties are combined in this analysis because the ceramics are in surface contexts and are small; a polychrome vessel may produce sherds that appear to be only black-on-red. Paste and temper resembles other types in the Tewa series with fine tuff and few sand grains. It is believed that this type was produced exclusively at the Tewa Pueblos along the northern Rio Grande.

Kapo Black

Kapo Black is a historic utilityware that was manufactured in the Tewa area from the late 17th century to the middle of the 18th century (both before and after the Pueblo Revolt of 1680) (Harlow 1973:40; Mera 1939:14; Schaafsma 2002:150). Generally, a dark black color that results from sooting in a reduced atmosphere, the ware is smoothed and polished with no additional decoration. The paste is similar to earlier Tewa wares, which consists of a fine tuff with little to no sand inclusions. Both bowls and jars were produced.

Imported Wares

White Mountain Redware

A small percentage of non-painted redware that, based on microscopic temper analysis, was neither glazeware or Tewa Red/Polychrome. Temper was sand and sherd based, leading to the interpretation of these unidentifiable ceramics as belonging to the White Mountain Redware category. Early varieties of the ware (St. Johns Polychrome) were found at Arroyo Hondo (Habicht-Mauche 1993) and Pecos Pueblo (Kidder 1936), and later ones were found at Classic period sites in the Chama such as Te'ewi (Wendorf 1953) and Howiri (Fallon and Wening 1987). White Mountain Redware was produced in east-central Arizona and it is not unlikely that interaction (as seen by pot mobility) occurred between the Rio Grande and Western pueblos.

CERAMIC ANALYSIS METHODOLOGY

All ceramics collected by PARP crews from Otowi and Tsirege (n = 8457) were sorted into previously described types. The descriptions by Kidder and Amsden (1931) and Habicht-Mauche (1993) proved most helpful, although the ceramic guide from Bandelier National Monument (National Park Service 1991) was also consulted. Understanding and dealing with the diversity of both biscuitware types and corrugated ceramics was greatly aided by discussions with archaeologists currently working in the northern Rio Grande (Kurt Anscheutz, Jim Vint, Richard Ford, Diane Curewitz; personal communications), as was an afternoon at the Laboratory of Anthropology in Santa Fe examining the Mera type collection.

Following Gauthier's (1987a) suggestion, one previously discussed Tewa Series type, Cuyamungue Black-on-tan, was not sorted for. The type is described by Harlow (1973) as being differentiated from Bandelier Black-on-gray by a tan paste and a "square" shaped rim. Gauthier (1987a) found that rim type and paste/slip color are not correlated and that classifying sherds in this category has the potential to cause serious errors in subsequent analyses.

To ensure data compatibility when the data from this project is evaluated in terms of previous analyses performed by LANL and the Laboratory of Anthropology at the Museum of New Mexico, the Museum's ceramic analyses framework was used to structure a methodology that measures multiple facets of prehistoric pottery. This includes sorting by pottery ware and type, vessel form, pigment type, interior and exterior modifications, temper and paste composition, rim sherd size and diameter, sherd weight, and vessel wall thickness. The only exception to the above traits measured is with the corrugated utilityware (n = 2612), in which vessel wall thickness was not measured due to time constraints (see Appendix CC).

Although the type of inclusions for all sherds was analyzed, a detailed examination was performed on the biscuitwares (Abiquiu Black-on gray and Bandelier Black-on-gray) to understand the range of diversity. This analysis will support any interpretations based on the aforementioned theoretical framework.

The subsequent statistical and spatial analyses were performed on all sherds that could reasonably be typed into one of the described categories. Unidentified sherds or ones that were incompletely coded (e.g., undifferentiated whiteware, undifferentiated biscuitware) were excluded from these analyses, although the data have been provided with this report.

Clay oxidation analysis using the refiring technique were conducted on multiple sherds (n = 335) of both Abiquiu Black-on-gray and Bandelier Black-on-gray bowls. The former were analyzed from surface units at both sites with substantial amounts of each ware and encompass the full range of temper and paste characteristics. The latter were taken from a unit at Tsirege that had a large amount of both ceramic types that included both micaceous and non-micaceous varieties. Clay oxidation does not provide the detailed provenance information of petrographic and chemical composition, but it does provide an inexpensive and expedient method of assessing the relationships between raw materials (clay) and the finished pottery found in archaeological contexts (Bubemyre and Mills 1991). Refiring sherds drives out organic impurities and chemically changes major components in the clay body. The most important of these is iron, which is converted to a reddish shade. Paste color results from firing conditions, atmosphere (oxidized or reducing), maximum temperature, duration of firing, and most importantly, clay composition (Mills 1987:186). Simply put, the more iron in the sample, the redder (darker) the color. Experiments by Shepard (1936, 1971) have shown that the ideal temperature to refire sherds for this intended purposed is at 950 degrees C (1750 degrees F) for 30 minutes. The resulting color was then measured with a Munsell® color chart.

The underlying assumption is that within both the biscuitwares and corrugated ceramics different clay sources were used, indicating change of procurement strategies over time or pot mobility. Because no raw material analyses (clay sources) were analyzed for this project, the former possibility is most easily testable. This analysis will help to lend interpretative strength to arguments about chronology, technology, identity, and craft specialization.

THE OTOWI (LA 169) CERAMIC ASSEMBLAGE

Tewa Series

Kwahe'e Black-on-White

As is to be expected for the surface assemblage of a large Classic period site, no sherds of this type were found. This does not negate the fact that a possible Coalition period occupation directly under the Classic period architecture contained some Kwahe'e Black-on-white; however, it is apparent that the site was densely and intensely occupied during the Late Coalition and Early Classic periods, if not later (Table 77.6).

Table 77.6. Percentages of decorated ceramic types by PARP collection in the Otowi surface assemblage.

Unit	Santa Fe B/w	Wiyo B/w	Biscuit A	Biscuit B	Sankawi B/c	Potsuwi'i	Glaze	Imported	Historic
A (*n* = 208)	1%	7%	30%	41%	14%	2%	4%	0	0
B (*n* = 150)	5%	17%	13%	45%	9%	3%	4%	0	3%
C (*n* = 369)	5%	16%	11%	44%	17%	3%	4%	<1%	<1%
D (*n* = 72)	6%	0%	28%	44%	11%	3%	8%	0	0
E (*n* = 441)	3%	6%	29%	41%	15%	2%	4%	0	0
F (*n* = 109)	14%	17%	19%	27%	17%	1%	6%	0	0
G (*n* = 42)	2%	0	12%	55%	17%	0	14%	0	0
H (*n* = 51)	0%	0	20%	51%	18%	4%	8%	0	0
J (*n* = 37)	3%	0	22%	41%	30%	3%	3%	0	0
K (*n* = 61)	20%	0	30%	23%	20%	2%	7%	0	0
L (*n* = 27)	7%	0	26%	44%	15%	0%	7%	0	0
M (*n* = 38)	5%	8%	16%	42%	8%	5%	11%	5%	0
Total (*n* = 1605)	5%	9%	22%	41%	15%	2%	5%	<1%	<1%

Santa Fe Black-on-White

Santa Fe Black-on-white occurred infrequently in the entire surface assemblage of Otowi, with only 78 sherds (5%) being reliably typed. This is probably not too surprising given that the site has traditionally been dated to the Early Classic period whereas Santa Fe Black-on-white is generally considered a Coalition period ceramic type. However, the analysis of the type at Arroyo Hondo placed later varieties into the first quarter of the 15th century (Habicht-Mauche 1993), allowing for the possibility of Santa Fe Black-on-white being present in larger quantities. Because this is a surface assemblage without stratigraphic cross-dating, the small amount of this type can be interpreted two ways: either Santa Fe Black-on-white is not being produced in great quantities at Early Classic period sites on the northern Pajarito Plateau, or Otowi dates around to or later than AD 1425. Although it is not possible to disprove the latter, the former proposition appears to be more favorable due to the large amounts of biscuitware and Sankawi Black-on-cream in the ceramic assemblage. With early 20th century excavations and pot hunting activity over the past century, the surface assemblages are far from representing a pristine abandonment context. These events surely mixed earlier and later pottery types thus allowing for Santa Fe Black-on-white to coexist among Sankawi Black-on-cream sherds.

Santa Fe Black-on-white was present in nearly every surface unit collected except for Unit H, which has a relatively small sample size (n = 51). The type dominates in two units: F and K. Unit F is located in the midden area of Roomblock A of what Wilson (1916a) described as the "old pueblo," or the original roomblock in the building sequence of the site. Subsequent surface analysis by LANL teams also arrived at this conclusion based on the predominance of early ceramics (LANL 1999). Unit K is located to the east of Roomblock B and was collected by PARP crews, "to obtain ceramics from earlier occupations" (PARP 1978). Although there is no indication of what these early occupation could have been based on, notes and maps created by these crews suggest it is likely the remains of a prior Coalition period site that sits below the Classic period architecture at Otowi.

Wiyo Black-on-White

Wiyo Black-on-white ceramics were found at approximately half of the units collected, with 9 percent (n = 147) reasonably typed. This type was found at Arroyo Hondo until AD 1475 and appears to occur with Abiquiu Black-on-gray, although it appears to have ended somewhat earlier and can be dated as an earlier type (Habicht-Mauche 1993). Units G, H, J, K, and L all had sherds present, and due to their location (spread out in all collected areas and nearby units with Wiyo Black-on-white was present) this can possibly be explained based on a small sample size.

Three collected units (B, C, and F) had a large amount (>15%) of Wiyo Black-on-white present. Units B and C are located to the south of the main plaza. Unit C is located on top of the mound that was recorded by PARP crews as "possible backdirt" from the excavations of Hewett and Wilson. Although as discussed above, this description is possibly incorrect. Unit C is adjacent to the central midden in which Unit B was collected. Both units are probably the result of mixing of the ceramic assemblages of the entire site. As such, there appears to be a middle 15th century occupation of Otowi, which would fit its definition as an Early Classic period pueblo.

Unit F is located in the midden of Roomblock A, which has been described as the oldest architecture of the site. This unit also had a large amount of Santa Fe Black-on-white ceramics, thus lending support that this was probably the earliest portion of the site to be occupied.

Abiquiu Black-on-Gray (Biscuit A)

Abiquiu-Black-on-gray has been dated from the late 14th century through possibly the middle of the 16th (Habicht-Mauche 1993), although it is considered a 15th century type. The type accounts for 22 percent (*n* = 346) of the ceramic assemblage at Otowi. Every unit collected on the site had Abiquiu Black-on-gray ceramics of relatively similar quantities (11% to 30%), which were considerably smaller compared to the amounts of Bandelier Black-on-gray sherds. Areas of low concentration (Units B and C) were located in the central midden and appear to have a mixed context of all ceramic types found at the site. Although these small amounts are puzzling, it appears that this was a result of sampling error as both of these contexts had high amounts of both Wiyo Black-on-white and Bandelier Black-on-gray, two types that bracket Abiquiu Black-on-gray in time.

For this project, samples of both Abiquiu Black-on-gray and Bandelier Black-on-gray bowl sherds were analyzed from Otowi and Tsirege to understand the degree of variability within and between sites and types. Five temper types were classified: primarily tuff, tuff and quartz sand, tuff and quartz sand and volcanics, tuff and quartz sand and plutonics, and a type with all the above inclusions.

Traditionally, the biscuitwares were thought to have been tempered (or self tempered) primarily with volcanic tuff (Mera 1932). Additional inclusions, either accidental or intentional, have been seen as the exception rather than the rule. However, when examining Abiquiu Black-on-gray vessels from Arroyo Hondo, Habicht-Mauche (1993) found that approximately 20 percent of the biscuitware sherds were tempered with quartz and other inclusions. Similar results are seen in the analysis of Abiquiu Black-on-gray sherds from Otowi, although the average from sample units with large quantities of the type are larger, averaging approximately 30 percent (Table 77.7). The majority of these tempered sherds have only quartz inclusions, and judging from the edges of the grains under 40x magnification, these are most likely sand. Whether this sand was intentionally added to the paste cannot be concluded at this time without analyses of the clay procurement areas, for sand may be naturally occurring and not separated from the raw clay used for pottery building.

Two other types of temper categories were discovered in this analysis: tuff with quartz sand and volcanics and tuff with quartz sand and plutonics. The first has dark igneous volcanic rock inclusions while the second has plutonic rocks such as granite. Although not well-represented in the Otowi Abiquiu Black-on-gray assemblage, these temper types may indicate non-local ceramic provenance, or perhaps differing raw material sources. This is especially the case for the plutonics. Because the traditional area of Tewa pottery is geologically volcanic, these inclusions could point toward ceramic mobility into the pueblo. Units (with substantial sample size, or greater than 40 sherds) with a small sample of plutonic tempered ceramics are Units C and A, with Unit A having a relatively larger amount (10%). Unfortunately, these two units are located on the earthen mound in the central plaza of Otowi making any spatial analysis void, for these ceramics could be associated with any of the roomblocks from the pueblo. However, the fact that these different tempers exist leads to further research questions about ceramic mobility and technology, as will be discussed in a later section of this report.

Table 77.7. Percentages of temper types by unit for Abiquiu Black-on-gray bowl sherds from Otowi.

Unit	Temper			
	Tuff	Tuff w/ sand	Tuff w/ sand + volc.	Tuff w/ sand + plut.
A (*n* = 62)	76%	21%	2%	2%
B (*n* = 20)	45%	50%	0%	5%
C (*n* = 41)	63%	22%	5%	10%
D (*n* = 18)	78%	11%	0	11%
E (*n* = 128)	70%	27%	3%	0
F (*n* = 20)	85%	15%	0%	0
G (*n* = 5)	20%	40%	20%	20%
H (*n* = 11)	27%	55%	9%	9%
J (*n* = 7)	29%	71%	0	0
K (*n* = 19)	68%	11%	11%	11%
L (*n* = 7)	86%	14%	0	0
M (*n* = 6)	100%	0	0	0
Total (*n* = 344)	70%	52%	30%	30%

Bandelier Black-on-Gray (Biscuit B)

Bandelier Black-on-gray is the predominant ware found at Otowi with 41 percent (*n* = 664) collected. The type has been dated from the early part of the 15th century through the middle of the 16th. Every unit collected had a large majority of this type. Using language that was in vogue in the early part of last century, this truly is a "Biscuit B pueblo."

Interestingly, two of the PARP units that had smaller amounts (<30%) of Bandelier Black-on-gray were the units of F and K, both of which had the largest amounts of Santa Fe Black-on-white pottery. Unit F is located in the midden of Roomblock A and Unit K is located to the west of Roomblock A. Both of these areas represent the earliest areas of occupation, with unit K in a possible Coalition period occupation and Unit F representing the first and oldest roomblock architecture.

The same sorts of temper categories that existed in Abiquiu Black-on-gray bowls are also present in bowl sherds of Bandelier Black-on-gray (Table 77.8). Units with substantial sample sizes encompassed the full range of this variability. Interestingly, the number of samples with plutonic inclusions outweighed those with volcanic temper (average of 1% versus 5%). This raises questions about where Bandelier Black-on-gray as manufactured and how it was brought into the site assemblage. This will be further discussed in a later section.

Table 77.8. Percentages of temper types by unit for Bandelier Black-on-gray bowl sherds from Otowi.

Unit	Temper			
	Tuff	Tuff w/ sand	Tuff w/ sand + volc.	Tuff w/ sand + plut.
A (*n* = 79)	65%	32%	1%	3%
B (*n* = 58)	60%	31%	2%	7%
C (*n* = 124)	81%	13%	1%	5%
D (*n* = 35)	57%	14%	26%	3%
E (*n* = 164)	71%	25%	1%	3%
F (*n* = 23)	70%	22%	9%	0
G (*n* = 18)	61%	39%	0	0
H (*n* = 25)	44%	48%	4%	4%
J (*n* = 15)	67%	13%	7%	13%
K (*n* = 12)	92%	8%	0	0
L (*n* = 12)	25%	33%	25%	17%
M (*n* = 15)	60%	27%	0	13%
Total (*n* = 665)	59%	21%	3%	4%

Sankawi Black-on-Cream

Sankawi Black-on-cream dates to the middle of the 16th to the middle of the 17th century (Harlow 1973), postdating all of the biscuitwares. The type is less prone to error in typing due to its distinguishing features (color, hardness, width) so its presence is securely recorded. The type was recorded in every collection unit at similar frequencies of 8 percent to 18 percent. The one exception was Unit J, which contained 30 percent in its assemblage. The unit is located to the far western portion of the site, and although it is intriguing to think that this could have been representative of a later occupation of the site, the sample size is too small (*n* = 36) to make any firm interpretations. Although Sankawi Black-on-cream is securely represented across Otowi, it is unlikely that this type was being used during the maximum occupation of the site, although it does suggest that we can evaluate the Bandelier Black-on-gray dating as weighing to the later end of its chronology.

Potsuwi'i Incised

Potsuwi'i Incised, which dates to AD 1550–1650 (Harlow 1973), can be seen as representing some of the latest occupation of the site. Although only present in two percent of the site assemblage (excluding the gray utilitywares), it is present in all units except for Unit G, which is located in the midden context of Roomblock A (the old pueblo). The percentage of Potsuwi'i Incised is nearly constant from 1 percent to 4 percent, making spatial analysis useless. The presence of this ware suggests that the site was occupied until the mid-16th century.

Glaze Series

Only three rim sherds with diagnostic characteristics were found to securely type into the Rio Grande glaze series. These samples are San Lazaro polychrome sherds that have been dated to

AD 1490–1525 (Schaafsma 2002:195), or more generically, Glaze D. Two sherds were found in Unit C on top of the earthen mound, and another was found in Unit E, located to the south of Roomblock A. Although the sample size voids any meaningful interpretations, it appears that the site was occupied through the first part of the 16th century. This is also substantiated by the amount of Sankawi Black-on-cream found in the assemblage.

Unidentified glazeware sherds were found in all units collected, although Units G and M had substantial amounts (>10%). Both are located in the midden area of Roomblock A, which is believed to be the oldest portion of the pueblo. It appears that the early occupation of the Otowi exchanged regularly with glazeware-making potters to the south.

Utilitywares

Overall, the grayware assemblage at Otowi was dominated by smeared-indented corrugated, both with (27%) and without (34%) mica inclusions (Table 77.9). The other large portion was Sapawe washboard (23%) although there was a small amount (11%) of indented corrugated ceramics found in surface contexts. Although the Bandelier Ceramic Guide (National Park Service 1991) tentatively puts micaceous smeared-indented corrugated chronologically later than the same type without mica, this cannot be tested due to mixed midden contexts. The highest concentration of Sapawe washboard (51%) was found in Unit A, located on the central mound in the main plaza. The type is dated to AD 1425–1600 (McKenna and Powers 1986; Mera 1935), making this deposit one of the latest of the site. This seems to fit well with other ceramic counts of the painted wares.

Table 77.9. Percentages of utility ceramic types by PARP collection in the Otowi surface assemblage.

Unit	Plain	Indented Corrugated	Smeared-Indented Corrugated	Plain Mica	Mica Smeared-Indented Corrugated	Sapawe Washboard	Striated	Clapboard
A (*n* = 105)	0	3%	12%	1%	30%	51%	0	3%
B (*n* = 54)	0	13%	30%	0	57%	0	0	0
C (*n* = 113)	7%	4%	26%	4%	31%	27%	0	1%
G (*n* = 42)	0	0	55%	0	43%	2%	0	0
H (*n* = 40)	5%	18%	0	0	48%	30%	0	0
J (*n* = 19)	0	32%	0	0	63%	5%	0	0
K (*n* = 102)	0	12%	39%	5%	19%	25%	0	0
L (*n* = 38)	0	0	53%	0	47%	0	0	0
M (*n* = 18)	0	100%	0	0	0	0	0	0
Total (*n* = 531)	2%	11%	27%	2%	34%	23%	0	1%

Historic Wares

Only five historic sherds were found at the site. All were unpainted redware with fine tuff temper and were typed as Tewa Red/Polychrome. This type dates from the middle of the 17th century to the early part of the 18th century. Four sherds (3%) were found in Unit B, located in the midden south of the main plaza and one sherd (<1%) was in Unit C located on the mound. Due to the lack of any sizable amount of historic wares at the site, it can be reasonably argued that there was no historic reoccupation of the site.

Imported Wares

Only three imported sherds were found in the surface collections from Otowi. All three were unpainted redwares with sherd and sand temper, thus typed as White Mountain Redware. One sherd (<1%) was found in Unit C, located on the mound south of the main plaza, and two others (5%) in Unit M in the midden area of Roomblock A.

Refiring Experiments

Refiring analysis was performed on 176 samples of both Abiquiu and Bandelier Black-on-gray bowls from Otowi, sampling to allow a full representation of all temper types classified. The results are listed in Table 77.10. It appears that there is variation between samples based on clay type, which, using a Munsell© color chart, were grouped into five main color groups: brownish yellow, reddish yellow, pink, brown, and yellowish red.

Table 77.10. Percentages of refiring colors in the clay oxidation experiments for both Abiquiu and Bandelier Black-on-gray bowl sherds from Otowi.

Abiquiu Black-on-Gray Bowl						Bandelier Black-on-Gray Bowl					
Unit	Brownish Yellow	Reddish Yellow	Pink	Brown	Yellowish Red	Unit	Brownish Yellow	Reddish Yellow	Pink	Brown	Yellowish Red
A	54%	38%	0	4%	4%	A	30%	55%	0	10%	5%
B	11%	72%	6%	11%	0	B	38%	54%	4%	4%	0
C	24%	62%	5%	10%	0	C	21%	75%	4%	0	0
E	41%	50%	0	9%	0	E	15%	59%	7%	15%	4%

All of the different clay types that the refiring experiment illuminated were present amongst both wares. It appears that brownish yellow and reddish yellow clay were the predominate types, with much smaller quantities of the others. There were no appreciable differences in spatial analysis aside from Unit E, which had a larger portion of Bandelier Black-on-gray bowls with reddish yellow versus brownish yellow. Because Unit E is located in the midden of Roomblock

E (the old pueblo) this raises an interesting question: do clay types seriate (or at least change somewhat) through time?

When comparing the Abiquiu and Bandelier Black-on-gray samples, it does not look as if there is a noticeable change of clay location between the two ceramic types. Brownish yellow and reddish yellow are the dominant color categories and both pottery types have similar amounts of the other colors as well.

Still another question remains: what can be made of the additional clay color categories? Do these represent additional ceramic provenances and hence ceramic mobility? Or are these rather the result of different clay procurement strategies across the pueblo, and time? Possible interpretations will be further elucidated by comparing the results of the refiring experiments with those of the temper analysis.

The refiring data were compared to that of the temper analysis (Table 77.11). It appears that there is no correlation of the two variables with the samples of both Abiquiu and Bandelier Black-on-gray bowl sherds with their associated temper types. The only interesting association is that the brown and yellowish red sherd samples were only associated with tuff and tuff and quartz sand tempered pottery. The same is true for the sherds that were pink in color aside from samples of Bandelier Black-on-gray pottery with volcanic inclusions.

Table 77.11. Percentages of samples of temper type by refiring color from biscuitwares at Otowi.

Unit A	**Temper**	**Refire Color**				
Abiquiu B/g		Brownish yellow	Reddish yellow	Pink	Brown	Yellowish red
	Tuff	30%	60%	0	10%	0%
	Tuff w/ sand	50%	40%	0	0	10%
Bandelier B/g		Brownish yellow	Reddish yellow	Pink	Brown	Yellowish red
	Tuff	30%	60%	0	10%	0%
	Tuff w/ sand	30%	50%	0	10%	10%
Unit B	Temper	Refire Color				
Abiquiu B/g		Brownish yellow	Reddish yellow	Pink	Brown	Yellowish red
	Tuff	10%	50%	10%	20%	0
	Tuff w/ sand	13%	88%	0	0	0
	Tuff w/ sand + plut..	0	100%	0	0	0
Bandelier B/g		Brownish yellow	Reddish yellow	Pink	Brown	Yellowish red
	Tuff	40%	50%	0	10%	0
	Tuff w/ sand	30%	60%	10%	0	0
	Tuff w/ sand + plut..	50%	50%	0	0	0

Unit C	Temper	Refire Color				
Abiquiu B/g		Brownish yellow	Reddish yellow	Pink	Brown	Yellowish red
	Tuff	20%	60%	10%	10%	0
	Tuff w/ sand	14%	71%	0	14%	0
	Tuff w/ sand + plut.	50%	50%	0	0	0
Bandelier B/g		Brownish yellow	Reddish yellow	Pink	Brown	Yellowish red
	Tuff	10%	90%	0	0	0
	Tuff w/ sand	33%	56%	11%	0	0
	Tuff w/ sand + plut..	20%	80%	0	0	0
Unit E	Temper	Refire Color				
Abiquiu B/g		Brownish yellow	Reddish yellow	Pink	Brown	Yellowish red
	Tuff	50%	40%	0%	10%	0
	Tuff w/ sand	44%	44%	0	11%	0
	Tuff w/ sand + volc	0	100%	0	0	0
Bandelier B/g		Brownish yellow	Reddish yellow	Pink	Brown	Yellowish red
	Tuff	20%	40%	0	30%	10%
	Tuff w/ sand	10%	70%	10%	10%	0
	Tuff w/ sand + volc	0	75%	25%	0	0
	Tuff w/ sand + plut.	33%	67%	0	0	0

Few interpretations can be made with this limited analysis. However, some plausible scenarios can be considered. Although it is possible that both the refiring and temper data exhibit the full range of technological variability for locally made pots, this is unlikely due to the specialization of biscuitware pottery shown by stylistic analysis (Hagstrum 1985). Because we have no data on local clay and temper sources this cannot be established. If different clay sources are being exploited, how do these relate to the variation of tempered samples? The question becomes: what's local? And which line of evidence most likely represents local versus non-local pottery? This will be further discussed in a later section of this report.

Comparison with LANL Collections

LANL crews revisited Otowi in 1999 (LANL 1999) and performed infield analyses of both ceramic and lithic artifacts in 12 units across the site. Of these units six corresponded with similar locations of the PARP collection unit locations (Table 77.12).

Table 77.12. Correlation of PARP and LANL testing units at Otowi.

PARP Unit	LANL Unit
A	11
C	12
D	4
G	6
J	7
M	5

Although the LANL analyses only included rim sherds, the sample sizes were big enough to compare to the ware and type counts made in this analysis (Table 77.13). On the whole, both the PARP and LANL analyses correlated well with the proportions of ceramics within 10 percent. Notable exceptions (in bold type font) are that some units contained Abiquiu Black-on-gray, Bandelier Black-on-white, and Sankawi Black-on-cream. These differences could be the result of many different kinds of phenomena, such as weathering and erosions (that covered or uncovered artifacts) during the 25-year duration between analyses, or illegal artifact collection. Other possibilities include the nearby but not perfect spatial comparison of PARP and LANL units or sampling error and lack of consistency in ceramic analysis by multiple persons. Most likely this is the result of a sample bias; PARP crews collected all ceramics and LANL crews only examined rim sherds. This explains the higher proportion of ceramic types in the PARP analysis.

Table 77.13. Comparison of percentages of decorated ceramics from both PARP and LANL analyses at Otowi.

Project	Unit	Santa Fe B/w	Wiyo B/w	Abiquiu B/g	Bandelier B/g	Sankawi B/c	Potsuwi'i	Glaze
PARP	A (*n* = 306)	1%	5%	20%	28%	10%	2%	3%
LANL	11 (*n* = 52)	0	2%	6%	21%	12%	4%	6%
PARP	C (*n* = 461)	4%	13%	9%	35%	13%	2%	3%
LANL	12 (*n* = 82)	1%	0%	13%	43%	7%	0	0
PARP	D (*n* = 72)	6%	0	**28%**	44%	11%	3%	8%
LANL	4 (*n* = 390)	0	1%	**12%**	39%	7%	0	2%
PARP	G (*n* = 84)	1%	0%	6%	27%	8%	0	7%
LANL	6 (*n* = 524)	2%	2%	16%	26%	5%	0	2%
PARP	J (*n* = 50)	2%	0	16%	**30%**	**22%**	2%	2%
LANL	7 (*n* = 82)	1%	0	13%	**43%**	**7%**	0	0
PARP	M (*n* = 36)	6%	8%	17%	**44%**	8%	6%	11%
LANL	5 (*n* = 256)	1%	3%	16%	**27%**	5%	1%	2%

Seriation and Chronology

Due to their location and size of ceramic assemblage, five units (Units H, E, G, A, and B) were selected to help understand the occupational sequence of Otowi. Unit H is located on top of Roomblock A (the old pueblo) and Units E and G are located in the roomblocks midden. Units

A and B are located on the earthen mound in the main plaza and the primary midden, respectively. Using the interpretations that were made for each ceramic type described above as well as the proportions of ceramic types and their associated dates, a table was constructed that dates these units from earliest to latest (Table 77.14).

Table 77.14. Selected units used to build site chronology from Otowi.

Unit	Santa Fe B/w	Wiyo B/w	Abiquiu B/g	Bandelier B/g	Sankawi B/c	Potsuwi'i	Glaze	Smeared IC	Mica SIC	Sapawe Wash.
H	0	0	12%	32%	11%	2%	5%	0	23%	15%
E	3%	6%	29%	41%	15%	2%	4%	NA	NA	NA
G	<1%	0	6%	27%	8%	0	7%	27%	21%	1%
A	<1%	2%	11%	15%	5%	1%	1%	5%	9%	50%
B	4%	13%	10%	35%	7%	3%	3%	8%	16%	0

Units H, E, and G are the oldest units and are associated with Roomblock A, which has traditionally been interpreted as the oldest portion of the site. Units A and B are associated with the rest of the site's architecture. To understand the relative dating of occupation at Otowi, a map was constructed (Figure 77.5). Roomblock A has been substantiated to be the oldest occupation, and Roomblocks B through E are chronologically later. Although there is no data to further understand this sequence and whether the whole site or just portions were occupied at the same time, it looks as if the pueblo grew from west to east, expanding from a small roomblock with one kiva to a large village pueblo with multiple kivas and a central plaza.

THE TSIREGE (LA 170) CERAMIC ASSEMBLAGE

Tewa Series

Kwahe'e Black-on-White

Like Otowi, no sherds of this type were found at the site, indicating a primarily Coalition period or later occupational sequence, at least for the upper strata of the site (Table 77.15).

Santa Fe Black-on-White

Santa Fe Black-on-white occurred infrequently in the Tsirege surface assemblage and was collected in half of the units in small quantities (>6%). This is not surprising due to the fact that even if the type was manufactured up until AD 1425, Tsirege has traditionally been dated to the Late Classic period.

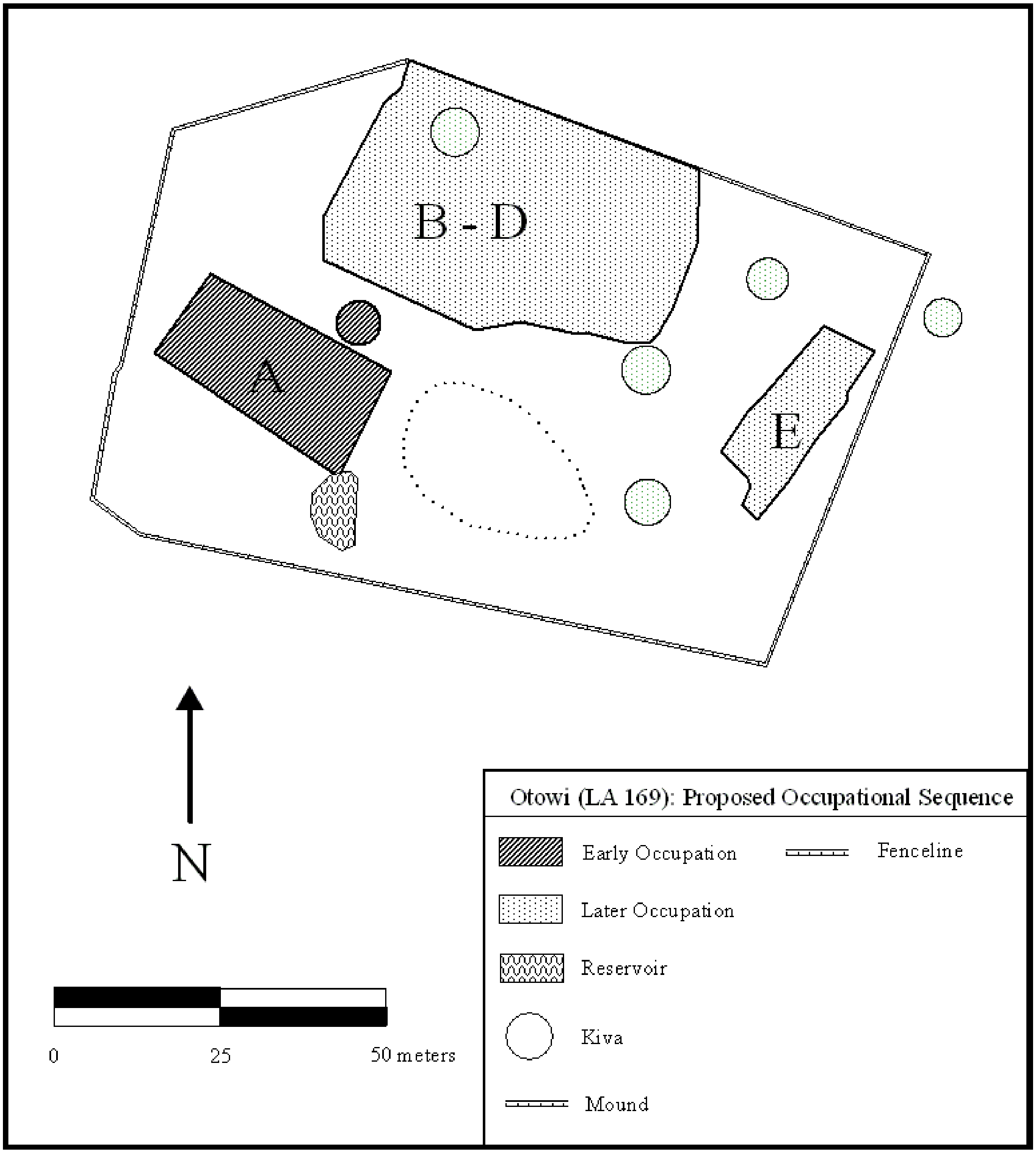


Figure 77.5. Proposed occupational sequence at Otowi.

Table 77.15. Percentages of decorated ceramic types by PARP collection in the Tsirege surface assemblage.

Unit	Santa Fe B/w	Wiyo B/w	Biscuit A	Biscuit B	Sankawi B/c	Potsuwi'i	Glaze	Imported	Historic
A (*n* = 805)	0	1%	2%	52%	28%	2%	12%	1%	1%
B (*n* = 1126)	1%	2%	12%	39%	34%	1%	9%	2%	1%
C (*n* = 59)	0	5%	3%	75%	8%	0	8%	0	0
D (*n* = 956)	0	<1%	2%	39%	43%	0	13%	<1%	2%
E (*n* = 7)	0	0	0	71%	29%	0	0	0	0
F (*n* = 33)	0	0	0	79%	9%	0	12%	0	0
G (*n* = 37)	3%	3%	11%	38%	35%	0	11%	0	0
H (*n* = 33)	0	0	3%	0	94%	0	3%	0	0
J (*n* = 156)	6%	2%	26%	19%	20%	1%	21%	1%	3%
K (*n* = 28)	0	4%	0	32%	50%	0	7%	0	7%
M (*n* = 238)	2%	3%	5%	35%	43%	1%	9%	2%	0
N (*n* = 164)	5%	8%	7%	32%	32%	1%	11%	1%	2%
O (*n* = 26)	4%	0%	8%	77%	12%	0%	0%	0%	0%
P (*n* = 10)	0%	10%	0%	80%	10%	0%	0%	0%	0%
Q (*n* = 359)	2%	0	6%	35%	36%	1%	18%	2%	1%
Total (*n* = 4037)	1%	1%	7%	41%	35%	1%	12%	1%	1%

Although all of the units had small amounts of Santa Fe Black-on-white, two of the PARP units (J and N) had 5 percent or greater. Unit J is located in the middle of Plaza 2 in the northwest portion of the site. The plaza is surrounded by two small roomblocks that are much smaller than the main architecture of the site and may be the remains of a Coalition period occupation. Unit N is located at the extreme northeastern section of the site. Although it is not affiliated with any mapped feature, the unit may also represent an earlier phase of occupation at the site. It is not uncommon in ancestral Tewa archaeology for earlier sites being dwarfed by Classic period building events, as demonstrated by the excavations at Te'ewi (Wendorf 1953).

Wiyo Black-on-White

Wiyo Black-on-white also occurred infrequently across the site being collected in small quantities (less than or equal to 10%) at most units. This type was found at Arroyo Hondo until AD 1475 and appears to coincide with Abiquiu Black-on-gray, albeit it appears to have ended somewhat earlier and can be dated as an earlier type (Habicht-Mauche 1993). Only Units E, F, and H did not have any sherds of this type collected most likely due to a small sample size. Two units had higher quantities of Wiyo Black-on-white present, although Unit P can be ignored due to its low total sample size (*n* = 10). Unit N had 8 percent (*n* = 13) of the sherds in its assemblage. Interestingly, this is also the unit with higher concentrations of Santa Fe Black-on-white ceramics, giving support that this unit represents an earlier occupation of the site (probably Coalition period) although there are no affiliated features.

Abiquiu Black-on-Gray (Biscuit A)

Abiquiu-Black-on-gray has been dated from the late 14th century through possibly the middle of the 16th (Habicht-Mauche 1993), although it is securely settled as a 15th century type. The degree of variation within these samples is shown in Figure 77.6.

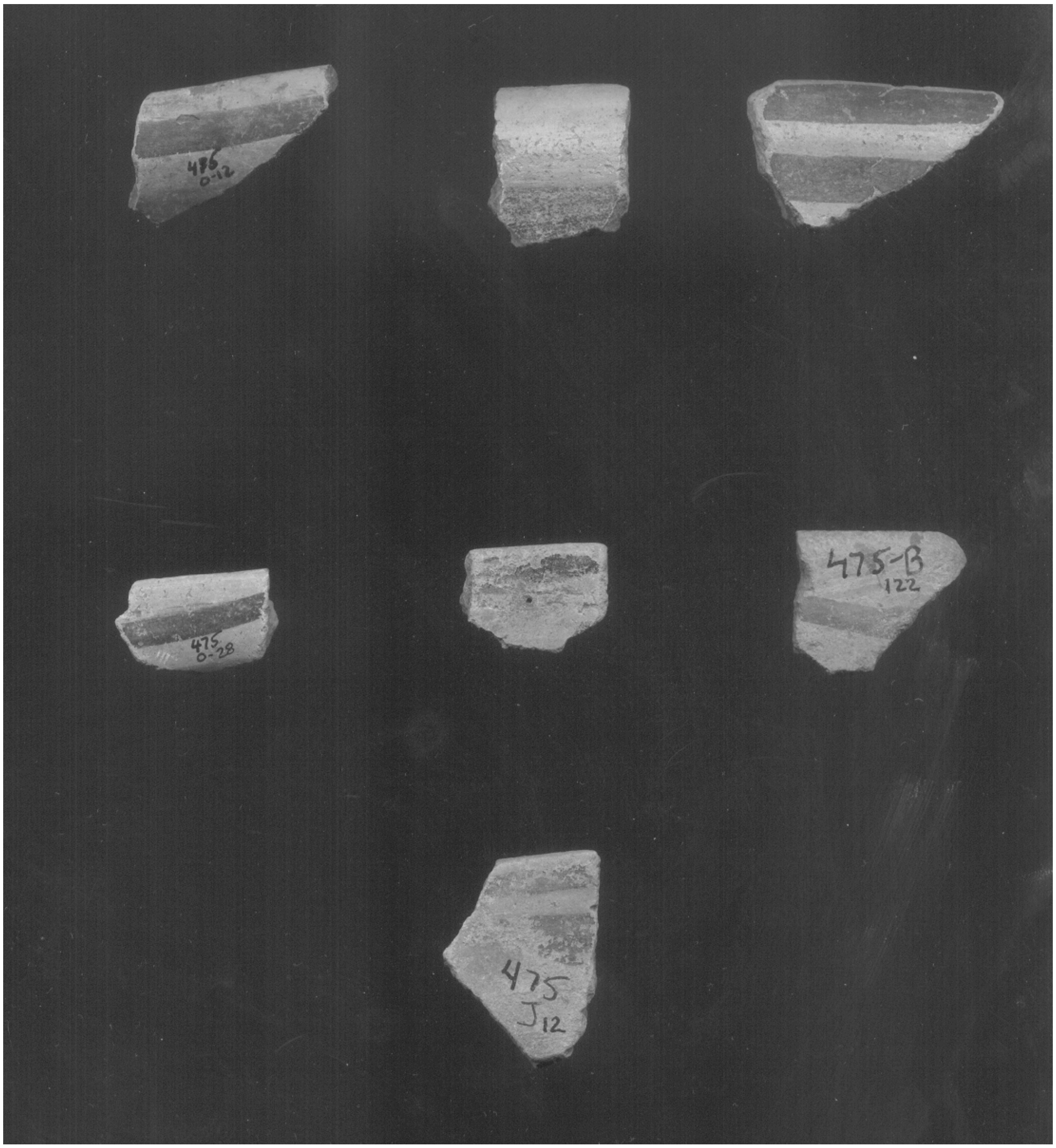


Figure 77.6. Abiquiu Black-on-gray bowl rim sherds from Tsirege.

The type is present at nearly every unit at Tsirege aside from Units E, F, and K, which have very small sample sizes. However, in the units where the type is present the concentrations are relatively low compared to later varieties of Tewa Series ceramics, ranging from 2 percent to 12 percent. The one exception is Unit J with 41 sherds (26%). This unit is located in the middle of Plaza 2 and is associated with two small roomblocks. The unit also had a relatively larger concentration of Santa Fe Black-on-white sherds, giving weight to the fact that although it appears that this was an early occupation, this area of the pueblo was occupied through the 15th century.

Unlike Otowi, the ceramic assemblage of Tsirege had much fewer samples of Abiquiu Black-on-gray bowls, which is understandable due to its later dates of occupation. However, like the samples from Otowi, the sherds broke down into four main categories during microscopic analysis (Table 77.16). Tuff was the dominant tempering material, with tuff and quartz sand being the second most common. However, unlike Otowi there were much fewer samples with plutonic inclusions. This could indicate differential access to resources or exchange networks, a question that will be addressed in a later section of this report.

Table 77.16. Percentages of temper types by unit for Abiquiu Black-on-gray bowl sherds from Tsirege.

Unit	Temper			
	Tuff	Tuff w/ sand	Tuff w/ sand + volc.	Tuff w/ sand + plut.
A (*n* = 20)	50%	40%	10%	0%
B (*n* = 136)	60%	27%	11%	1%
C (*n* = 0)	0	0	0	0
D (*n* = 17)	94%	0	6%	0
F (*n* = 0)	0	0	0	0
G (*n* = 4)	100%	0	0	0
J (*n* = 41)	41%	49%	10%	0
K (*n* = 0)	0	0	0	0
M (*n* = 12)	83%	8%	8%	0
N (*n* = 12)	92%	8%	0	0
O (*n* = 0)	0	0	0	0
P (*n* = 0)	0	0	0	0
Q (*n* = 19)	32%	53%	11%	5%

Bandelier Black-on-Gray (Biscuit B)

Bandelier Black-on-gray was found in nearly every unit collected (aside from Unit H that had a small sample size [*n* = 33]). The type has been dated from the early part of the 15th century through the middle of the 16th. The unit with the largest percentage of the type recovered from a collection with a substantial sample size (>100 sherds) was in Unit A, with 52 percent (*n* = 415). This unit is located in the midden area on the east side of the site and represents the ceramic assemblage of the Eastern Roomblock. At least this portion of the site can be considered a "Biscuit B" roomblock, dating somewhere in the 15th to middle of the 16th centuries. The degree of variation within the samples found at the site is illustrated in Figure 77.7.

Figure 77.7. Bandelier Black-on-gray bowl rim sherds from Tsirege.

Microscopic analysis has shown that the proportions of tuff versus tuff and quartz sand inclusions are well weighted toward tuff (Table 77.17). However, compared to Otowi the percentages of quartz-tempered Bandelier Black-on-gray pottery are smaller. All temper types were found at the site but with much smaller quantities of ceramic samples with plutonic inclusions. One exception to this is Unit N (18% plutonic-tempered samples) located in the northeastern portion of the site near Eastern Roomblock. Is this indicative of non-local pottery? The answer to this question can be aided by evaluating the clay oxidation analysis data.

Table 77.17. Percentages of temper types by unit for Bandelier Black-on-gray bowl sherds from Tsirege.

Unit	Temper			
	Tuff	Tuff w/ sand	Tuff w/ sand + volc.	Tuff w/ sand + plut.
A (*n* = 390)	62%	23%	15%	1%
B (*n* = 372)	57%	24%	16%	3%
C (*n* = 44)	68%	25%	7%	0
D (*n* = 347)	79%	17%	4%	0
F (*n* = 24)	71%	21%	8%	0
G (*n* = 5)	60%	40%	0	0
J (*n* = 12)	83%	8%	8%	0
K (*n* = 7)	71%	29%	0	0
M (*n* = 67)	82%	10%	7%	0
N (*n* = 39)	49%	33%	0	18%
O (*n* = 20)	75%	10%	15%	0
P (*n* = 8)	75%	13%	13%	0
Q (*n* = 112)	61%	32%	4%	3%

Sankawi Black-on-Cream

Sankawi Black-on-cream dates to the middle of the 16th to the middle of the 17th century (Harlow 1973), post-dating all of the biscuitwares. The type is present in all collected units, ranging from 8 percent to 94 percent. The degree of variation is shown in Figure 77.8. Of the units with a substantial sample size (>100 sherds), Units D and M had the greatest concentrations. Four-hundred-twelve Sankawi Black-on-cream sherds (43%) were recovered in Unit D, which is located in the large midden area north of the northern roomblock, and 102 sherds (43%) were recovered from Unit M, which is located in the midden area east of the eastern roomblock. Both of these units likely represent their respective roomblock. It can be interpreted that both the Northern and Eastern Roomblocks were the latest occupied areas of the pueblo.

Potsuwi'i Incised

Potsuwi'i Incised, which dates to AD 1550–1650 (Harlow 1973), represents some of the latest occupation of the site. The type is only found in the Tsirege ceramic assemblage in very small quantities (1%) in about half of the collected units. Because these units are distributed over all major features of the site, a spatial analysis was not possible. However, it appears that some Potsuwi'i Incised was used at the site, possibly in its later occupations. The proportions of the pottery type are lower than that of Otowi, which is surprising because of the larger proportions of later ceramics (Sankawi Black-on-cream and Glaze E and F). These problems will be discussed later in this report.

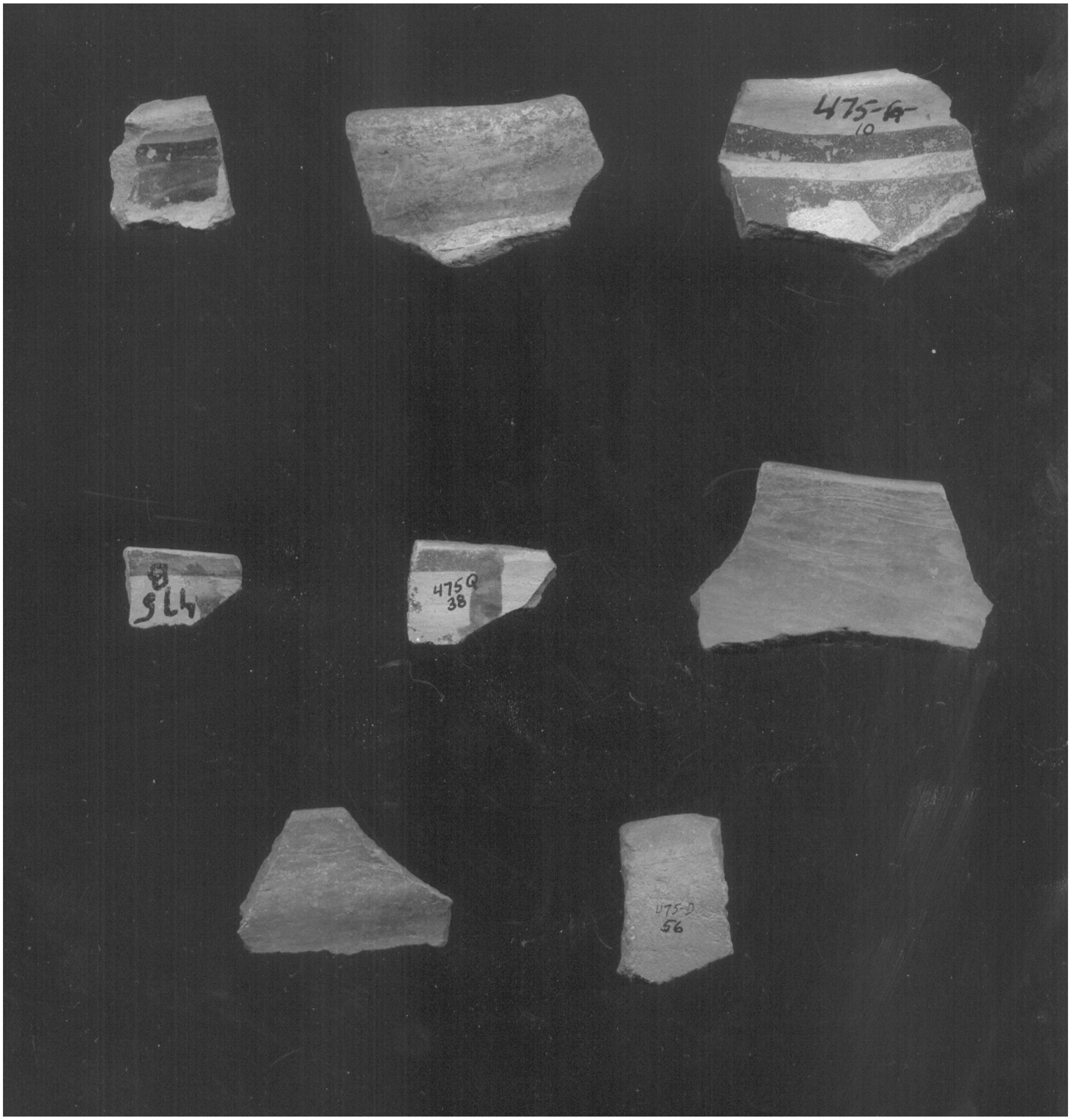


Figure 77.8. Sankawi Black-on-cream bowl rim sherds from Tsirege.

Glaze Series

The full range of Rio Grande glazewares were present on the surface context of Tsirege in all collected units. Although the glazeware counts are much higher than those of rim sherds (see

Table 77.18 for percentages of glazeware totals per unit), rim sherds provide a unique sample that allows for typing a vessel using only a small portion. Many of the units had only small amounts of glaze series rim sherds in their assemblages. However, three units (B, C, and Q) had substantial quantities (>10 sherds). Both Units B and C are located in the main plaza of the pueblo, with Unit B located in the midden (possibly more associated with the Western Roomblock?) and Unit C in the center of the plaza directly between the Eastern and Western Roomblocks. Unit Q is located in the northwestern portion of the site near the two small roomblocks. Interestingly, Unit Q is dominated by Glaze A ceramics, which date to AD 1315–1425 (Schaafsma 2002:195; Vint 1999:391). This further substantiates the fact that the small roomblocks in Plaza 2 represent the oldest visible occupation of the site. Units B and C are both dominated by Glaze D ceramics that have been dated to AD 1490–1525 (Schaafsma 2002:195). Although only very few sherds of Glaze E (AD 1515–1625) and F (AD 1625–1700) ceramics are present on the site, they are best represented in Units A and D, located in the midden areas of the Eastern and Northern roomblock, respectively. These two roomblocks appear to be the last occupied areas of the pueblo and could possibly extend the occupation of the pueblo into the 17th century.

Table 77.18. Percentages of glazeware rim sherd type by unit from Tsirege.

Unit	Glaze Series Type						
	Glaze A	Glaze B	Glaze C	Glaze D	Glaze E (early)	Glaze E (late)	Glaze F
A (*n* = 6)	17%	17%	0	33%	0	17%	17%
B (*n* = 13)	15%	15%	8%	38%	8%	15%	0
C (*n* = 17)	12%	29%	0	35%	6%	12%	6%
D (*n* = 4)	0	0	0	0	25%	50%	25%
G (*n* = 2)	0.5	0	0.5	0	0	0	0
M (*n* = 1)	0	0	1	0	0	0	0
N (*n* = 1)	0	0	1	0	0	0	0
Q (*n* = 12)	42%	0	33%	17%	8%	0	0

Utilitywares

Tesuque Grayware is the predominant utilityware found at the site (Table 77.19). Although it dates from AD 1250–1500 (Habicht-Mauche 1993; McKenna and Powers 1986; Mera 1935), the ending date has been largely untested. There is a dominance of the no-mica smeared-indented corrugated variety (62%), although 11 percent of the assemblage had mica-based Tesuque Gray as well. This causes doubt whether the mica inclusions really signify chronological change (the proportions are similar to the earlier site of Otowi) and whether these mica samples are the result of ceramic mobility.

Sapawe Washboard pottery was found in every context of the PARP surface collections and represents 23 percent of the utilityware assemblage. Of the units that are not classified as "pot hunters' cache" and with substantial sample size, Unit A has the highest proportion of this ware.

Not surprisingly, this is in the midden of the Eastern Roomblock, which is thought to be part of the latest occupation of the site.

Table 77.19. Percentages of utility ceramic types by PARP collection in the Tsirege surface assemblage.

Unit	Plain	Indented Corrugated	Smeared Indented Corrugated	Plain Mica	Mica Smeared Indented Corrugated	Sapawe Wash.	Striated	Clapboard
A (*n* = 375)	2%	0	38%	0	27%	33%	0%	0
B (*n* = 331)	2%	2%	59%	2%	17%	17%	2%	1%
C (*n* = 257)	5%	2%	70%	0	4%	18%	0	1%
D (*n* = 736)	1%	<1%	78%	0	4%	16%	0	0
E (*n* = 5)	0	0	60%	0	0	40%	0	0
H (*n* = 82)	0	0	0	0	0	100%	0	0
J (*n* = 217)	5%	2%	65%	2%	11%	13%	1%	0
K (*n* = 10)	0	0	10%	0	40%	50%	0	0
Total (*n* = 2013)	2%	1%	62%	1%	11%	23%	<1%	<1%

Historic Wares

Only a small amount of historic sherds were found at the site (51 sherds, 1%). All were unpainted redwares with fine tuff temper and were typed as Tewa Red/Polychrome. This type dates from the middle of the 17th century to the early part of the 18th century. Tewa Red/ Polychrome ceramics were found in half of the PARP units, although in small percentage (1 to 2%) and were spread evenly across the site. It appears that, although these sherds were not part of the original occupation, they may represent a later reoccupation or visitation of the site in the 17th or 18th centuries.

Imported Wares

Forty-nine imported sherds were found in the surface collections from Tsirege. All were unpainted redwares with sherd and sand temper, thus typed as White Mountain Redware. These sherds, while present in very small quantities in seven of the 12 PARP collection units, were most abundant in Units A (10 sherds) and B (23 sherds). These units represent the Eastern and Western Roomblocks, respectively, indicating that exchange with distant regions likely happened throughout the occupational sequence of the pueblo.

Refiring Experiments

The clay oxidation refiring experiments performed on both Abiquiu and Bandelier Black-on-gray bowl sherds showed a much more limited degree of variability than those of Otowi (Table 77.20). No sherds were recorded as "pink" and only a very small amount of Bandelier Black-on-gray were classified as "brown." Dominant colors for both ceramic types were reddish yellow, brownish yellow, and yellowish red. There does not appear to be any spatial significance to the location of certain clay groups compared to others. When the two pottery types are compared there appears to be many more samples of yellowish red clay paste in Abiquiu Black-on-gray bowls, which possibly could be a function of changing clay procurement strategies or exchange interactions through time.

Table 77.20. Percentages of refiring colors in the clay oxidation experiments for both Abiquiu and Bandelier Black-on-gray bowl sherds from Tsirege.

Abiquiu B/g Bowl					Bandelier B/g Bowl				
Unit	Brownish yellow	Reddish yellow	Brown	Yellowish red	Unit	Brownish yellow	Reddish yellow	Brown	Yellowish red
A	0	38%	0	10%	A	0%	52%	0	48%
B	20%	55%	0	5%	B	15%	80%	3%	3%
D	8%	35%	0	0	D	31%	65%	0	4%

Like the analysis of Abiquiu and Bandelier Black-on-gray bowl sherds from Otowi, the results of the refiring analysis were compared to the temper data generated through microscopic analysis (Table 77.21). Because of the small amount of samples that were recorded as "brown" these samples were combined with the "brownish yellow" category.

Table 77.21. Percentages of samples of temper type by refiring color from biscuitwares at Otowi.

Unit A	**Temper**	**Refire Color**		
Abiquiu B/g		Brownish yellow	Reddish yellow	Yellowish red
	Tuff	0%	70%	30%
	Tuff w/ sand	0%	88%	13%
	Tuff w/ sand + vol.	0%	100%	0%
Bandelier B/g		Brownish yellow	Reddish yellow	Yellowish red
	Tuff	0%	50%	50%
	Tuff w/ sand	0%	30%	70%
	Tuff w/ sand + vol.	0%	30%	70%
	Tuff w/ sand + plut.	0%	75%	25%
Unit B	**Temper**	**Refire Color**		
Abiquiu B/g		Brownish yellow	Reddish yellow	Yellowish red
	Tuff	40%	40%	20%

Unit A	**Temper**	**Refire Color**		
	Tuff w/ sand	30%	70%	0%
	Tuff w/ sand + vol.	10%	90%	0%
	Tuff w/ sand + plut.	0%	100%	0%
Bandelier B/g	Tuff	10%	90%	0%
	Tuff w/ sand	0%	100%	0%
	Tuff w/ sand + vol.	33%	67%	0%
	Tuff w/ sand + plut.	22%	78%	0%
Unit D	**Temper**	**Refire Color**		
Abiquiu B/g		Brownish yellow	Reddish yellow	Yellowish red
	Tuff	20%	80%	0%
	Tuff w/ sand	0%	0%	0%
	Tuff w/ sand + vol.	0%	100%	0%
	Tuff w/ sand + plut.	0%	0%	0%
Bandelier B/g	Tuff	20%	80%	0%
	Tuff w/ sand	30%	60%	10%
	Tuff w/ sand + vol.	43%	43%	14%
	Tuff w/ sand + plut.	0%	0%	0%

Like the samples from Otowi there does not appear to be any correlation between temper type and refiring (oxidation) color. Possible reasons and interpretations of these two sets of data (provenance and technology) will be discussed in the next section.

Seriation and Chronology

Due to location and size of ceramic assemblage, four units were selected to help understand the occupational sequence of Tsirege in combination with the distribution of individual ceramic types described previously. The units and their ware count proportions are listed in Table 77.22 from latest to earliest occupation. Figure 77.9 is a map showing a reconstruction of possible occupation across the site.

Table 77.22. Selected units used to build site chronology from Tsirege.

Unit	**Santa Fe B/w**	**Wiyo B/w**	**Biscuit A**	**Biscuit B**	**Sankawi B/c**	**Potsuwi'i**	**Glaze**	**Smeared IC**	**Mica SIC**	**Sapawe Wash.**
A	0	1%	2%	36%	20%	1%	8%	12%	9%	11%
D	0	<1%	1%	22%	25%	<1%	8%	35%	2%	7%
B	0	1%	10%	32%	27%	1%	7%	14%	4%	4%
J	3%	<1%	12%	9%	9%	<1%	10%	41%	7%	8%

Units A and D are located in the midden contexts of the Eastern and Northern Roomblocks, respectively. The ware counts in Table 77.15 are similar, and the individual ceramic type/ware analysis indicates that the occupation for each of the roomblocks is contemporaneous (at least at the resolution of this analysis). Unit B is located in the midden for the Western Roomblock, which appears to date slightly earlier than the eastern and northern architecture. Unit J, located near the small roomblocks and kiva in Plaza 2, is obviously the earliest occupation of the site based on the number of Glaze A ceramics and the presence of Santa Fe Black-on-white pottery.

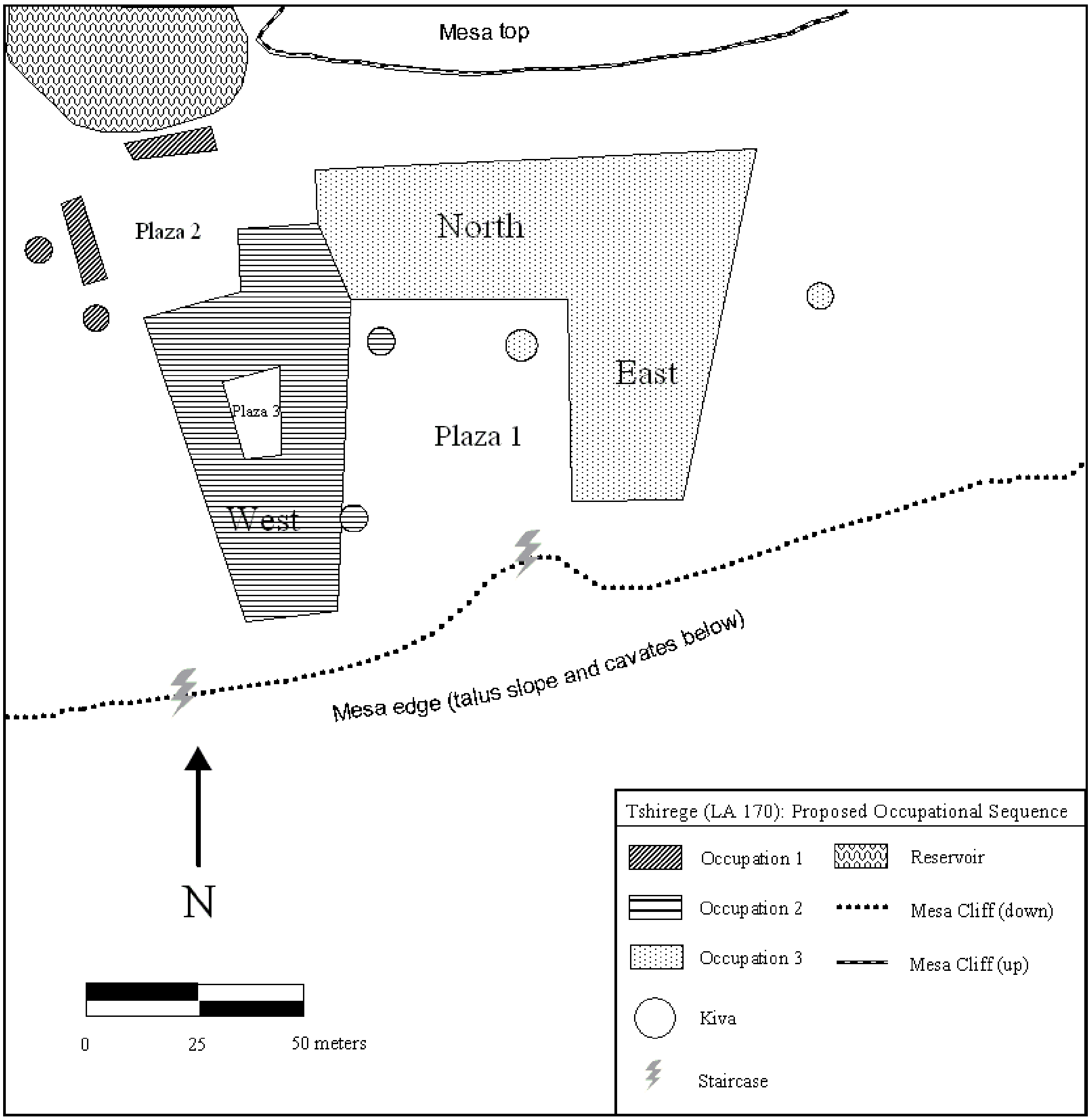


Figure 77.9. Proposed occupational sequence at Tsirege.

It is likely that the two small roomblocks represent the earliest phase of occupation of the pueblo (perhaps extending back into the Coalition period?). During the middle- to- late Classic period, the pueblo underwent a series of expansion events with first the Western and then the Eastern and Northern Roomblocks being built. At this point with limited analysis, it remains impossible to understand which architecture was being occupied contemporaneously, although it is likely that the entire pueblo of Tsirege was not being lived in at any one time.

DISCUSSION

Chronology

Wendorf and Reed (1955) formulated the regional chronology of the northern Rio Grande, a guide that is still relevant today. However, the assigning of specific dates to sites on the Pajarito Plateau has undergone multiple revisions and still appears to require work at a finer scale. Establishing and trusting a good chronology is inherently important in interpreting every question of prehistoric Tewa life on the plateau. This section describes previous research and proposes how this project will serve to clarify some unresolved issues.

Aside from rough approximations based on the presence of biscuitware and its correlation to the chronology presented by Wendorf and Reed (1955), there has been little work on the Pajarito Plateau to understand accurate dating of the Tewa pueblos. This, of course, is due in part to limited excavations and that PARP collections were primarily surface based. This is the case for the two large Classic period sites that this report has analyzed. After limited collections, de Barros (1981) performed microseriation analysis on the collections part of the PARP sites, including Otowi, which he tentatively dated to AD 1325/1350 to 1550/1575. LANL surveys have proposed that the end date be moved to AD 1600, or the end of the Classic period (LANL 1999). The other site, Tsirege (LA 170), remained undated for unknown reasons, perhaps being that not enough surface collection had been performed by the time of the analysis.

Although provenience is not well understood, the Laboratory of Tree-Ring Research (LTRR) at the University of Arizona has dated multiple samples that have yielded dendrochronological dates for the large pueblos of Tsirege and Otowi (see Chapter 7, Volume 1). Stallings' (1933) excavations of Tsirege procured 59 samples from the site. Of these, there were three cutting dates that range from AD 1559–1581, with overall occupation taking place primarily during the AD 1570–1600 time frame. Although Wilson (1916a) excavated Otowi with no collection of ancient wood (these excavations took place well before the advent of dendrochronology), tree-ring samples were collected by Stallings and submitted to the LTRR (see Chapter 7, Volume 1). Of these, five samples were dated, with one cutting data at AD 1414 and the rest suggesting occupation nearly a century of occupation in the AD 1400s.

Although the PARP surface collections do pose problems, such as the fact that these large pueblos were probably occupied over multiple centuries and this time span cannot be accurately recorded using surface collections alone, using relative frequencies of ceramics can inform researchers of general chronological trends. For this project it is important to compare the relative dates of occupation between Otowi and Tsirege, as well as construct an occupational sequence for each site.

Because of the mixed and unreliable contexts of the surface assemblages, as well as the known ceramic chronology with very large temporal time spans (some ceramic types are present for almost two centuries), the use of microseriation or mean ceramic dating (South 1977) seems inappropriate. This is compounded with the fact that the latter dates of the Tewa Series pottery is suspect, with the terminal dates ending with the assumed abandonment of Tewa sites not along the Rio Grande by the mid-16th century (Richard Ford, personal communication).

Both Otowi and Tsirege have small quantities of Santa Fe Black-on-white, which dates the early occupation of the site to at least the first part of the 15th century. The presence of this type is isolated to specific sections of both pueblos, which this report argues is evidence for the growth of the pueblo over time. No earlier Kwahe'e Black-on-white sherds were found at either Otowi or Tsirege, and the percentages of Santa Fe Black-on-white were relatively small. However, this does not refute the possibility that an earlier Coalition period occupation was dwarfed by later Classic period building and living events, as seen at other pueblos in the region (Wendorf 1953).

When compared to each other, and in concert with the available tree-ring dates (see Chapter 7, Volume 1), it does appear that Tsirege was occupied later than Otowi. The tree-ring dates for Otowi suggest that the site was occupied through the 15th century, but the small but present quantity of Sankawi Black-on-cream (15%) on the surface context suggests that the site was inhabited into the 16th century, most likely in Roomblocks B through E.

One tree-ring cutting date at Tsirege dates to AD 1581, suggesting that the site was most likely occupied through the end of the 16th century. This is supported by the large amount of Sankawi Black-on-cream pottery (35%). There is reason to believe that the pueblo may have been occupied into the 17th century, with the presence (although small) of Glaze E and F pottery found in the midden contexts of the Northern and Eastern Roomblocks. The very small quantities of historic ceramics do not suggest a reoccupation of the site, but rather a revisitation by later Pueblo people.

Although questions of identity, craft production, and socio-political structure are inherently important in understanding northern Rio Grande prehistory, a firm knowledge of the time-space systematics of the region are not only a desired, but a required, first step. Further research into this area could take the form of direct dating of the pottery itself as was conducted by Ramenofsky and Feathers (2002) to understand dates of abandonment of pueblos along the Rio Chama drainage.

Identity

Social identity has been described as "the ways in which individuals and collectives are distinguished in their social relations with other individuals and collectives" (Jenkins 1996:4). It is based on relativity: simply put, a group cannot have an identity without a comparison to another group of individuals, or using Jenkin's term, collective. The archaeological characterization of identity is important in understanding prehistory at a multi-scalar level, for it provides the researcher insight into migration, use of the physical landscape, and relationships with the larger world. As Mills (2002) points out, each turning point of Southwestern prehistory involved a restructuring and alteration of group identity. This is especially true for the northern Rio Grande in the Classic period where site aggregation rapidly consolidated populations with differing backgrounds and worldviews (Adams and Duff 2004).

The study of identity is the study of similarities and differences between groups of individuals. Although social boundaries have been notoriously difficult to delineate (see papers in Stark 1998) and are often permeable and "fuzzy," using a multi-scalar approach to understand identity such as that of Duff (2002), creates quantifiable tests to social boundedness. Social identity may be studied at the regional (Duff 2002), the community (Herbich 1989), and even at the intra-site level (Duwe 2006; Duwe and Neff 2006) using a variety of methodologies that attempt to record meaningful patterns in the material record. Social identity is important for two main reasons: the first is that some sort of measure of the group is necessary to facilitate archaeological comparisons between populations in both time and space, especially without the use of classic culture areas; and second, that social identity is fundamentally important to modern descendant communities who have a large stake in Native American Graves Protection and Repatriation Act-legislated cultural affiliation studies.

To qualify and quantify identity, researchers take measurements in material culture that reflect the day-to-day interactions between people. This testing of identity has taken many shapes over the past decade. Recently, it has relied on technological aspects of practice frameworks, using the ideas of *habitus* (Bourdieu 1977) that states that the ways of making material culture can be measured archaeologically and used to infer social identity. The ways in which this is done will be described in the next section. It can also be measured indirectly through interpreting the configuration and scale of craft production, specifically that of craft specialization. As will be illustrated below, craft production and identity are often interrelated in meaningful ways.

There is a very real cultural division across the Pajarito Plateau that was recorded into the historic period, and continues to exist in the modern era (Harrington 1916; Kidder 1936). The ethnohistoric record documents Tewa speaking people in the north and Keres speaking populations in the south, with the line drawn somewhere around east to west on the southern portion of the Pajarito Plateau near Frijoles Canyon (Harrington 1916). The earliest archaeological ceramic research verified this dichotomy with biscuitware producers in the north and glazewares to the south (Kidder 1915). Not only were the ceramic assemblages from prehistoric sites dominated by one class of ware or the other, it was stated as fact early on that this correlated to differences in production areas, with the Tewa pueblos not participating in the procurement and use of glazes and their dedication to the biscuitwares. This conclusion was later verified by Shepard (1936) in her technological analyses of pottery from Pecos Pueblo and surrounding regions.

Although modern researchers try to avoid the "pots as people" hypothesis without sound evidence, it appears that the "Tewa area," defined by the Tewa-Keres line in the south upwards into the Chama River basin and including the five modern pueblos of San Ildefonso, Santa Clara, San Juan, Tesuque, and Nambe (Harrington 1916), correlates well with what Mera (1935) called the "Biscuitware Pueblos." Recent research by Graves and Eckert (1998) and Futrell (1998) further support the argument that the apparent division of biscuitware producers to the north and glazeware producers to the south delineate Tewa and Keres ethnic boundaries, respectively. In addition, from ceramic counts given from preliminary PARP ceramic data and LANL infield analysis (LANL 1999), glazewares account for only 1 to 25 percent of the ceramic assemblage. This contrasts with the large amounts of biscuitware produced in the Tewa area and exported, with the most famous case being that of Pecos Pueblo where Kidder found the Keres pueblo to have 20 percent in the assemblage (Kidder 1936). Interestingly, these ceramic analyses contrast with studies of rock art on the Pajarito Plateau, in which there appears to be no striking difference between the northern and southern halves of the region (Munson 2002). This begs the questions: what was being traded for biscuitwares, and what sorts of economic relationships were happening between the Chama and the greater northern and central Rio Grande region? Do these reflect social or political networks? And most important to this proposal, what does this say about Tewa identity? Is the historic Tewa-Keres boundary really in such correspondence with pottery production and distribution? Are pots actually representing the relationships and identity of people? And finally, how do changes in ceramic production and exchange vary through time, specifically looking at the two sites of Otowi and Tsirege?

This project can only start to answer the above questions in small ways. Interestingly, although there is only a small amount of glazeware at Otowi there are much greater frequencies at Tsirege. Tsirege has been classified as a Tewa pueblo as it is located on the northern part of the Pajarito Plateau and has an abundance of prehistoric Tewa series pottery (biscuitware, Sankawi Black-on-cream) in its assemblage. If the above-mentioned assumptions are used to hypothesize the amount of glazeware at the site this should be very low (<5%) as is the case for other Tewa pueblos (Futrell 1998; Gauthier 1987a; Graves and Eckert 1998; Wendorf 1953). Interestingly, this is not the case. Tsirege has 8 percent glazeware in the site's overall ceramic assemblage and 12 percent among the decorated pottery. The question arises: what do these higher frequencies mean?

Perhaps the proposed ethnic Tewa/Keres boundary did exist in prehistory, although it was more permeable than previously thought. If this was the case, then a Tewa pueblo located near the boundary would likely have greater percentages of glazeware than those to the north. The proposed boundary based on ethnic identity could still have existed, although it is likely that there was much more interaction between groups near the Frijoles Canyon border. Future research could explore this boundary more fully, examining architectural and lithic evidence to further understand the degree and meaning of this proposed permeability.

Technological Considerations

Pfaffenberger (1992) argues that the study of technology in material culture "may significantly alter the way anthropologists analyze everyday life, cultural reproduction, and human evolution" (Pfaffenberger 1992:491). In the past three decades, archaeologists have become increasingly interested in style, specifically that of technology. Technological style has been defined by Rice (1987:201) as "a combination of experience and custom resulting in a body of information and practice governing the manufacture of material culture, which leads to a characteristic product with a unique range of properties." Many attributes of technological style can be seen only during the production phase of an artifact's life; therefore, the most likely way that these attributes could be precisely copied would be first-hand observation, such as a teacher-student relationship. This has a distinct advantage over other overt forms of style, such as painted designs, for archaeologists interested in understanding knowledge transmission. In short, there are many things about creating a pot, a point, a sandal, or any other object that cannot be mimicked by examining the finished product, but rather is learned in the process of knowledge transmission through forming communities of practice.

Many artifacts carry inherent messages about social identity not intended by their producers (Hegmon 1998). Stark (1998, 2005) discusses the theory of learning frameworks and *habitus* (*sensu* Bordeiu 1977), which is defined as culturally specific ways of doing things that are generally unconscious actions (Dietler and Herbich 1998). In essence, although there may be many ways to express oneself in the creation of objects such as pottery, many of the skills and ways of "doing things" are learned early in one's career and are perpetuated throughout life. Although specific technical choices are affected by multiple factors such as environmental constraints and behavioral decisions, the work of archaeologists (Crown 2001, 2002) and ethnoarchaeologists (Wallaert-Pêtre 2001) show that many aspects of technology (examined as technological style) remain relatively stable when passed down through apprenticeship relationships along social identity lines.

These arguments are also supported by ethnographic and ethnoarchaeological studies in the learning of motor skills, which are taught and not manipulated consciously by the student (Arnold 1985:235-237; Gosselain 1998). This is the basic assumption of the study of technological style and how it is used as a methodology for studying socially complex ideas of communities of practice and ancient apprenticeship.

Besides their ubiquity in the archaeological record, ceramics are also unique in the amount of data they carry about the technical choices of prehistoric potters. Because of this, pottery has become the primary material class in studying technological style and applying it to learning frameworks and communities of practice theory. Ethnoarchaeological studies are especially helpful in testing assumptions about the way in which knowledge is transferred. Herbich (1989) explains that the Luo of Kenya have specific "micro-styles," or distinctive combinations of technological, formal, and decorative features characteristic of different potting communities between separate villages. These communities pass knowledge of how to manufacture a pot from older to younger members. Kramer (1997) also describes ceramic knowledge transfer in an Indian study area of Rajasthan as that of mother-daughter learning.

Not surprisingly, prehistoric pottery has been a perennial focus for the analysis of technological style in the archaeological record. Clay preparation techniques (Gosselain 1998), temper types (Goodby 1998), vessel size and shape and wall thickness (Chilton 1998), and vessel forming techniques (Gosselain and Smith 1995; Miller 1985; Welsh and Terrell 1998) have all been examined as ways that covert, sometimes unconscious information is transmitted with the teaching and learning of how to create a pot. Even the painting style itself has been uniquely studied, such as the patterning of brush stroke sequences on White Mountain Redware in east-central Arizona (Van Keuren 1999, 2001, 2005).

In summary, by studying how a pot is made through its technological characteristics it is possible to make inferences about group identity at both a micro and macro scale and to understand the boundedness and interactions between these groups.

In recent years, the analyses of the technological aspects of artifacts have gained prominence in the archaeological literature, with talk of technological style affecting many of the anthropological theories currently being used by Southwestern researchers, including those of "communities of practice" and other models of knowledge transmission. This section details how analyzing the technological aspects of pottery from Classic period sites on the Pajarito Plateau will both help to understand social identity at a macro and micro level, and also help to answer basic unresolved questions of procurement and manufacture of northern Rio Grande ceramics.

As stated earlier, measuring the technological style of pottery, or the unconscious and non-signaling aspects of a pot's design, can be used to infer group identity. In short, in the American Southwest where ethnohistoric documents inform researchers that society was matrilineal and matrilocal, pottery was performed and instructed and learned by women. Therefore, certain "ways of doing" in the form of procuring raw materials (locations or in their mixtures), shaping a pot, mixing pigments, painting the design, and firing the final product will be similar within communities of practice, or what has become known as "potting communities" (Fenn et al. 2006). These special technological characteristics have been identified and measured in many ways. This project has focused on four characteristics: vessel wall thickness, vessel size and shape, temper type, and paste composition (on a crude scale by 20x microscope and paste color via Munsell© color classification). Samples were also selected for future compositional analyses of both chemical (using inductively coupled plasma-mass spectrometry) and mineralogical (using petrographic analysis).

The analysis of the technology of ceramics in the American Southwest is nothing new. Anna Shepard pioneered the use of optical petrography in understanding the provenance and material properties of pots in the first half of the 20^{th} century. One of her most famous early studies was the analysis of pottery excavated at Pecos Pueblo by A.V. Kidder in the 1920s and 1930s. Her study (1936) examined not only ceramics produced at the site, but also those that were imported from other areas. She focused on the biscuitware series, and attempted to not only source the production area of the pottery, but also the technological steps that must have gone into making the pot, ideas that could fit under the rubric of *chaînes opératoires*. Interestingly, her study appeared so thorough that little if nothing has been written in succeeding years about the technology of the biscuitwares. These ideas have been applied to earlier periods on the Pajarito Plateau, however. Wilson and Castro-Reino (2005) used both the microscopic and petrographic analyses described above to understand differences or similarities in potting style amongst Santa Fe Black-on-white ceramics from Coalition period sites. They successfully interpreted the use of unique geologic resources from four sites as indicating local production, even in the face of a widely used regional painted tradition. These same problems have also been addressed across the entire Pajarito Plateau using a combination of microscopic and painted style analyses (Ruscavage-Barz 1999, 2002).

As noted by Mera (1932) and others, the biscuitwares were produced with a unique dark paste that fired to a light gray color and were tempered with volcanic tuff. On further petrographic examination, Shepard (1936:487) found this to be almost entirely true, with few other inclusions apart from quartz or feldspar grains, which she attributes to be naturally occurring in the clay. Other petrographic analyses revealed that the paste was unusually hard and had a preponderance of voids leaving the ceramics weighing less per volume than paste from contemporary wares. Refiring suggested that the pots were fired in an oxidizing (but not fully) environment at approximately 800°C.

Using her understanding of the geology of the northern Rio Grande, Shepard concluded that both the clay and temper used to make biscuitware originated in the Chama District, and hence were the product of local potters. The amounts of the ware found at Pecos were almost 20 percent of the assemblage (Kidder 1936) and were thus traded extensively to the south.

Most importantly, Shepard was able to reconstruct the technological processes of which the biscuitwares were made. Shepard (1936:491) discovered that the ware was unusually standardized in vessel form and design style. This has implications that will be discussed below. One of her main research questions was: what makes the paste so light and porous? Was it the kind of tempering material, the quality of the clay, the method of firing, or a combination of all three? And why would potters want these types of properties?

When examining local clay and temper from the Chama District, Shepard (1936:496) found that the firing temperature was unimportant to the porous nature of the ceramic, and that certain local clays and tempers were responsible for these properties. These tempers occurred in volcanic tuff outcroppings throughout the district, and the local clays that were believed to be procured for ceramic production were composed of high quantities of tuff. Using workability tests, Shepard also found that the clays necessary to make biscuitwares were extremely difficult to use, and based on this she made the inference that these clays were selected not for their ease of use in potting, but for their fired characteristics. But why use these types of clays and tempers? Shepard (1936:497) proposed that these materials, when fired, allowed for a dark gray paste that extenuated the black mineral paint well, creating an appearance unlike any other black painted pottery. In essence, the product's quality and visual appearance compensated for its difficulty in manufacture, perhaps giving worth to the vessel due to the skill and effort invested by the potter.

I have found no technological analyses of any of the other Classic period wares in the Tewa area, including the Pajarito Plateau that is as in-depth as Shepard's (1936) study of the biscuitwares. What is known about Potsuwi'i Incised and the micaceous and corrugated wares has been already stated in overviews by Mera (1932) and Wendorf (1953), as well as a recent study by Curewitz (2004a).

Basic technological understanding of the process of manufacture is imperative in understanding communities of practice and hence identity, as well as the mode and nature of craft production. Because no researchers have made any overall synthetic inferences on the ceramic technology from the Tewa area since the 1930s, the analyses in this report have attempted to add to the understanding of the nature and changes of biscuitware technology. Due to time and money constraints, as well as the limited scope of this project, the synthetic overview that is so needed is not produced here. Rather some interesting trends and characteristics were observed that will help future researchers to better understand the technological considerations of northern Rio Grande pottery. Data on temper and refiring oxidation experiments are summarized below. Although the interpretations may be misguided or faulty, the hope is that the data will be of some use.

The recording of temper attributes can assist in the inference of many archaeological problems, including craft production and specialization, prehistoric economics, and ceramic technology. However, one important observation is immediate before any future statistical and spatial analyses: temper inclusions in the biscuitwares are *extremely* variable. This high degree of variability is not stressed in many past writings (Kidder 1936; Mera 1932, 1935; Wendorf 1953), but has been described in more recent publications (Gauthier 1987a; Habicht-Mauche 1993). From the analysis of both Abiquiu and Bandelier Black-on-gray ceramics from both Otowi and Tsirege, one thing is striking: there is much more than tuff included in the paste. This includes quartz sand, but also to a lesser degree, volcanic and plutonic inclusions. Perhaps the sand was part of the raw clay material and was sorted out by some potters but not others? Or perhaps this is a function of time? Or maybe this is indicative of pottery made in other places and imported into sites on the Pajarito Plateau. Based on surface contexts with no established chronological control, these questions are impossible to answer, although it is likely that this technological aspect of making biscuitware pottery is socially meaningful. As for the additional inclusions of volcanic and plutonic material, this is likely indicative of pottery with provenance outside of the immediate area of the two studied pueblos. This is especially the case with the plutonic inclusions, although this will be further resolved with petrographic and chemical analyses.

To understand the provenance of the clay material itself, clay oxidation (refiring) analysis were performed on both Abiquiu and Bandelier Black-on-gray bowl sherds from both sites. This analysis was built on the work of Gauthier (1987a) who proposed that from refiring experiments from Bandelier Black-on-gray from Howiri, a large Classic period pueblo along the Rio Ojo Caliente (a tributary to the Rio Chama and one of the northernmost prehistoric Tewa pueblos), clay sources changed through time. He describes a general trend that was also observed by Shepard (1936) that clay sources gradually changed from light yellow clay to a darker yellow.

Of course, the surface contexts from Otowi and Tsirege do not have the luxury of chronologically controlled stratigraphy. However, when Gauthier's color chronology is applied to Bandelier Black-on-gray bowls from Tsirege, where this report has interpreted that the eastern and northern roomblocks were the latest occupied architecture at the site with the western roomblock slightly earlier, it does not hold up (Table 77.23). Perhaps this is due to the mixed contexts of these surface assemblages, or maybe (and most likely) that the potters on the Pajarito Plateau have access to different clay sources than their contemporaries to the north.

Table 77.23. The application of Gauthier's (1987a) clay oxidation color chronology based on Bandelier Black-on-gray ceramics at Tsirege.

Unit	Occupation	Roomblock	5YR (later)	7.5YR (earlier)
A (*n* = 34)	Later	Eastern	97%	3%
D (*n* = 26)	Later	Northern	42%	58%
B (*n* = 40)	Earlier	Western	60%	40%

The clay oxidation colors stated earlier in this report are representative of different clay sources, as the color reflects the amount of iron and hence the source's geological signature. There is a great deal of variability within the said analysis, and although no interpretations of provenance can be made until clay sources are evaluated, there was probably biscuitware being produced in multiple pueblos in the Tewa area and not just at one locale. The same is true with the variability in temper sources, and although there is no clear correlation between temper type and oxidation color, these data suggest that there is a great deal of potential in understanding which pueblos are producing pottery, the nature of exchange relationships and pottery mobility, and what technology can tell us about group identity.

Craft Specialization

Craft specialization is part of the larger method and theory addressing craft production, which "are a fundamental part of archaeological inquiry in that they are central to the reconstruction of ancient lifeways and the explication of sociocultural evolution" (Costin 2002). If the record of prehistoric peoples is inherently materialistic, then understanding how these artifacts are made and distributed can illuminate not only the actions of the craftspeople, but also those of their societies in general. The ways in which craft production has been characterized and analyzed has a long history in the field, but generally focuses on typologies, modes of production, parameters of variation, and specialization. Costin's (1991, 2002) view that studying a production system as an integrated whole that accounts for all actions and variables between craftspeople, technology, artifacts, exchange, and distribution is regarded as completely appropriate for this study, hence the heavy emphasis on technology. However, to address the more specific problems of identity and areas and intensity of production based on the ceramic assemblage, I focus here on craft specialization.

In essence, specialization of craft production means that "fewer people make a class of objects than use it" (Costin 2002:276). Although traditionally specialization has been used to explain and interpret cultural complexity, it has more recently been used in small-scale societies to infer ritual specialization and group identity and cohesiveness (Mills and Crown 1995). Costin (1991) has formulated four parameters in which to view craft production, in which specialization can be analyzed. The first is the *context* of production, which reflects the nature of the demand for a particular good. The second is *concentration* of production, which describes the spatial relationship between producers and consumers. The third is *constitution* of the production unit, which describes the group size and social relations of those individuals who regularly cooperate to produce a recognized corpus of goods (Costin and Hagstrum 1995). This is a continuum with one end being the household group and the other being the workshop. And the fourth parameter is the *intensity* of production, which describes the relative amount of time workers put into craft production in relation to other economic tasks.

These four parameters can be measured in various ways to understand the context, nature, and scale of craft specialization, which are often contextual to the artifact assemblage. The main advantage of a holistic approach to production is that is accounts for many kinds of variation and does not measure whether there is a presence or absence of specialization, but rather what kind of specialized production and by whom. After these questions are answered it is possible to infer what these newly found answers can tell us about social and technological identity.

As stated above, the study of ceramic craft specialization is helpful in understanding group identity and social boundaries. Prior work on the Pajarito Plateau used measurements of standardization and efficiency in pottery decoration. Melissa Hagstrum (1985) analyzed 12 Classic period Biscuit B bowls from Otowi (LA 169) and concluded that due to brush-stroke sequences used on the bowls, the painting style was increasingly standardized and more efficient than prior pottery. She uses this evidence to propose increasing ceramic specialization into the Classic period, which is concurrent with observations made by Kidder (1917), Shepard (1936), and Mera (1932, 1935).

Hagstrum's study used whole vessels from Otowi to present an accurate, yet minimal analysis of standardization and specialization of Classic period pottery. For comparison with Hagstrum's data and due to a large sample size of rim sherds, Bandelier Black-on-gray bowl rim sherds were compared between Otowi and Tsirege. Two measurements were used in this comparison: vessel size (the diameter of the bowl opening) and interior framing line width.

Vessel size and standardization differed between the two sites (Figure 77.10). In general, the mean size of Bandelier Black-on-gray bowls from Otowi was smaller than those from Tsirege (Table 77.24). Also, Tsirege had a much smaller standard deviation of bowl size than Otowi. If consistency of pottery is a sign of standardization, Tsirege is producing more standardized vessels, which could be interpreted as a higher degree of craft specialization.

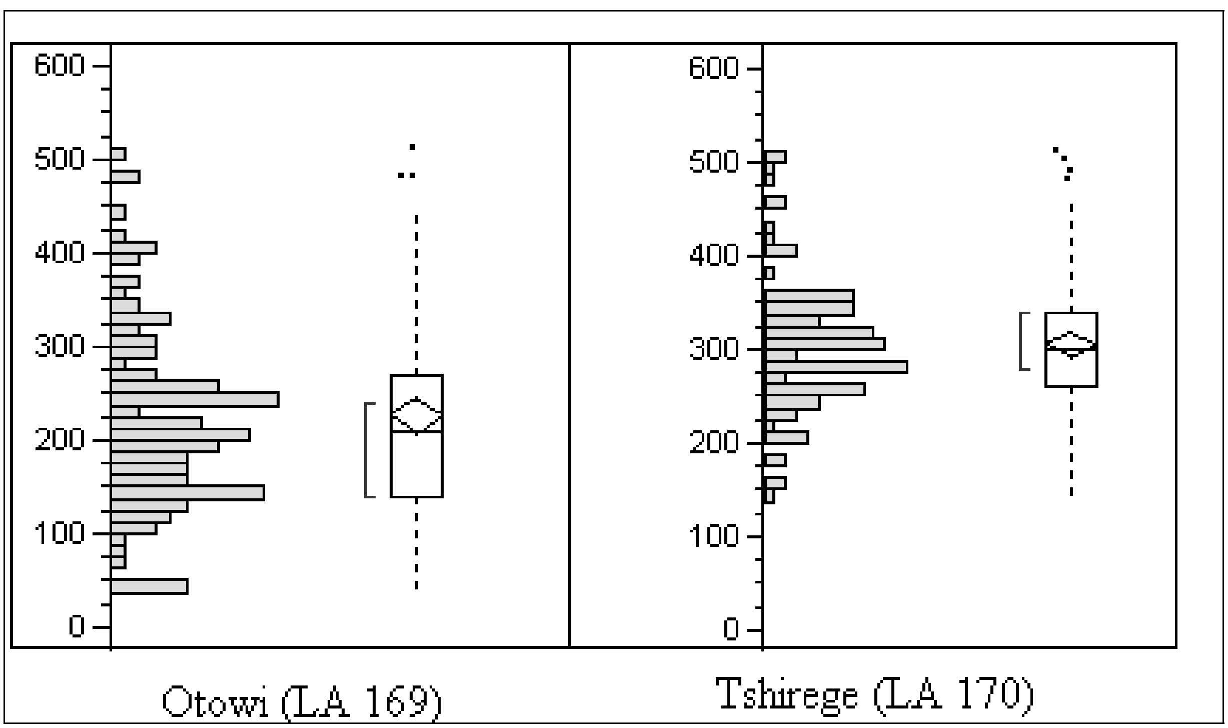


Figure 77.10. Distribution of rim diameter of Bandelier Black-on-gray bowls between Otowi and Tsirege.

Table 77.24. Statistics of the distribution of rim diameter of Bandelier Black-on-gray bowls between Otowi and Tsirege.

Site	# of Samples	Mean	Std. Dev.	Std. Err. Mean	upper 95% Mean	lower 95% Mean
Otowi	119	226.05	109.52	10.04	245.93	206.17
Tsirege	99	305.05	72.38	7.27	319.49	290.61

The same sorts of relationships between Otowi and Tsirege were also seen when comparing the width of the interior framing line between the sites (Figure 77.11). The standard deviation of framing line width was much smaller than that of Otowi, also suggesting specialization of pottery production (Table 77.25).

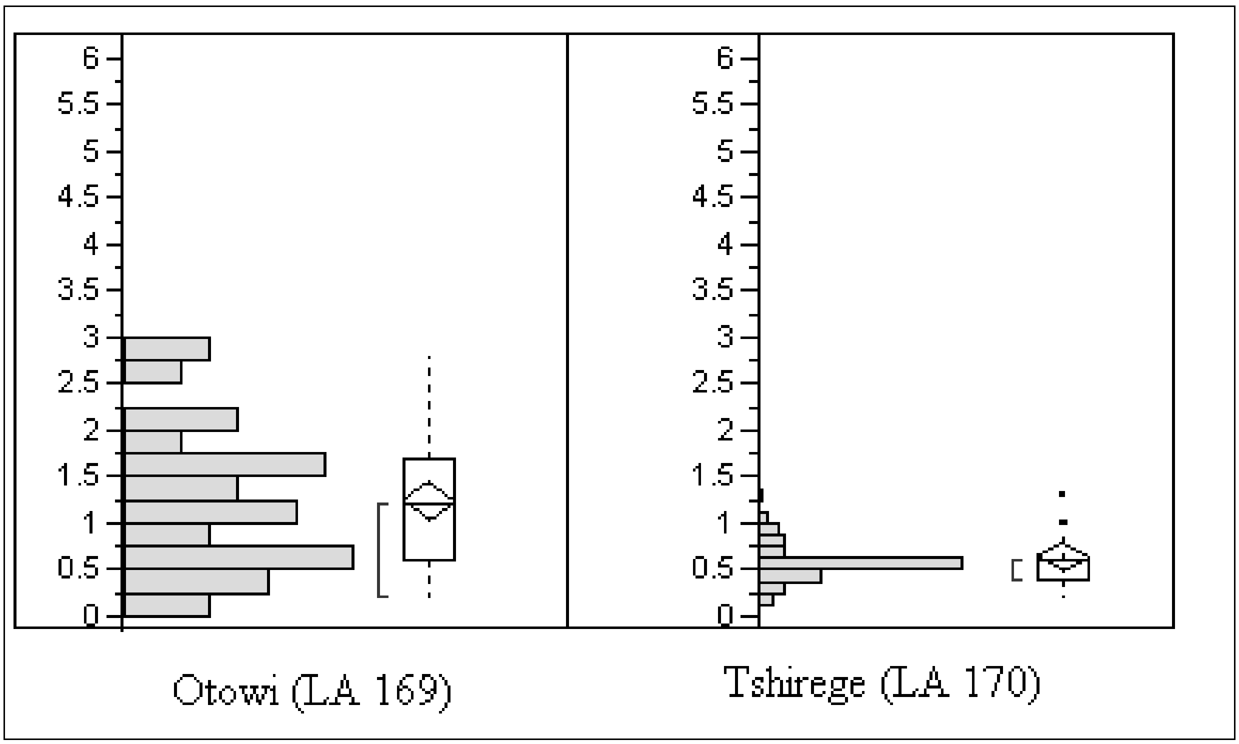


Figure 77.11. Distribution of interior framing line width of Bandelier Black-on-gray bowls between Otowi and Tsirege.

Table 77.25. Statistics of the distribution of interior framing line width of Bandelier Black-on-gray bowls between Otowi and Tsirege.

Site	# of samples	Mean	Std. Dev.	Std. Err. Mean	upper 95% Mean	lower 95% Mean
Otowi	47	1.24	0.75	0.11	1.46	1.02
Tsirege	76	0.65	0.65	0.07	0.80	0.50

With the limited context of this study it is not possible to address all of Costin's (2001) parameters of specialization. However, it does appear that Tsirege is producing standardized

Bandelier Black-on-gray pottery not unlike what was observed by Hagstrum (1985), at least compared to the Bandelier Black-on-gray pottery from Otowi. This argument is bolstered by the fact that there appears to be less variability in clay sources, as well as temper types, in the Tsirege assemblage as seen in the results of the clay oxidation experiments and microscopic analysis described earlier in this report.

Perhaps the degree of variation in the measured attributes of biscuitware pottery from Otowi results in regional exchange of ceramics whereas Tsirege is producing much of its own pottery, and probably much of the pottery for the northern Pajarito Plateau. Although this report cannot account for technological changes through time, it is most likely that there are real differences between biscuitware at the two contemporary Classic period pueblos. The importance of Tsirege as a central pueblo is also suggested by the larger rim diameter of the vessels found at the site, which is indicative of feasting events. These events brought people from the entire region together for social and most likely ritual purposes.

The importance of Tsirege as a central, large, and chronologically late occupied pueblo appears to be a fruitful research topic for future studies. The site is described multiple times in many Tewa oral traditions (Parsons 1994 [1926]). This research will aid researchers in understanding the scale and logistics of prehistoric Tewa social organization.

CONCLUSIONS

This project has sought to analyze and interpret both decorated and utility ceramics from two Classic period sites on the northern Pajarito Plateau. For the first time, the ceramic collections made by the PARP have been fully analyzed and the data made available to interested researchers. Interpretations have been made on the occupational sequences of both Otowi (LA 169) and Tsirege (LA 170), as well as their approximate dates of occupation in comparison to the northern Rio Grande chronology. Additionally, data have been generated relating to technological aspects of this pottery in which tentative interpretations have been made dealing with social identity, ceramic technology, and craft specialization of prehistoric Tewa potters from two large and understudied pueblos.

The following points summarize the findings and interpretations of this report:

1. Using relative frequencies of ceramics from surface contexts, the occupational sequence of both Otowi and Tsirege has been proposed.

2. Using these same frequencies, both Otowi and Tsirege have been situated chronologically within the culture history of the northern Rio Grande region.

3. Due to higher than expected frequencies of glazeware ceramics found at Tsirege, a new model of boundary permeability has been proposed for the prehistoric Tewa/Keres ethnic division across the Pajarito Plateau.

4. Both microscopic temper and clay oxidation experiments on biscuitware from Otowi and Tsirege suggest high variability in use of materials and technology of production, suggesting that these wares were being produced by many potters across the Tewa pueblos.

5. When comparing ceramic attributes of rim diameter and framing line width, as well as variability in the use of clay sources between Otowi and Tsirege, it appears that Tsirege produced much more standardized vessels. This suggests that the pueblo was an important producer of pottery for the region.

6. The rim diameters of Bandelier Black-on-gray pottery from Tsirege was larger than that of Otowi, suggesting that Tsirege was a pueblo of central importance in the region as evidence of feasting events.

This project has raised more questions than it has answered (the sign of interesting data) and it is hoped that these data will be helpful for future research in understanding how Classic period sites on the northern Pajarito Plateau interacted between and within themselves and with the larger Rio Grande region.

CHAPTER 78
AN ANAYLSIS OF MICACEOUS POTTERY FROM THE PAJARITO PLATEAU

B. Sunday Eiselt

INTRODUCTION

The current study is based on examination of 107 sherds representing 22 vessels distributed among four sites dating to the early Historic and Homestead periods at Los Alamos National Laboratory (LANL). This count includes nine sherds from the Serna Homestead (LA 85407), eight from the McDougall Homestead (LA 131237), four from one Apache campsite (LA 85864), and seven from a second Apache campsite (LA 85869). Seventy-seven sherds representing one isolated pot drop were also analyzed. With the exception of one likely commercial terracotta vessel, all ceramics were locally made and represent well-defined and dated northern Río Grande ceramic types attributed to Pueblo, Jicarilla Apache, and Hispanic potters. Examination of 164 clay fragments recovered from LA 131237 indicates that all of these pieces represent burned and unburned adobe plaster.

CERAMIC TYPE IDENTIFICATIONS

Ceramic analysis included examination of each sherd using a 40x Zoom microscope and standard measurement charts and templates. Sherds were classified according to form and origin of production through observations on shape, color, paste, and surface finish. Microscopic analysis was used to identify paste and surface characteristics. Tewa and Hispanic plainwares were identified based on typologies developed by Olinger (1992) and others (Carrillo 1986, 1997; Levine 1990, 2004). Micaceous sherd type identifications were based on descriptions provided in Carrillo (1997), Dick (1965a, 1968), Gunnerson (1969), Lang (1997), and Warren (1981). The characteristics used to define micaceous and plain paste ceramics are indicated in Tables 78.1 through 78.3, and additional descriptions may be found in Eiselt (2005, 2006).

Twenty-four historic ceramic types are currently defined for the northern Rio Grande region. These include plainware, decorated, and micaceous ceramics made by Pueblo, Jicarilla Apache, and Hispanic potters. Plainware types include Tewa and Hispanic redwares (17^{th} century to present), San Juan Red-on-tan (AD 1700 to present), Casitas Red-on-brown and Casitas Red-on-brown smudged (Hispanic: pre-AD 1672 to 1890), Kapo Black (Santa Clara Pueblo: 17^{th} century), Tewa and Hispanic polished blackwares (17^{th} century to present), and Carnué Plain (Hispanic: AD 1700 to 1895). Decorated wares include Tewa, Pojoaque, Ogapoge, Powhoge, and Nambé Polychrome and Powhoge Black-on-red. Micaceous types encompass residual paste and slipped varieties including Cimarron Micaceous (Jicarilla Apache: AD 1730 to present) and Ocate Micaceous (Jicarilla Apache AD ~1550 [1600]–1730), Taos Micaceous (AD ~1550 [1730] to present); Peñasco Micaceous and Vadito Micaceous (Picurís: ~1550 [1690] to present), Tewa Micaceous and Micaceous Slipped (17^{th} century to present), and Petaca Micaceous and El Rito Micaceous Slipped (Hispanic: AD 1690–1890).

Table 78.1. Distinguishing characteristics of Pueblo and Hispanic plainwares (from Carrillo 1997; Dick 1968; Levine 1990, 2004; Olinger 2004).

Ceramic Type	Forms	Surface Treatment	Paste Characteristics
Tewa Red and San Juan Red-on-tan	Large water and storage jars (unslipped, unpolished interiors). Bowls and soup plates also present. Flanged plates with well-defined flanges	Slip on exterior does not extend over rim and on to interior. Slip band below rim at shoulder; above band is polished not slipped (usually redware). Applied with a brush, producing a fine line with an even edge	Vitric tuff temper, often with pumice and/or fine sand mixed in. Soft paste with thicker walls (fired at lower temperatures?)
Casitas Red-on-brown and smudged	Bowls and soup plates dominate but larger jars also present. Flanged plates with poorly defined flanges	Thin slip not highly polished (streaky appearance), unevenly applied (with a rag?) leaving uneven edges between the band and the polished surface. Bowls: slipped on interior, slip extends to a narrow band on the exterior. Jars: narrow band of slip on exterior extends over the rim and to the interior. Decorations also include occasional scrolls, circles, and bulls-eyes on bowl interior	Vitric tuff temper, often with pumice and/or fine sand mixed in. Soft paste with thicker walls (fired at lower temperatures?)
Tewa polished blackwares	Large water and storage jars (unslipped unpolished interiors). Bowls and soup plates also present. Flanged plates with well-defined flanges	Thick slip, well-polished on exterior and interior of bowls with some crazing and cracking evident on the surface of thick slip pieces	Fine to medium sand temper, occasionally a very small amount of tuff or pumice. Friable but glassy paste (fired at higher temperatures?)
Hispanic polished blackwares	Bowls and soup plates dominate but larger jars also present. Flanged plates with poorly defined flanges	Thin slipped not highly polished (streaky appearance), unevenly applied leaving uneven edges between the band and the polished surface. Bowls: slipped on interior, slip extends to a narrow band on the exterior. Jars: narrow band of slip on exterior extends over the rim and to the interior	Vitric tuff temper, often with pumice and/or fine sand mixed in. Soft paste with thicker walls (fired at lower temperatures?)

Table 78.2. Distinguishing characteristics of micaceous slipped pottery (from Dick 1968; Eiselt 2005; Olinger 1992).

Characteristics	**Vadito Micaceous**	**Tewa Micaceous Slipped (Santa Clara, San Ildefonso)**	**Tewa Micaceous Slipped (San Juan)**	**Tewa Micaceous Slipped (Nambe/ Pojoaque/ Tesuque**	**El Rito Micaceous Slipped**
Forms	Large and medium-sized bowls and jars, storage vessels	Large and medium-sized bowls and jars, storage vessels	Large and medium-sized bowls and jars, storage vessels	Large and medium-sized bowls and jars, storage vessels	Large and medium-sized bowls and jars, storage vessels
Interior Surface finish/color	Sanded and polished raw clay (characteristic shimmering appearance). Reduced	Thick to thin reduced Santa Fe formation clay slip, highly polished. Dark brown to black in color (no mica)	Thick to thin reduced Santa Fe formation clay slip, highly polished. Dark brown to black in color (mica rare to common)	Thin oxidized plain clay slip. Mica content much greater than San Juan, Santa Clara, and San Ildefonso	Thick to thick reduced Santa Fe formation clay slip, highly polished. Dark brown to black in color (mica rare to common)
Exterior Surface finish/color	Fine silvery muscovite mica wash (reduced)	Golden yellow, orange, or gray primary micaceous clay slip (oxidized and reduced)	Golden yellow, orange, or gray primary micaceous clay slip (oxidized and reduced)	Distinctive salmon-pink to salmon-orange primary micaceous clay slip (oxidized)	Primary micaceous clay slip
Clay Paste	Muscovite mica, quartz mica schist	Plain (Santa Fe formation) with vitric tuff, pumice, and glass sherds that are easily mistaken for mica. Fine rounded sands common	Plain (Santa Fe formation) with moderate amounts of muscovite mica (biotite rare). Variably sized arkosic sands dominant.	Plain (Santa Fe formation) with abundant muscovite and biotite. Poorly sorted arkosic sands present	Plain (Santa Fe formation) with abundant arkosic sands (tuff, pumice and glass rare)
Core	Black to dark gray, laminated and coarse	Gray and dense (to ropey) or slightly granular with rounded aplastics	Black to burnt umber, granular and friable paste	Gray to light gray granular and friable paste	?

Table 78.3. Distinguishing characteristics of micaceous pottery (from Eiselt 2005).

Characteristics	Petaca Micaceous	Peñasco Micaceous	Taos Micaceous	Tewa Micaceous	Cimarron Micaceous
Vessel Forms	Small atole cups, jars, and bowls common, medium to large storage vessels and jars present but rare, pinch pots, candlestick holders, comales	Small bowls and jars, large storage vessels and jars, pitchers, figurines	Small and large bowls and jars frequently with multiple appliqués and spouts, pitchers, figurines	Small bowls and jars common, pitchers, figurines	Small and large bowls and jars, bag-shaped jars, medicine bowls, pitchers, pipes, pinch pots, figurines, appliqués common at neck and shoulder
Rim and Neck Forms	Everted (acute) on small vessels, gently everted on large vessels. Occasionally thickened neck wall below rim, inverted rim bowls common	Everted (acute) on small vessels, gently everted on large vessels, inverted rim bowls common	Gently everted to straight, inverted rim bowls common	Gently everted to straight, inverted rim bowls common	Gently everted to straight bowls and jars
Rim Margin	Undulating (uneven) and fluted/crenulated	Undulating (uneven) and fluted/crenulated	Undulating (uneven) and fluted/crenulated, indentations common	Undulating (uneven) and fluted/crenulated	Cut and straight (common). Occasionally fluted or crenulated (accompanied by y-shaped lip profile)
Lip Profile	Round (occasionally bulbous and thickened) and subangular	Round to tapered	Round to subangular with parallel-sided neck below rim	Tapered, round, subangular	Flat (square), expanding (keeled and y-shaped), sanded lip face,

Characteristics	**Petaca Micaceous**	**Peñasco Micaceous**	**Taos Micaceous**	**Tewa Micaceous**	**Cimarron Micaceous**
					occasional corn-cob indentations
Base Configuration	Rounded to flat	Conical to subangular, flat	Conical to subangular with occasional acute concave center	Rounded to flat	Conical to subangular with occasional slight concave center
Corn-cob Scrape Marks	Occasional, obliterated	Occasional, obliterated	Occasional, obliterated	Rare to absent, obliterated	Pronounced on interior and exterior necks and rims, partially obliterated through application of slip and/or slurry
Sanding	Heavily sanded and unslipped on some interiors, otherwise rarely sanded	Light sanding especially at interior and exterior rims	Light sanding especially on interior bowls, otherwise sanding rare	Light sanding especially at interior and exterior rims, occasionally highly sanded with mixed clays	Light sanding especially at interior and exterior rims
Slip/Slurry	Thick and uneven slurry on interior and exterior (slurry covers protruding aplastics or thin watery slurry that is prone to cracking and erosion)	Fine “silvery” muscovite mica wash (characteristic shimmering appearance)	Usually thick, even application	Rare with occasional presence of ochre	Usually thick, even application, with occasional presence of ochre
Buff/Polish	Light buffing only on some pieces. Wipe marks are present and pronounced on most pieces	Light buffing	Light buffing with a tendency towards high gloss finish on later pieces (20th century)	Light buffing	Moderate buffing especially on interior and exterior neck and rim

Characteristics	**Petaca Micaceous**	**Peñasco Micaceous**	**Taos Micaceous**	**Tewa Micaceous**	**Cimarron Micaceous**
Surface Compaction	Slight to none with most pieces rough to the touch	Slight to none with most pieces rough to the touch. Occasionally compacted through polishing	Slight to none with most pieces rough to the touch. Occasionally compacted through polishing	Slight to none with most pieces rough to touch. Occasionally compacted through polishing on interior bowls	Highly compacted and smooth to the touch with 'waxy' appearance
Smudging	Common to rare on interiors and exteriors	Common on interiors and exteriors	Common on interiors and exteriors	Rare with light gray to salmon-colored or orange oxidized clay	Common to rare on interiors and exteriors
Aplastic Size and Sorting	Coarse paste with large aplastics and poorly sorted aplastics (poorly cleaned clay). Aplastics range from 0.5 to 3.0 mm with large aplastics common in small, thin-walled vessels	Fine paste with small well-sorted aplastics (screened?). Mica "spalling" common on surfaces of some pieces	Fine paste with small well-sorted aplastics (screened?). Mica "spalling" common on surfaces of some pieces	Fine paste with small well-sorted aplastics (screened?). Occasional dense gray paste (evidence of clay mixing)	Generally well-sorted. Aplastic size varies with the size of the vessel
Aplastic Constituents	Quartz, muscovite mica, micaceous schist, Vadito group accessory minerals with hematite common	Quartz, muscovite mica, micaceous schist, Vadito group accessory minerals with garnet and feldspars common	Quartz, muscovite mica, micaceous schist, Vadito group accessory minerals with garnet and feldspars common	Quartz, muscovite mica, micaceous schist, Vadito group accessory minerals with biotite common	Quartz, muscovite mica, micaceous schist, Vadito group accessory minerals
Clay Constituents	Primary micaceous clay (no evidence of mixing)	Primary micaceous clay (evidence of mixing rare)	Primary micaceous clay (mixing rare)	Primary micaceous clay with some evidence of mixing w/ plain clays	Primary micaceous clay (evidence of mixing rare)

The ceramics identified for this project represent a limited but representative subset of these types including Cimarron Micaceous, Tewa and El Rito Micaceous Slipped, Tewa and Hispanic polished blackwares, and one prehistoric black-on-white sherd. Several indeterminate body sherds also were tentatively assigned to community based on similarities with known types. Nearly 91 percent of the total assemblage (*n* = 96 or 59 percent of the minimal vessel count) are ceramics made from primary micaceous clays or ceramics slipped with mica clay. Eight percent (*n* = 9 or 41 percent of the minimal vessel count) represent plain paste varieties.

SOURCE PROVENANCE DETERMINATIONS

Source provenance determinations for the LANL ceramics are based on visual examination of ceramic cross-sections and published descriptions of ceramics. Plain paste and micaceous ceramics may be assigned to producer community based on clay and temper identifications and ethnographic references to clay source utilization. Olinger (1992, 2004) has described the characteristics of plain paste temper that separate ceramics by Tewa Pueblo with a major axis of difference between Pueblos east of the Río Grande and those to the west. San Juan, Pojoaque, and Tesuque ceramics contain higher abundances of finely divided muscovite and biotite mica as a natural constituent of the Santa Fe Group clays used in ceramic production. These clays border a portion of the Sangre de Cristo Range that contains Precambrian mica-schist outcrops (as discussed below). Santa Clara and San Ildefonso ceramics are made from Santa Fe Group clays that rarely contain mica but instead are mixed with Tertiary volcanic sources to the west.

Pueblo plainwares are typically tempered with vitric tuff with smaller amounts of pumice, glass, and/or fine sand. These elements also occur as natural constituents of clays. Hispanic plainwares, in contrast, have fine to medium sand temper with occasional tuff or pumice (Carrillo 1997; Levine 1990; Olinger 1992). Pueblo pottery also is softer and the pastes are not as glassy as Hispanic types. Olinger attributes differences in paste fabrics to firing practices with higher temperatures achieved in Hispanic kilns (see also Carrillo 1997). D. Levine (2004:167) states, however, that the pastes of Hispanic wares are generally more friable than the tuff-tempered Tewa wares due to higher amounts of coarse sand temper. Geochemical analysis nonetheless suggests that Hispanic and Pueblo plainwares were made with the same geologic clays (Olinger 2004:137). Differences in paste related to Pueblo and Hispanic plainwares also extend to mica-slipped varieties, which can be further distinguished based on the color and aplastic constituents of the slip.

The micaceous clays of the northern Río Grande are located in the Sangre de Cristo Mountain Range and southern San Juan Mountains. Specifically, they occur in several Precambrian-cored topographic uplifts including the Brazos (Tusas Range), the Sangre de Cristo (Taos, Picurís, Truchas, and Santa Fe Ranges), and the Río Mora Uplifts (Rincon Range and El Oro Mountains) (Figure 78.1). The Precambrian complex is composed of metamorphic schists, quartzites, and other metarhyolites and metasedimentary rocks. Muscovite is the most common mica type found in these formations, occurring in pegmatite dikes and in quartz-muscovite schists (Austin et al. 1990). The largest deposits are associated with a middle Precambrian rock sequence called the Vadito Group, which contains an average of 38 percent to 50 percent muscovite by weight (Bauer 1988; Beckman 1982:37; Gresens and Stensrud 1974). Translucent and iron-stained quartz, feldspar, and quartz-mica schist account for 40 percent to 60 percent. Accessory minerals occur in trace amounts and include magnetite, biotite, hematite, rosy quartz, white quartz, and garnet primarily. Micaceous clay source districts and source areas are defined by regional variations in Vadito Group lithologies including trace element geochemistry of clay (Eiselt 2006). Figure 78.1 shows the locations of clay source districts and sampled source areas for comparison to LANL ceramics. Table 78.4 identifies major differences in trace mineral and rock abundances and other characteristics of micaceous clay that distinguish major source districts (Petaca, Picuris, Cordova-Truchas, and Mora) based on visual examination alone. These characteristics may be compared to ceramic pastes to determine source provenance of finished pottery. Source determinations, in turn, may be related to ethnographic accounts of clay harvesting practices by pottery producing community (Table 78.5).

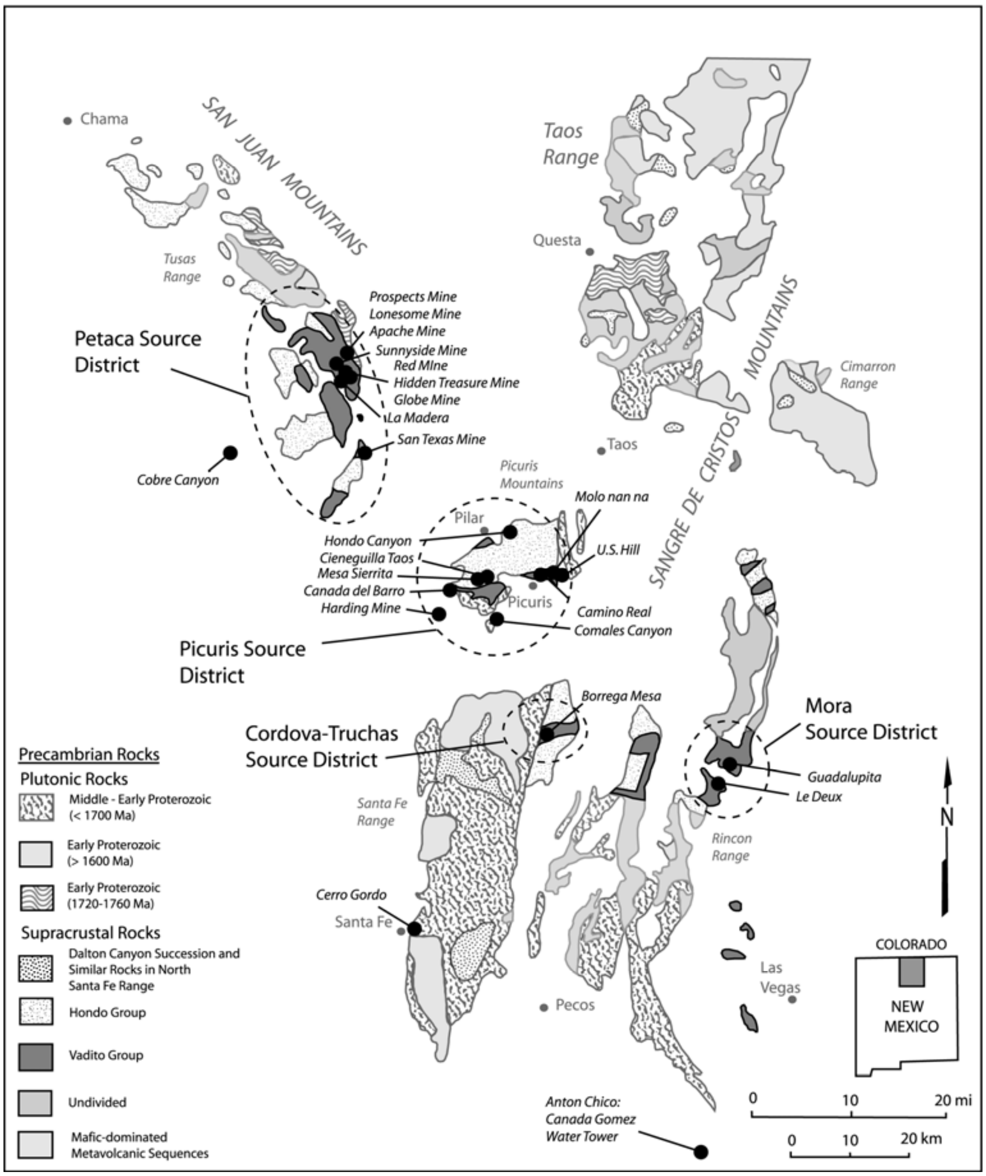


Figure 78.1. Map showing locations of predefined source districts and source areas (Redrawn from Bauer and Williams 1989).

Table 78.4. Summary of diagnostic traits for source districts (from Eiselt 2006).

High Abundance	Low Abundance	Other Characteristics	District
Quartz-mica schist (dominant). Hematite (large, common). Rosy quartz	White quartz. Booked biotite. Garnet	Medium-fine texture (mica and aplastics). Poorly sorted, angular aplastics. Red to pink muscovite	Petaca
Magnetite (dominant). Biotite (common). Garnet. Hematite (small, rare)	Quartz mica schist. Rosy quartz. White quartz (none).	Fine texture (mica and aplastics). Subangular to round aplastics. White to green muscovite	Picuris
Biotite (dominant). Magnetite. Booked biotite.	Quartz-mica schist (none). Garnet (none). Hematite.	Coarse texture (mica and aplastics). Poorly sorted, angular aplastics	Cordova-Truchas
Magnetite (dominant). Biotite. Quartz-mica schist.	Garnet (none). Booked biotite.	Coarse texture (mica and aplastics). Poorly sorted, angular aplastics	Mora

Table 78.5. Ethnographically recorded micaceous clay sources and communities.

Cultural Group	Location	Reference
Picuris	North side of Picuris Mountain on the trail from Ranchos de Taos to Picuris	Spinden 1916
Picuris	Three miles ENE of Vadito at the head of Osha Canyon (Molo nan na)	Dick 1990
Picuris	Molo nan na Proper (Destroyed)	Dick (undated map), modern potters
Picuris	Camino Real at the top of Picuris Mountain	Gunnerson 1970
Picuris	U.S. Hill	Dick (undated map), modern potters
Picuris	Cañada del Barro at Apache Springs	Modern potters
Taos	North side of Picuris Mountain	Parsons 1936; Spinden 1916
Taos	Arroyo del Alamo, on the north side of Picuris Mountain along the Camino Real trail leading to Picuris	Ellis 1974
Taos	Near the head of Arroyo Hondo Canyon near trail leading from Picuris to Ranchos de Taos	Modern potters
Taos	U.S. Hill	Modern potters
Taos	Red Mine and Apache Mine areas near Petaca	Modern potters
Jicarilla	North side of Picuris Mountain on trail leading from Ranchos de Taos to Picuris	Parsons 1936; Spinden 1916
Jicarilla	Ancient Sericit mica deposit (U.S. Hill)	Dick 1990

Cultural Group	Location	Reference
Jicarilla	In the mountains, 18 miles SE of Taos	Opler 1971a
Jicarilla	Petaca	Anonymous 1974
Jicarilla	Las Truchas	Gunnerson 1970; Schroeder 1974a, b
Jicarilla	West (north) side of Santa Fe Canyon about 1.5 miles above Santa Fe	Harrington 1916
Jicarilla	Clay bank located at San Jose, probably upstream on the Pecos River	Bender 1974; Carrillo 1997
Jicarilla	U.S. Hill	Modern potters
Jicarilla	Red Mine and Apache Mine areas near Petaca	Modern potters
Northern Tewa	Pokæn fu'a'a (south of Cundiyo and Nambe in the Cañon de Chimayo)	Harrington 1916
Northern Tewa	Pokæn fuk'ondiwe located two miles east of the town of Petaca	Harrington 1916
Northern Tewa	West (north) side of Santa Fe Canyon about 1.5 miles above Santa Fe	Harrington 1916
Northern Tewa	Borrega Mesa (south of Cordova)	Modern potters
Northern Tewa	Red Mine and Apache Mine areas near Petaca	Modern potters
San Ildefonso	Near Chamisal	Spinden 1916
San Ildefonso	North side of Picuris Mountain on the trail from Ranchos de Taos to Picuris	Spinden 1916
San Ildefonso	North side of Santa Fe Canyon	Spinden 1916
San Ildefonso	North side of Chimayo Creek near Truchas	Spinden 1916
San Ildefonso	Las Truchas	Guthe 1925
San Ildefonso	North side of Santa Fe Canyon	Guthe 1925
San Juan	Truchas Creek, a mile or two southeast of the town of Truchas	Harrington 1916
Santa Clara	Chimayo Valley	Hill and Lange 1982
Santa Clara	North side of Santa Fe Canyon	Hill and Lange 1982
Hispanics	Red Mine and Apache Mine areas near Petaca	Modern potters
Hispanics	Borrega Mesa (south of Cordova)	Modern potters
Hispanics	Las Truchas	Carrillo 1997

RESEARCH QUESTIONS

Ceramic analysis focused on answering several research questions related to dating historic sites and establishing the cultural affiliations of pottery. Specifically, the relative abundances of ceramics of different types were examined to investigate the timing of homestead and tipi ring occupations and the nature of ceramic exchange between site occupants and neighboring communities.

Temporal changes in the relative abundances of plain, decorated, and micaceous wares have been noted by several researchers working in the northern Rio Grande. Moore (1996) relates these changes to two factors: style and economy. The use of locally produced pottery varied as access to imported cooking, serving, and storage vessels changed after the colonial period. Tewa polychromes replaced glazewares by the late 1700s. Similarly, polished redwares comprise a large percentage of early colonial period assemblages by comparison to blackwares and decorated wares. Redwares waned in popularity through time, while blackwares increased until they were the most common types in the Santa Fe Trail and Railroad periods (ca. 1820s to 1890s). The use of decorated wares also decreased significantly during this time (D. Levine 1990, 2004; Moore 1996:149). Work by Carrillo (1997) and Levine (1990) in the Abiquiu area suggest that increases in blackwares may be explained, in part, by increased ceramic production in Hispanic villages during the 19th century.

Micaceous wares followed a similar trajectory to that of the blackwares, becoming the second most common category of ceramics by the 1820s. Carrillo (1997:131) relates the popularity of micaceous pottery to preferences associated with the cooking qualities of micaceous wares, and Eiselt (2006) additionally attributes the proliferation of mica pottery to the presence of Jicarilla Apache potters in the Chama after the 1840s. The removal of the Apaches to the Dulce Reservation and the increased availability of commercial cooking and serving wares after the 1890s led to significant declines in local pottery manufacturing, including plainware and micaceous ceramics.

Relative abundances of plain, decorated, and micaceous ceramics thus may be used to date archaeological assemblages to major periods including the early colonial (ca. 1590 to 1700), the late colonial (ca. 1700 to 1821), the Mexican and U.S. Territorial periods (roughly 1821 to 1890), and the pre-New Mexico statehood period (ca. 1890–1912).

Ceramic assemblages also may be related to patterns of economic exchange and interethnic relations including village-based specialization and trade in subsistence and ceramic goods between women (Brody and Colberg 1966; Carrillo 1997; Dickey 1949:90–91; Eiselt and Ford 2007; Ford 1972; Levine 2004; G. Schroeder 1964:46–47; Swadesh 1974:41; Thomas et al. 1992). Hispanics were primary consumers of Indian-made ceramics, although several villages in the northern Río Grande also produced and traded their own pottery (Carrillo 1997). Hispanic assemblages thus provide direct evidence for the organization of ceramic distribution and the scale of production and trade by pottery community during the Historic period. Village assemblages are typically dominated by Pueblo and Jicarilla pottery with lesser amounts of Hispanic wares (Eiselt and Darling 2007). The homestead sites on LANL present an excellent opportunity to examine patterns of exchange in the more remote areas of the plateau, particularly as this relates to ceramic trade with the Jicarilla and San Ildefonso Pueblo.

CERAMIC DESCRIPTIONS

Ceramic type identifications by site are provided below along with brief interpretations of assemblage characteristics at the end of each section.

McDougall Homestead (LA 131237)

The McDougall Homestead, occupied from around 1907 or 1908 to 1942 or 1943, was owned by Hispanic and Anglo families sequentially for relatively short periods of time (McGehee et al. 2006). The ceramic assemblage is likewise attenuated but is indicative of this multi-cultural occupation. A total of eight sherds representing six vessels were recovered (Table 78.6). Sherds are attributed to Hispanic, Jicarilla, and Pueblo potters, and a single terracotta fragment likely represents a commercially manufactured vessel of unknown origin dating to the Anglo occupation. Complete descriptions are provided below along with type identifications and probable source determinations where appropriate.

Table 78.6. LA 131237 ceramic counts.

Ceramic Type	**Ceramic Form**	**Total Sherd Count**	**Minimum Vessel Count**
Cimarron Micaceous	Medium- to large-sized jar (24 cm orifice diameter)	1	1
Cimarron Micaceous	Small- to medium-sized jar (unknown diameter)	3	1
Hispanic Blackware	Small- to medium-sized jar (unknown diameter)	1	1
Peñasco/Tewa Micaceous	Bowl/jar	1	1
Indeterminate Micaceous	Unknown	1	1
Terracotta (Commercial)	Unknown	2	1
Total		**9**	**6**

Ceramic Descriptions

Field Specimen (FS) 179 represents a definite Cimarron Micaceous ceramic rim sherd. Diagnostic characteristics include rim form and surface finish. The vessel displays a nicely finished expanding rim profile with squared edges and slight keeling to the exterior. Vessel walls have been smoothed (either with the hands or a rough stone) and then slipped with a relatively thick micaceous slurry that was subsequently rag polished to a mat luster on the interior. Polish extends on to the lip face. The vessel appears to represent a medium to large cook pot with an orifice diameter in excess of 24 cm. The dominant minerals in the paste include angular and poorly sorted translucent yellow quartz, quartz mica-schist, and muscovite mica. Accessory minerals include some garnet and possibly magnetite. The specific array of minerals combined with particle sizes, sorting, and angularity suggest that the clay for this vessel came from the Petaca source district.

The FS 432 sample represents a definite Cimarron Micaceous vessel. This sample includes one rim, a neck, and a body fragment that all appear to be part of the same small- to medium-sized cook pot or olla. The lip of the rim is flanged or crenulated. The margins of the rim are subangular, with a slightly squared and expanding profile. The lip face displays a slight, longitudinal finger groove, which is diagnostic for Cimarron Micaceous. Vessel surfaces are smooth and nicely compacted but are not sanded or polished. A thin micaceous wash has been applied to the surface. Wipe-marks are visible as faint striations. Corn cob scrape marks are absent. The interior portion of the neck fragment contains a dark encrustation or film that is likely carbonized food residue, which typically builds up on vessel bases and necks through repeated use. The dominant minerals in the paste include subangular sand-sized quartz and feldspars and muscovite mica. Inclusions are relatively well-sorted and fine. Accessory minerals include garnet, hematite, and minor amounts of biotite. These minerals are apparent in cross-sections and on the surfaces of pieces. Hematite fragments are visible in cross-section as dark black (reduced) areas that also have diffuse margins. The specific array of minerals combined with particle sizes, sorting, and angularity suggest that the clay for this vessel came from the Picuris source district. The general lack of quartz-mica schist further eliminates Petaca as a likely source, and the lack of white quartz and abundant biotite likewise eliminates Cordova-Truchas.

FS 84 represents a likely Hispanic rim sherd. Diagnostic characteristics include surface finish and paste characteristics. The vessel is reduced and a slip has been applied to the exterior. This slip extends over the rim and to the interior. The slip is thin and poorly polished, and the margin of the interior band is irregular, suggesting application with a rag as described by Levine (1990) and Carrillo (1997). The vessel appears to represent a small- to medium-sized jar with an unknown orifice diameter. The dominant minerals in the paste include fine, sub-angular to rounded translucent quartz and feldspars with minor amounts of microscopic glass fragments. Paste and surface finish characteristics are consistent with Hispanic blackwares dating to the Territorial period in Hispanic sites near Abiquiu (e.g., see Carrillo 1997; Levine 1990).

FS 430 is a micaceous rim sherd that contains ambiguous diagnostic traits that prevent a good identification. Most of the characteristics are consistent with Picurís pottery, but Tewa manufacture cannot be ruled out. Vessel form could not be determined. The rim profile is rounded and slightly bulbous, and a thin micaceous wash has been applied to the surface but is not polished. Paste texture and aplastic constituents also are most similar to Picuris district clays. The paste texture is fine, laminated, and well-sorted. Dominant plastics include angular to sub-rounded quartz and muscovite mica. Accessory minerals include feldspar, garnet, and possibly magnetite. Biotite is absent and this rules out the Cordova-Truchas clay district as a possible source for the clay. The general lack of quartz-mica schist and hematite also seems to eliminate Petaca. However, the vessel has not been greatly reduced in firing, which is a good characteristic for Peñasco Micaceous, and the mica content is low relative to typical Peñasco sherds. Round rims and oxidized firings are common features of Tewa micaceous ceramics. Tewa Micaceous cannot be ruled out as a result.

The FS 190 micaceous body sherd also contains ambiguous diagnostic traits that prevent a good identification. Clay paste is similar to FS 430 and may be from the Picuris district, but this cannot be confirmed. Vessel surfaces are smooth and compacted. A micaceous slip has been applied to interior and exterior surfaces, but is not polished.

The two FS 190 terracotta body sherds are likely commercially made and date to the Anglo occupation of the site. The form of the vessel cannot be determined but may represent portions of a flower pot.

Summary

The LA131237 ceramic assemblage, although small, is relatively diverse with input from Jicarilla, Hispanic, and Tewa or Picuris potters. Locally made ceramics likely date to the Hispanic occupation of the site, whereas the terracotta fragments were probably deposited during the later Anglo occupation. The earlier Hispanic assemblage is consistent with other Chama Valley homestead sites dating to the U.S. Territorial period, which typically include a diversity of ceramics attributed to Jicarilla, Pueblo, and Hispanic potters. The Hispanic blackware vessel may have been made at the homestead or it was procured from one of the known pottery-producing Hispanic villages in the Chama such as Abiquiú.

Although the historic documents indicate that the McDougall Homestead was established in 1907 or 1908, the ceramic assemblage suggests that the area may have been occupied at a slightly earlier date. The presence of Cimarron Micaceous, in particular, suggests a pre-1895 occupation that may overlap with nearby Jicarilla campsites (LA 85864 and LA 85869). However, the Jicarillas did continue to produce and use micaceous pottery at Dulce as late as 1909 to 1920 and individual families also regularly left the reservation covertly up to the 1920s. These off-reservation forays included hunting, clay harvesting, trade, and visiting friends or family members who were adopted or married into Hispanic and Pueblo households, particularly at Taos, Picuris, Abiquiu, and La Madera and La Petaca. These visits seem to have dropped off significantly after the 1920s, once the government improved conditions on the reservation, including the introduction of sheep in 1918 and the establishment of better health and educational facilities. There are no documented cases of Jicarillas visiting homesteads on the LANL, although the Jemez district was one of the favored fall hunting grounds of the Olleros from the 1850s to the turn of the last century. Cimarron Micaceous vessels therefore may have been obtained by the Hispanic residents of the site through trade with Apache visitors some time between 1895 and 1920. The possible presence of Peñasco Micaceous ceramics also may be attributed to Jicarilla trade. According to Schroeder (1964:46–47), the Jicarilla Apaches traded pottery from San Juan and Picurís Pueblos to Hispanics living near the Chama and upper San Juan Rivers during the 19th century.

The general characteristics of the McDougall ceramic assemblage are consistent with 19th and early 20th century patterns of interethnic exchange in ceramics reported by Carrillo (1997), Moore (1996), Eiselt (2006), and Eiselt and Ford (2007). All of the vessels identifiable to form represent jars and cooking vessels. Ceramic types and proportions, particularly the prevalence of micaceous and blackware ceramics, can be attributed to the Hispanic occupation of the site some time before 1920 and possibly as early as the late 19th century. The terracotta vessel post-dates this occupation.

The Serna Homestead (LA 85407)

The Serna Homestead was occupied at a slightly later date than the McDougall homestead and this is reflected in the ceramic assemblage. The post-1913 date for the Serna Homestead is associated with a general lack of residual micaceous pottery (particularly Cimarron or Peñasco

Micaceous) and the nearly exclusive presence of mica slipped and plainware ceramics made by Tewa potters. A total of 10 sherds representing nine vessels were recovered (Table 78.7). A total of 164 fragments of burned and unburned adobe plaster also were recovered from the Area 1 cabin and the Feature 1 horno. Complete descriptions are provided below along with type identifications and probable source determinations where appropriate.

Table 78.7. LA 85407 ceramic counts.

Ceramic Type	Ceramic Form	Total Sherd Count	Minimum Vessel Count
Tewa Blackware (San Ildefonso, Santa Clara)	Unknown	2	2
Tewa Micaceous Slipped (San Ildefonso, Santa Clara)	Large storage vessel?	2	1
Tewa Micaceous Slipped (Nambe, Tesuque, Pojoaque)	Unknown	2	2
Hispanic/Tewa buff/plain	Unknown	4	4

Ceramic Descriptions

FS 377-2 is a Tewa Blackware sherd likely originating in Santa Clara or San Ildefonso. Ceramic cross-sections reveal a fine but friable clay paste. The dominant constituents of the clay include vitric tuff, pumice, and fine sand temper. Interior and exterior surfaces are sanded, slipped, and polished. The exterior surface is a deep glossy black. The interior is polished to a lesser degree and is partially oxidized. Vessel form cannot be determined.

FS 346 is a Tewa Blackware sherd likely originating in Santa Clara or San Ildefonso. Ceramic cross-sections reveal a fine but friable clay paste. The dominant constituents of the clay include vitric tuff, pumice, and fine sand temper. Interior and exterior surfaces are sanded, slipped, and polished. Minor amounts of microscopic muscovite mica are visible on the exterior slip surface. Vessel form cannot be determined.

The FS 324 and FS 337 ceramics represent two Tewa Micaceous slipped body sherds likely belonging to the same vessel. Surface finish, wall thickness, and paste characteristics are identical. The form of the vessel cannot be determined, but it was likely a relatively large jar based on the wall thickness of the body sherds (7 mm). The pieces may represent portions of a storage vessel. Ceramic cross-sections reveal a fine but friable clay paste. The dominant constituents of the clay include rounded stream sands and microscopic glass fragments with minor amounts of vitric tuff and pumice. The interior of the vessel is sanded, polished to a mat finish, and reduced, but is not slipped. The exterior is slipped with a thin micaceous wash that contains an abundance of muscovite mica and no biotite. Paste characteristics indicate that the vessel was produced either in San Ildefonso or Santa Clara using local clay and temper sources.

The FS 117 body sherd represents a Tewa Micaceous slipped jar or bowl. Ceramic cross-sections reveal a relatively coarse and friable clay paste. The dominant constituents of the clay include subangular to rounded and poorly sorted stream sands and minor amounts of muscovite mica. The interior of the vessel is sanded, slipped with a thin slurry of plain clay, polished to a mat finish, and reduced. The exterior is slipped with a relatively thick micaceous slurry containing muscovite and biotite mica. Paste characteristics and surface finish indicate that the vessel was produced at San Juan, Nambe, Pojoaque, or Tesuque using local clay and temper sources.

The FS 305 body sherd is nearly identical to FS 117. Paste and surface finish are the same with the notable exception that biotite is not present in the micaceous slip of the FS 305 sherd. Paste characteristics and surface finish indicate that the vessel was produced at San Juan, Nambe, Pojoaque, or Tesuque using local clay and temper sources.

Four body sherds (FS 116, FS 135, FS 377-1, and FS 402) likely represent separate vessels but are otherwise very similar in appearance. Each is tempered with medium to fine and subangular arkosic sands. Interior and exterior surfaces are not slipped. Clay color is a light buff to brown. The general lack of tuff, pumice, glass, and mica suggests that the sherds may be Hispanic in origin, but the small size of the sherds prevents a definite identification. Vessel form cannot be determined.

Adobe Plaster

A total of 164 fragments of burned and unburned adobe plaster were recovered from LA 85407. Nearly all of them (n = 163) came from the Area 1 cabin, with the majority encountered in the Stratum 2 post-occupational fill. Plaster was present in most of the interior grid units but was concentrated primarily in Room 1. One fragment was recovered from the horno (Feature 1) in Area 3. There are no visible differences between the plaster from the cabin and the horno.

A number of characteristics separate adobe plaster from fired ceramics. The adobe paste consists of a fine, granular clay paste containing moderate amounts of rounded quartz and fine arkosic sands. Tuff and pumice aplastics are present but rare in most cases. Unburned fragments are buff to gray in color. Interior sides show signs of being attached to an adobe floor or wall substrate. Aplastics are exposed at the roughened contact surface. Exterior surfaces were buffed with a soft cloth, wool, or chamois. Striations are visible, the surfaces are compact, and some crazing is evident on the fine clay float or film. None of the pieces show any signs of sanding, polishing, or firing consistent with pottery and only a few display slight curvature. Several of the unburned pieces also contain fragments of a possible whitewash or paint, further suggesting wall plaster. In general, the adobe plaster is compact but not fused or vitrified through firing. Burned pieces also break easily and were likely baked in one or more of the post-occupational fires that destroyed the structure. The context, distribution, and physical characteristics of the plaster indicate that portions of the walls within the cabin were finished with adobe, possibly in the area of an interior wood burning stove or hearth in Room 1. Plaster from the area of the horno may have come from the interior or exterior of this feature.

Summary

The LA 85407 ceramic assemblage indicates that residents of the Serna Homestead obtained locally produced ceramics from the Tewa Pueblos almost exclusively. Vessels consist of blackware and micaceous slipped vessels, some of which may represent large storage vessels. Four of the sherds (40% of the total assemblage) appear to be Hispanic in origin, but this could not be verified. Despite the lack of diagnostic pumice, tuff, or glass in the temper, these unidentifiable fragments could represent Tewa vessels. Sixty-seven percent of the identifiable assemblage (n = 4, or 3 out of 5 vessels) originated either in Santa Clara or San Ildefonso, including both of the Tewa blackwares and one of the Tewa Micaceous slipped fragments. Thirty-three percent of the identifiable assemblage (n = 2, or 2 out of 5 vessels) originated east of the Rio Grande at Nambe, Pojoaque, San Juan, or Tesuque. Both of these vessels are Tewa Micaceous slipped fragments.

Ceramics were recovered from three features including the Area 1 cabin, the Area 4 circular rock alignment (Feature 2), and the Area 6 corral (Feature 3). All of the Santa Clara/San Ildefonso ceramics were associated with the cabin and all of the ceramics from Nambe, Pojoaque, San Juan, or Tesuque were associated with the circular rock alignment. Both features also contained unidentifiable Hispanic/Tewa buffwares and one unidentifiable buffware also was associated with the corral. Unfortunately, ceramic distributions do not contribute to a better interpretation of the circular rock alignment function, although it is interesting that all of the east-side Tewa ceramics were associated with this feature. The presence of ceramics in the feature, however, suggests that it may have functioned as a storage facility or outdoor food service or cooking area. The presence of adobe fragments indicates that portions of the cabin interior were prepared or finished with plaster.

The prevalence of Tewa ceramics and general lack of Jicarilla ceramics is consistent with the post-1920s occupation of the site. Residents interviewed as part of ongoing LANL research indicate that members of nearby Pueblos continued to use the mesa areas on the plateau for gathering, hunting, and religious activities. In particular, homestead farmers hired local Pueblo men to help with plowing and harvesting, and homesteaders also sold cane syrup and exchanged crop seed and information about medicinal plants with nearby Pueblos, especially San Ildefonso (Vierra et al. 2006:223–224). The LA 85407 excavations demonstrate that ceramics also were part of this exchange system. Ceramics from the Serna Homestead may be contrasted with the McDougall Homestead assemblage, which shows significant input from Apaches and likely represents a pre-1920s rather than post-1920s Hispanic occupation.

Apache Campsite: LA 85864

LA 85864 includes a rock ring alignment likely representing the remains of a wickiup or tipi foundation. Three micaceous sherds representing two vessels were recovered from this structure. Unfortunately, all three of the fragments represent small body sherds and could not be definitively identified to maker, but they were likely produced or used by the Jicarillas. A single Biscuit A fragment also was recovered from the site. Complete descriptions are provided below along with type identifications and probable source determinations where appropriate.

Both of the sherds from FS 575 likely came from the same vessel based on paste and surface finish characteristics. This vessel displays characteristics most similar to Cimarron Micaceous. Sherds contain only a moderate amount of mica. Rosy quartz and possible magnetite are present but rare and may indicate a Cordova-Truchas Source District origin for the clay. Exterior and interior sherd surfaces are burnished and compacted, unlike Tewa vessels. No corncob striations are present.

The FS 572 sherd appears to be made from an alluvial clay containing mica rather than primary micaceous clay. Mica fragments are silt- to clay-sized and larger fragments are rare. Aplastics are subangular to subrounded. The origin of the clays used to make this ceramic is unknown, although alluvial micaceous clays are present north of Abiquiu. Surface slip or float does not appear to be micaceous. Ethnic affiliation also is unknown.

The FS 574 fragment represents a small Biscuit A body sherd.

Apache Campsite: LA 85869

LA 85869 includes two rock ring alignments likely representing the remains of wickiup or tipi foundations. A total of six micaceous sherds representing two vessels were recovered along with a possible Tewa buffware fragment. The micaceous fragments represent small body sherds and could not be definitively identified to maker, but they were likely produced or used by the Jicarillas. Complete descriptions are provided below along with type identifications and probable source determinations where appropriate.

Both of the FS 309 sherds likely came from the same vessel based on paste and surface finish characteristics. This vessel displays characteristics most similar to Cimarron Micaceous. The ceramic paste contains abundant muscovite mica in a gradient of sizes. Biotite and booked biotite also are common. Aplastics include translucent to white quartz (dominant) and magnetite (rare). The abundance of booked biotite in combination with the presence of magnetite and white quartz indicate a Cordova-Truchas Source District origin for the clay. A micaceous float (slurry) was applied to the exterior surface. Exterior and interior sherd surfaces are burnished and compacted, unlike Tewa vessels. No corn cob striations are present.

All four of the FS 328 sherds likely came from the same vessel based on paste and surface finish characteristics. This vessel displays characteristics most similar to Cimarron Micaceous. Ceramic pastes contain abundant muscovite in a gradient of sizes. Quartz mica-schist also is common, and iron-stained quartz and magnetite are present. One small fragment of hematite was noted. The abundance of quartz-mica schist and the presence of iron-stained quartz and hematite strongly suggests a Petaca Source District origin for the clay. Vessel interiors are smudged. Interior and exterior surfaces are compacted by sanding and burnishing, but some wipe-marks also are visible.

FS 325 represents a probable Tewa buffware body sherd of unknown origin.

Summary

The small ceramic assemblages recovered from LA 85864 and LA85869 are consistent with other sherd assemblages found at 19th century Jicarilla Apache sites in the Chama District and elsewhere. Although type identifications are tentative, all of the micaceous sherds likely represent Cimarron Micaceous vessels based on paste characteristics and surface finish. The Petaca and Cordova-Truchas source districts are represented and these two districts were used extensively by the Jicarillas (Eiselt 2006). Vessel surfaces also are highly compacted through burnishing and polishing; traits that are likewise commonly found on 19th century Cimarron Micaceous sherds (Eiselt 2005). The Biscuit A sherd from LA 85864 may represent an earlier component at the site. The probable Tewa buffware sherd at LA 85869 was probably brought to the site by Apaches.

Isolated Pot Drop

The isolated pot drop is an excellent example of a medium-sized Cimarron Micaceous long-necked olla or cook pot with an orifice diameter of around 26 cm. The 77 recovered fragments include five rim sherds, three neck sherds, and 69 body fragments. Base sherds are not evident, suggesting that the vessel had a conical or rounded bottom. The neck is long and gently everted with vertical corn cob scrape marks on the exterior and horizontal corn cob scrape marks on the exterior. Interior and exterior surfaces have been lightly sanded and rag burnished. The rim is sharply keeled and expanding and shows evidence of being sanded and burnished. The paste includes residual micaceous clay that contains abundant quartz, feldspars, and mica-schist. Minor amounts of magnetite also are present. Paste texture is fine and laminated. A general lack of accessory minerals prevents a definite determination of source district, but Petaca or Picuris are likely candidates. The vessel likely dates from around 1850 to 1880 or 1890 based on similarities with dated types in the Río del Oso Valley (Eiselt 2006).

DISCUSSION

Summary counts and percentages from each of the four sites and the isolated pot drop are listed in Table 78.8. Cimarron Micaceous is the most numerous ceramic type in the overall assemblage and this type occurs at three of the four sites examined as part of this study. Ceramics originating in the Tewa Pueblos are the next most numerous categories and are associated with the homestead sites primarily.

Table 78.8. Ceramic summary counts.

Ceramic Type	Total Sherd Count	Minimum Vessel Count
Cimarron Micaceous	89 (83.2)	6 (27.3)
Indeterminate Micaceous (Cimarron?)	1 (0.9)	1 (4.5)
Peñasco/Tewa Micaceous	1 (0.9)	1 (4.5)
Indeterminate Micaceous	1 (0.9)	1 (4.5)
Tewa Micaceous Slipped (Nambe, Tesuque, Pojoaque)	2 (1.9)	2 (9.1)
Tewa Micaceous Slipped (San Ildefonso, Santa Clara)	2 (1.9)	1 (4.5)
Tewa Blackware (San Ildefonso, Santa Clara)	2 (1.9)	2 (9.1)
Hispanic Blackware	1 (0.9)	1 (4.5)

Ceramic Type	Total Sherd Count	Minimum Vessel Count
Hispanic/Tewa buff/plain	5 (4.7)	5 (22.7)
Prehistoric Biscuit A	1 (0.9)	1 (4.5)
Terracotta (Commercial)	2 (1.9)	1 (4.5)
Total	107 (100.0)	22 (100)

The content and diversity of the McDougall Homestead ceramic assemblage are characteristic of 19th century assemblages elsewhere in the Chama. These assemblages contain a mixture of Pueblo, Jicarilla Apache, and Hispanic ceramics with blackwares and micaceous wares being dominant up to the 1890s. Occupation of the McDougall Homestead may therefore pre-date the 1906 to 1907 patent by a few years. Some of the ceramics could represent heirloom pieces or micaceous tradewares produced by the Apaches after their removal to Dulce, but the overall assemblage composition is characteristic of 19th century ceramic production and exchange economies in the Chama (Carrillo 1997; Eiselt 2006; Moore 1996).

In contrast, the Serna Homestead site assemblage is consistent with a post-1920s occupation. Nearly all of the ceramics are attributed to the Tewa. Hispanic and Jicarilla Apache ceramics are lacking, and this can be attributed to a general decline of pottery making by these two groups after the 1890s. The Serna assemblage likewise reflects general trends in Chama Valley economies and trade relationships after the turn of the last century. These trade relationships involved the exchange of clay and pottery between Hispanic and Tewa villagers. For example, mica clay was obtained by San Juan potters from their Hispanic neighbors at Abiquiu (Schroeder 1964:46–47). Hill and Lange (1982:83) also note that Santa Clara potters obtained micaceous clays from neighboring Spanish-Americans (probably from Cordova or Abiquiu) who came to the pueblo to trade. Picuris and Taos likewise traded mica pottery to San Juan, Santa Clara, and San Ildefonso Pueblos to pay for curing ceremonies during the 20th century (Ford 1972:37–39), and Nambe produced cooking ware for trade with other Pueblos and Hispanics (Ford 1972:40).

Ceramic analysis and oral history testimony on the LANL demonstrate that these trade relationships also extended to the plateau and included neighboring homestead grants and Pueblos. Most of the Pueblo ceramics in both homestead assemblages came from neighboring San Ildefonso or Santa Clara Pueblos and Jicarilla Apaches, but Tewa Pueblos east of the Rio Grande are also represented. Although oral testimony makes no mention of exchange between women, they were undoubtedly involved in trading ceramics.

The presence of several Jicarilla Apache sites and abundant Cimarron Micaceous ceramics in the LANL assemblage is not surprising. During the 19th century, the Jicarilla traded their own ceramics in addition to pottery from San Juan and Picuris to Hispanic villagers living near the Chama and upper San Juan Rivers (Schroeder 1964:46–47). The Jemez Mountains were sacred to the Olleros, and Jicarilla hunting camps were located near Los Alamos according to oral testimony gathered by ethnographers and ethnohistorians during the 20th century (Goddard 1911:206; A. Schroeder 1974a:128, 1974b:445). Also, nearly 200 Olleros also stayed at San Ildefonso for several months in 1884 while they negotiated a permanent reservation (Tiller 1983:92–93). The archaeological sites and ceramics on the LANL thus may be attributed to the Ollero band of the Jicarilla as part of their occupation of the Española Basin. Specifically, they may belong to the *Saitinde* local group who regularly hunted the Jemez Mountains and Pajarito Plateau, but the *Dachizhozhin* cannot be eliminated.

By the 1850s, nearly all of the Olleros were living in the Lower Chama Valley from Canjilon to Española. The total population was around 300 people or six extended families divided into two local groups. The *Dachizhozhin* maintained their headquarters in the Petaca and El Rito areas, and the *Saitinde* took up residence near Española and Abiquiu. The favored hunting grounds of the *Dachizhozhin* included the Tusas and San Juan Mountains as far north as Colorado. The favored hunting grounds for the *Saitinde* were the Jemez Mountains. The 1869 census for the *Saitinde* lists a total of 170 people distributed among three extended families. One family occupied the Rio Puerco near Coyote, and the second lived in the lower reaches of the Rio del Oso (Opler 1971b:317). The third may have lived part time at Coyote and part time in the vicinity of Petaca. The headwaters of the Rio del Oso was a favored camping place for all of the *Saitinde* families moving into the Jemez Mountains for the communal fall hunts during the 1860s (Anonymous 1974:207). At the headwaters, these families traded ceramics and other items with Hispanic homesteaders at Los Rechuelos and San Lorenzo (Eiselt 2006).

The identification of Cimarron Micaceous sherds at the two tipi ring sites and at the McDougall homestead is important for two reasons. First it suggests that the Jicarilla continued to trade with Hispanic settlers as they moved in and around the Jemez Mountains and Pajarito Plateau during the communal fall hunts. Second, it reveals the itinerate nature of Jicarilla Apache pottery exchange, which involved villages and Pueblos along the Rio Grande in addition to individual homesteads in the mountains and plateaus surrounding the Española Basin.

CONCLUSION

Ceramics from the four LANL sites function as temporal and cultural indicators. The McDougall site assemblage reflects late 19th century patterns of ceramic exchange, with Jicarilla, Hispanic, and Pueblo sherds represented. The Serna site assemblage is consistent with the early 20th century date for this homestead and reflects a general decline in the diversity of ceramic production and ethnic communities producing ceramics after the 1890s. Nearly all of the sherds at the Serna Homestead are Tewa in origin, with most originating either at San Ildefonso or Santa Clara. The Serna assemblage also shows that trade between homesteaders on the plateau and neighboring Pueblo groups also included ceramics in addition to food, labor, and medicinal plants. The two tipi ring sites are attributed to the Jicarilla based on site features and ceramics. Historic documents suggest that they likely represent *Saitinde* seasonal hunting camps dating from the 1840s to the 1880s or 1890s. While on the plateau, Jicarillas interacted with local residents through the exchange of pottery.

CHAPTER 79
SETTLEMENT CHANGE AND DEMOGRAPHY ON THE PAJARITO PLATEAU

Brandon M. Gabler

PUEBLO AGGREGATIONS: A PERENNIAL PROBLEM IN PREHISTORY

Between AD 1250 and 1300, the social organization of Native American communities on the Pajarito Plateau underwent a profound shift known to archaeologists as “pueblo aggregation,” in which large aggregated residential structures replaced smaller, more numerous, and widely dispersed households. Understanding aggregation and related processes is critical to southwestern archaeology, and these have been addressed through innumerable approaches for decades (Cordell et al. 1994; Orcutt 1991; see chapters in Adams and Duff 2004; Adler 1996; Cordell and Gumerman 1989; Kohler 2004; Neitzel 1999). These arguments have not yet developed a unified understanding of aggregation as an adaptive strategy by prehistoric populations throughout the U.S. Southwest. Sheer population growth could lead to increased density of small settlements. Instead, a new form of village settlement appeared (the large complex pueblo), likely coupled with a new form of social organization (Cordell et al. 1994). A possible ecological framework for this innovative qualitative change is offered by ecologist C. S. Holling's (Holling and Gunderson 2002; Holling et al. 2002) model of adaptive cycles. Holling's model proposes a fundamental relationship between growth and structural change, and so offers a candidate explanation. But testing the fit of the adaptive cycle model requires empirical data on paleoenvironmental change changes in farming and settlement patterns, and an analytical model that captures the essence of Holling's qualitative predictions.

The Ancestral Puebloan Pajarito Plateau is a dynamically coupled socio-ecological system (SES), in which migrant Puebloans from desiccated landscapes elsewhere on the Colorado Plateau (i.e., San Juan Basin) encountered local peoples during the last half of the Coalition period (AD 1250–1325; Cordell 1979b; Hill and Trierweiler 1986; Hill et al. 1996; Vierra et al. 2006:192; Wendorf and Reed 1955). The migrants brought with them alternate ideas of social structure, agriculture, tools, and the rituals and behaviors associated with these lifeways. Additionally, their arrival caused an increase in population unachievable by local reproduction alone, adding additional stress to an environment already under the pressure of the Great Drought (AD 1276–1299). There exist two narratives, elaborately intertwined, but potentially separable in order to understand the whole in more detail. The two stories are as follows: 1) the social institutions that allowed the application, development, and evolution of intensified agriculture on the Pajarito Plateau, and 2) the ensuing adaptation to changing climatic conditions, culminating in drastic reformation of settlement pattern into aggregated pueblos. The second story, which is the primary focus of this research, is the ecological half of the Pajarito SES. It is necessary to understand both stories independently for the purposes of modeling the SES as a whole—such is the nature of the study complex adaptive systems (CAS; see Lansing 2003 for a discussion of complex adaptive systems and emergent behavior). Any misunderstanding of the details of the parts will obviously lead to a gross misunderstanding of the sum of those parts, since the larger Pajarito system as a whole is—as with all CAS—greater than the sum of its parts. This study attempts to investigate several hypotheses that have been proposed for the

Pajarito Plateau, specifically, and the U.S. Southwest broadly.

The first hypothesis is that there is a significant, observable change in geographic location through time, specifically an increase in elevation, of agricultural (fieldhouses) structures (Preucel 1986; Hill and Trierweiler 1986; Vierra et al. 2006:202–203). The second is that population peaked during the Late Coalition period and declined again during the Classic period (Preucel 1986; Hill et al. 1996; Orcutt 1999). Finally, returning to the heuristic adaptive cycle model, the last hypothesis is that the patterns of population migration, expansion, aggregation, and eventual relocation off of the Pajarito Plateau fit a regional pattern of nested adaptive cycles on the Colorado Plateau (Crown et al. 1996; Holling and Gunderson 2002).

Understanding the ecological narrative is linked directly to the understanding of settlement pattern and location throughout the Coalition and Classic periods (Table 79.1). There exists a developing set of ecological theories revolving around ideas of resilience and complexity, with conceptual models based on Holling's heuristic models of nested adaptive cycles (Holling and Gunderson 2002). In the confines of this project, the information revealed by the first two hypotheses above is employed to test the adaptive cycle models as productive means for exploring and describing the complex SES of the central Pajarito Plateau. Finally, future work is discussed as a direct result of the inability to fully center the Pajarito Ancestral Puebloan system within the framework of adaptive cycles.

Table 79.1. Ancestral Puebloan chronology for the Pajarito Plateau.

Period	Dates
Early Developmental	AD 600 to 900
Late Developmental	AD 900 to 1150
Early Coalition	AD 1150 to 1250
Late Coalition	AD 1250 to 1325
Early Classic	AD 1325 to 1400
Middle Classic	AD 1400 to 1550
Late Classic	AD 1550 to 1600

The Pajarito Plateau is a series of interconnected mesas, and as such is a relatively bounded system of high- and low-elevation flat lands, amenable to agriculture but subject to annual climate fluctuation. The region covers approximately 700 square km (270 square miles) and ranges in elevation from 1500 to 3000 meters (4920 to 9840 feet). It is bounded by Santa Clara Canyon to the north, Cochiti Canyon to the south, the Jemez Mountains to the west, and the Rio Grande to the east (Vierra et al. 2002:195). The Pajarito Plateau, as a geographically bounded system, provides an ideal opportunity to examine local pueblo aggregation as well as the functioning of adaptive cycles. Events such as initial occupation and abandonment—critical to panarchy, or nested adaptive cycles—are apparent from the material record. It is essential to test the Pajarito Plateau data against a heuristic model of adaptive cycles at multiple scales, following Holling et al. (2002). The patterns of aggregation throughout northern New Mexico and southern Colorado suggest that at a super-regional level, aggregation may have been cyclic with migration serving as the destruction/reorganization phases of Holling's adaptive cycle discussed below.

METHODS AND THEORY

The key challenge for models of resilience and adaptation in the Southwest is to determine the scale at which to view cycles of agricultural intensification, aggregation, demographic change, and migration to eliminate noise but capture the system as a whole. Pueblo aggregation cannot be understood by simply assessing the movement of individual households. Detail of individual households will likely be necessary, but it is the system as a whole that develops aggregation, in turn causing changes in population size, agricultural strategies, and migration. The entire plateau region must be addressed to understand the processes driving the formation of large pueblos throughout the Rio Grande Classic period.

Testing Pueblo Aggregation

This research builds on the work of Schiffer (1976) and Reid et al. (1975) who developed principles of behavioral archaeology to frame the material record of the past in terms of past and present human behavior and its impact on the environment. Cordell et al. (1994) and Orcutt (1991) proposed that settlement relocation and aggregation at the end of the Coalition period was, at least in part, due to decreased precipitation, because the events coincide in time. Strategies 1 and 3 of the four behavioral archaeology strategies are of importance here, because they deal with the use of past material culture to understand past (Strategy 1) and present (Strategy 3) human behavior. Strategy 1 of behavioral archaeology properly addresses Cordell et al. (1994) and Orcutt's (1991) formulation of these assumptions that dictate the change in settlement patterns. While their conclusion may be appropriate and logical, there could be other driving factors as well. Models of aggregation and the processes driving it in the Southwest will be useful for analyzing aggregation or similar settlement patterns in other archaeological systems. Thus Strategy 3 becomes important to the question of aggregation, for through the analysis of the Pajarito populations in terms of adaptive cycles, the research uses the material record about the past to make statements of wider applicability throughout various systems in the past and present. Like other questions posed and addressed through Strategy 3 (Reid et al. 1975:865), general processes of aggregation may exist with the potential to be identified through the study of individual instances. Those with high data resolution, like the case on the Pajarito Plateau, provide the most promise for developing general laws about aggregation.

Panarchy: Adaptive Cycles for an Ecological Perspective

Within archaeological research, there is a growing concern with connecting the behaviors of people in the past to those in today's world. Holling (1973) and Gunderson and Holling's (2002) theory of nested adaptive cycles, or *panarchy*, seeks to explain resilience of natural ecosystems. The adaptive cycle is divided into four phases: exploitation or rapid growth (r), conservation (K), release or destruction (Ω), and reorganization (α). Panarchy is applied to socio-ecological systems (Carpenter et al. 2001; Holling et al. 2002; Westley et al. 2002) to explain resilience of human systems to ecological disturbance and vice versa. Though the adaptive cycles likely will not *explain* the variation observed through time on the Pajarito Plateau, they may provide a framework within which patterns may be observed to fit, or not fit, the expected cyclic patterns.

The long time-depth of archaeological systems combined with the high-resolution data on the Pajarito Plateau makes these Ancestral Puebloans ideal for testing against the panarchy model, especially as they operate at and across multiple scales (Levin 1992). If fitted to a panarchy, the Pajarito Plateau story (Figures 79.1 and 79.2) may appear as follows. Exploitation is a phase of economic optimization, and where the adaptive cycle would have "flipped" into a mode of agricultural production in the prehistoric Southwest. On the Pajarito Plateau, agricultural groups are moving toward the conservation phase by AD 1150. During this phase, small pueblo sites develop at low- and high-elevation mesas, capitalizing on widespread precipitation and varying levels of soil nutrients. Populations reach carrying capacity during this phase, and beginning around AD 1250 or 1275, a brief release phase occurs, potentially at the hands of the Great Drought (AD 1276–1299). Immediately, the Puebloans would begin a phase of restructuring. It is within this phase that aggregation occurs, as a response to either the massive release of resources during the Great Drought, or more likely the immense immigration of Puebloans from the San Juan Basin to an already depleted Pajarito Plateau resource area.

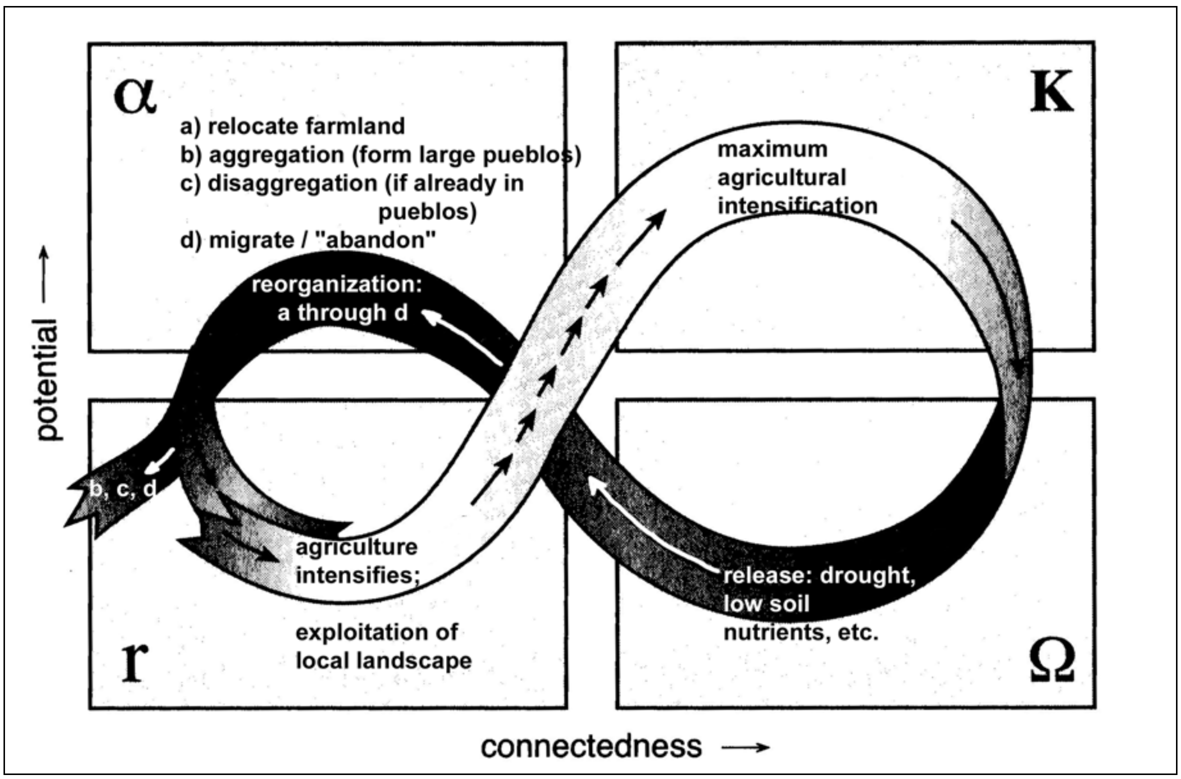


Figure 79.1. Adaptive cycle for village farming societies in the U.S. Southwest (adapted from Holling and Gunderson 2002:34, Figure 2-1).

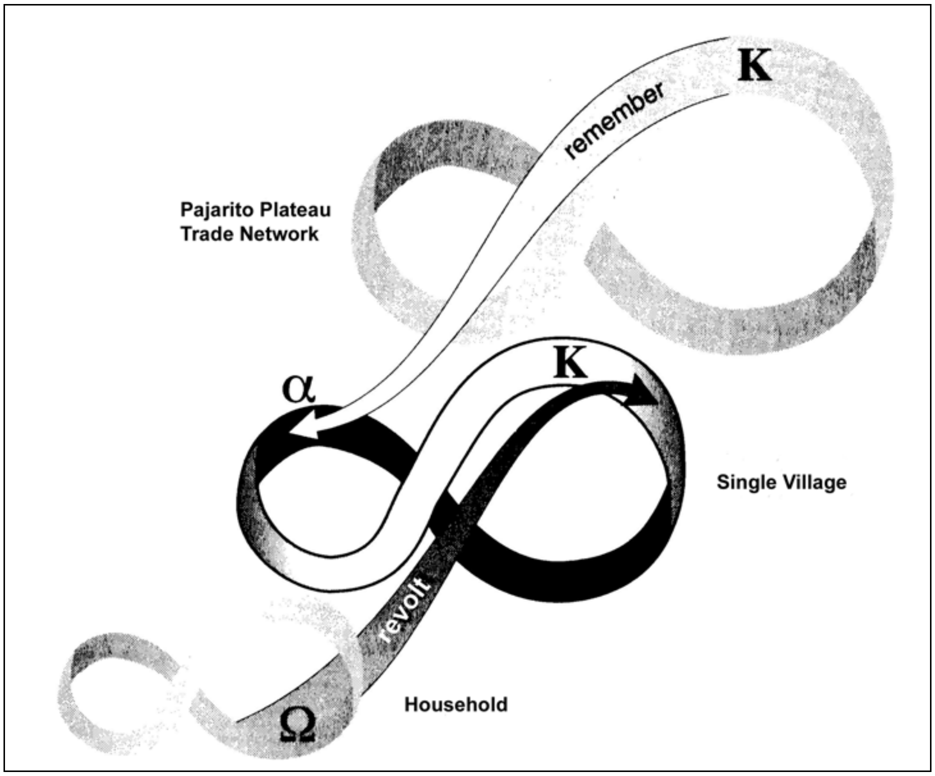


Figure 79.2. A panarchy representing the multiple levels of adaptive cycles for the pre-aggregated Pajarito Plateau (adapted from Holling et al. 2002:75, Figure 3-10).

The questions raised by an adaptive cycle relate to causes of change at the end of each phase and to the potential lack of a second cycle on the Pajarito Plateau. Cordell (1989) and Orcutt (1991) argue for a reorganization of massive pueblos at low elevations during the AD 1300s as a direct result of climate change. However, there is evidence for an aggrading environment (AD 1295–1330; see Chapter 7, Volume 1) following the Great Drought, suggesting that social factors must have influenced the continued organization into aggregated pueblos—one such idea is that of populations migrating out of southern Colorado and western New Mexico, where Puebloans had established cliff dwellings and large pueblos before abandoning them by AD 1300.

The Pajarito Plateau archaeological environment provides data rich with potential for testing the emergence and dissolution or migration of an agricultural society against the assumptions included in framing the system within Holling's adaptive cycles. Single households, villages, trade networks, and migration patterns may serve as the multiple spatial scales necessary to test the cyclic nature of human behavior, while growing seasons, generations, and settlement relocation in pre-state agricultural societies of the Southwest should provide the multiple temporal scales.

Holling's adaptive cycle model will be tested through the analysis of settlement patterns and change through time as the Pajarito farmers develop aggregation. As shown in Figures 79.1 and 79.2, there are multiple processes operating at each stage of the cycle, and various cycles occurring at different scales. To disconfirm the adaptive cycle model, it may be necessary to show that the cycle does not repeat, and therefore is not a cycle at all, rather a trajectory.

Additionally, it may be possible to show that the Great Drought did not constitute a great enough drain of resources to influence the reorganization phase. If this is the case, then it is social, not ecological, properties driving reorganization into aggregated pueblos, suggesting that the Pajarito system follows some other adaptive process uncaptured by Holling's model.

Data, Resolution, and Application

Agriculture on the Pajarito Plateau began between AD 900 and 1150 as small-scale horticulture, and was thoroughly established by AD 1150 at the start of the Coalition period. Throughout this time, population growth steadily increased followed by decreased precipitation during the mid to late 1200s culminating in the 'Great Drought' throughout the region. This period is also when the plateau experiences its greatest population growth rate and the beginning of major pueblo aggregation. By AD 1325, the beginning of the Classic period, nearly all agriculturalists occupying the plateau lived in a few large (>300 room) pueblos, as opposed to the more abundant smaller roomblocks (8 to 30 rooms, with a maximum around 100 until the large, 200- to 250-room structures appeared during the latest Coalition period) consistent throughout the Coalition period (Vierra et al. 2002). Through high-resolution LANL data, it is possible to test ideas relating to adaptation and resilience in the prehistoric American Southwest.

Cultural Resource Information

The research presented here uses existing field survey and excavation data as well as various sources of climate and landscape information for the Pajarito Plateau. The Conveyance and Transfer (C&T) Project involved excavation of nearly 30 fieldhouses, several pueblo roomblocks, and field survey and site recording on several thousand acres of land on the Pajarito Plateau. These sites comprised agricultural period artifacts and structural materials, much from the Coalition (AD 1150–1325) and Classic (AD 1325–1600) periods. The fieldhouses and pueblo roomblocks are a large portion of the current investigation of settlement pattern on the plateau to determine causes of aggregation and provide glimpses into the daily lives of village farmers. Grid gardens and check dams provide useful information about where the Ancestral Puebloans were routinely farming and where they may have avoided with relative consistency. The C&T Project added to an existing substantial database generated by past archaeological research on the plateau. These investigations include those before LANL by Hewett (1904, 1905, 1906, 1908a) and Wilson (1916, 1917, 1918b); and the LANL-era investigations conducted by Steen (1977, 1982), Worman and Steen (1978), and the Pajarito Archaeological Research Project (PARP) led by Hill (Hill et al. 1996). Additional investigations on the Department of Energy's LANL property have been conducted until the present under the supervision of various LANL archaeologists (Vierra et al. 2002; Vierra et al. 2006). The cultural resource database lists sites by their standard attributes (location, area, survey name, eligibility) as well as classifies each by type (Table 79.2) and likely affiliation (Table 79.3).

Table 79.2. Archaeological site type categories present at LANL and used in this research (Vierra et al. 2006:183–185).

Type	Description
Cavate	Isolated, multi-roomed contiguous, or adjacent groups of rooms that are carved into cliff faces within the Bandelier Tuff geological formation.
Complex or plaza pueblo	One or more pueblo roomblocks enclosing a plaza; generally (but not always) larger than pueblo roomblocks.
Pueblo roomblocks	Contiguous, multi-roomed habitation structures of more than four rooms, lacking a plaza, and constructed of adobe, jacal, or masonry.
One- to three-room structures	Small surface structures, consisting of rectangular or D-shaped rock alignments, no more than three rooms, and constructed of unshaped dacite cobbles or shaped and unshaped tuff blocks. Often referred to as “fieldhouses.”

Table 79.3. Temporal affiliation categories assigned to LANL archaeological sites (Vierra et al. 2006:180).

Affiliation	Dates	Comments
Coalition	AD 1150–1325	The majority of LANL Ancestral Puebloan sites fall within this period; first widespread agricultural success, beginning of aggregation at end of 1200s.
Late Coalition/ Early Classic	AD 1250–1400	Overlaps Coalition and Classic periods, generally used for sites that are confirmed multi-component after excavation, or whose surface deposits are deemed to span both periods based on survey (i.e., presence of multiple painted wares, especially Wiyo Black-on-white [see Chapter 76, this volume]).
Classic	AD 1325–1600	Major settlement reorganization during this period, when aggregation into a few large plaza pueblos occurred.

Ecological Information

The data pertinent to this project include elevation (LIDAR data as a digital elevation model at a cell resolution of 16 feet), paleoclimate (annual precipitation reconstructed from tree-ring indices for AD 680 through 2002; see Chapter 7, Volume 1; Dean and Robinson 1977) soil samples and types across the plateau, hydrology, and vegetation/land cover. Department of Energy/LANL owns the majority of the central Pajarito Plateau (north of Frijoles Canyon), which is the area of interest for this research.

Methodological Applications

The open source GRASS geographic information system (GIS) program (GRASS Development Team 2006) is used to operationalize the data and analyze potential settlement patterns within the Pajarito system. These localized interpretations are available for multiple regions in the Southwest, providing insights into cross-cultural similarities in pueblo social organization, response to changing climate, and population dynamics. The GIS framework of settlement pattern analysis will become the foundation for building an agent-based model of individual household interaction (Box 2002; Kohler et al. 2005; Lim et al. 2002). An agent-based model applied in this fashion will allow for intensive experiments with control over agent behavior, landscape change (i.e., erosion or modification by humans), and climate factors, while providing the possibility for emergent properties of the archaeological system as a complex adaptive system (Lansing 1991, 2003).

Humans adapt not only to their perception of the environment, but also to the cultural system in which they live. Puebloan society transforms due in part to climate response and in part to the growing complexity of society through pueblo interactions, religious beliefs, and changing community dynamics of cooperation and trade. Societies generally only adapt to the extent that is necessary based on changing conditions (Trigger 1995:450), and what they leave behind forms the archaeological record, which anthropologists must make sense of to determine the extent of adaptation required by the past populations.

Data Shortcomings

It is critical to bring to the forefront two issues with the archaeological data used in conducting statistical tests and creating models throughout this research. First, archaeological sites lacking a constrained chronological period are not included in the analyses. Table 79.1 contains the broadest scale chronological information deemed acceptable for inclusion. Various sites in the LANL database have been coded as “Undetermined Prehistoric” or “Undetermined Anasazi” and as such are not useful to the present analyses. Second, there seems to be some difficulty in ascribing chronological time ranges of Coalition or Classic period based on surface surveys using ceramic seriation, considering the abnormally long ranges of painted wares such as Santa Fe Black-on-white. This ceramic type, for example, spans 200+ years and overlaps the Coalition and Classic periods considerably, causing considerable haze during the Late Coalition/Early Classic transition, especially if other ceramic types were not sufficiently visible on the surface. Included in future work for this project will be a return to the original field notes of the Steen, PARP, and other LANL surveys to attempt to bring further chronological control to some of the sites, particularly those currently defined as undetermined thus far.

Geographic Location and Culture Change

As stated above, it has been proposed through past research on the Pajarito Plateau (Crown et al. 1996; Hill and Trierweiler 1986; Hill et al. 1996; Vierra et al. 2006) that the mean elevation of agricultural structures increases through time. Specifically, Preucel (1986) suggests that there is an observable shift to higher elevations during the Classic period, potentially suggesting movement into the uplands to aid in capturing moisture for agricultural purposes.

Using the LANL cultural resources database within GRASS, sites were separated into different files based on the site type and affiliation classifications (see Tables 79.2 and 79.3). Only those sites with assigned cultural affiliation were used for these analyses. Out of a total of 823 sites meeting these criteria, 422 are Coalition period roomblocks or cavates with more than three rooms (Figure 79.3), 146 are Coalition period one- to three-room structures (Figure 79.4), 53 are Late Coalition/Early Classic structures with more than three rooms (Figure 79.5), 46 are Late Coalition/Early Classic one- to three-room structures (Figure 79.6), 37 are Classic period structures with more than three rooms (Figure 79.7), and 98 are Classic period one- to three-room structures (Figure 79.8). These data and the other site types are summarized in Table 79.4. For purposes of calculations, sites are grouped as either large sites (those with four or more rooms, including all types of pueblos and cavates that have been identified as contiguous) or small sites (those with one to three rooms). These categories are intended to avoid bias between functionality of sites as well as differences in the actual occupants of sites; therefore, all rooms are equal in the initial assumptions, as in Orcutt's momentary population calculations (1999).

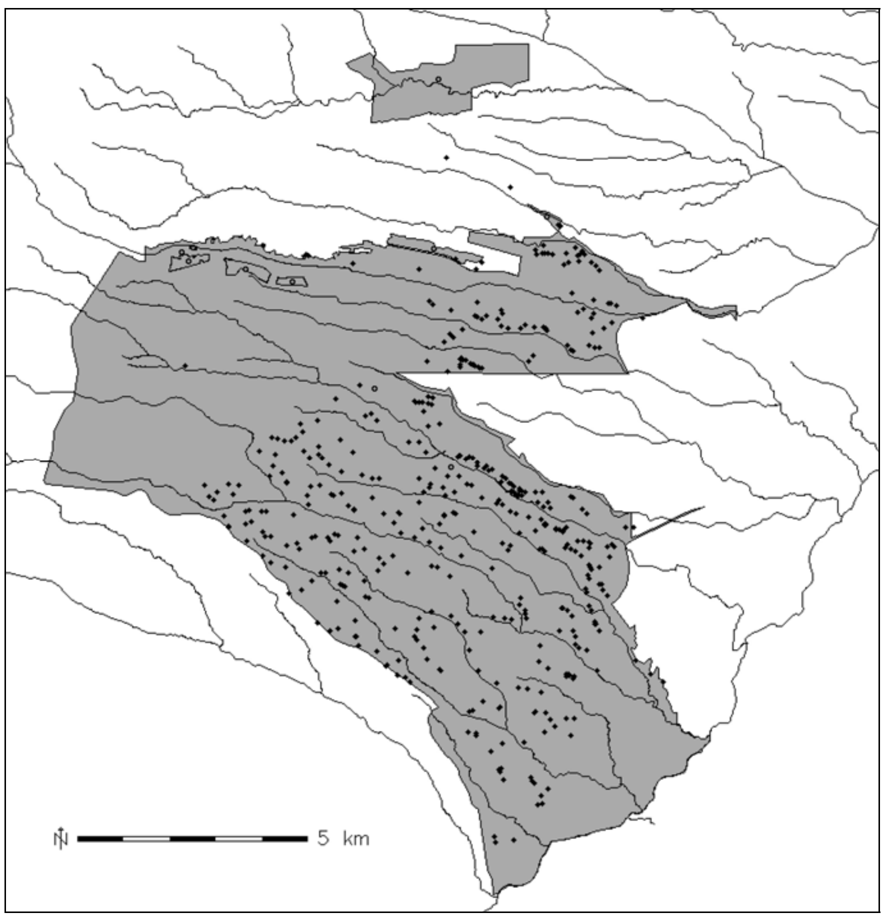


Figure 79.3. Coalition period pueblos with more than three rooms. LANL region shaded.

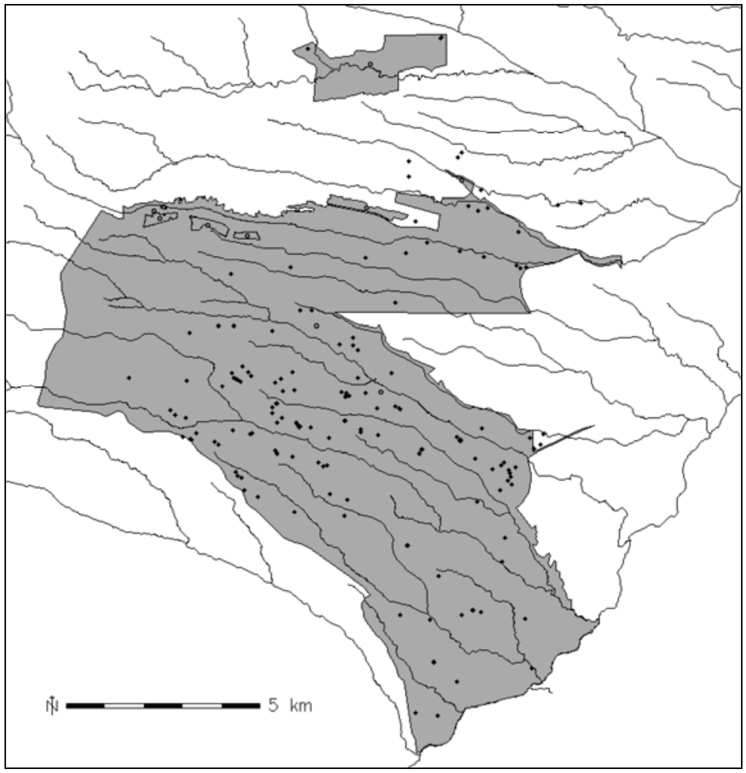


Figure 79.4. Coalition period small (one- to three-room) structures.

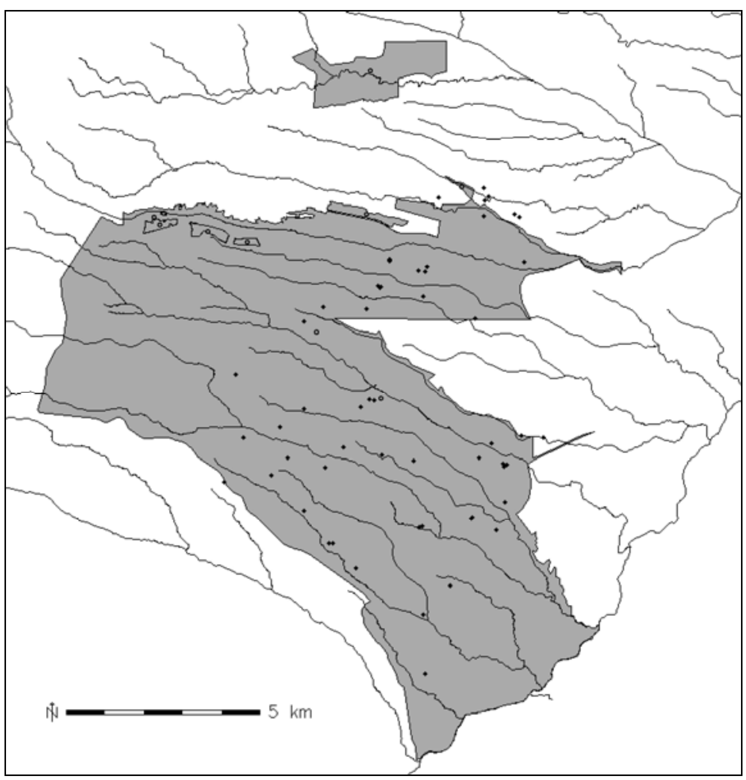


Figure 79.5. Late Coalition/Early Classic period pueblos with more than three rooms.

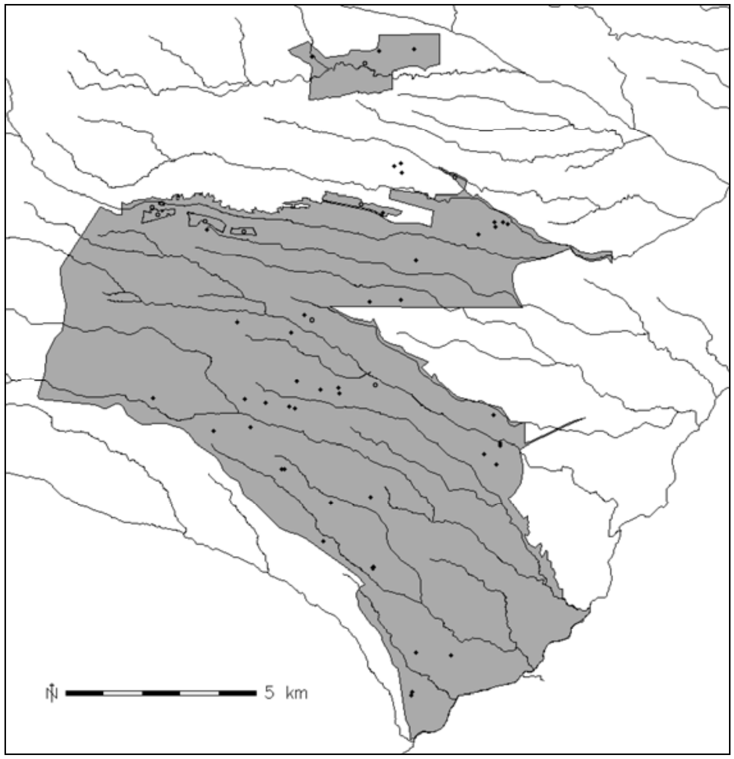


Figure 79.6. Late Coalition/Early Classic period small (one- to three-room) structures.

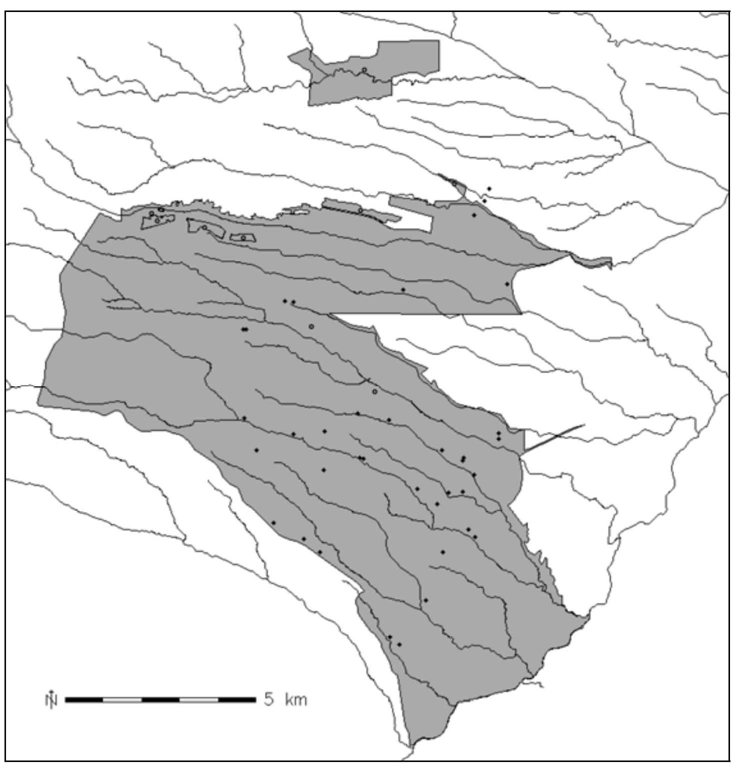


Figure 79.7. Classic period pueblos with more than three rooms.

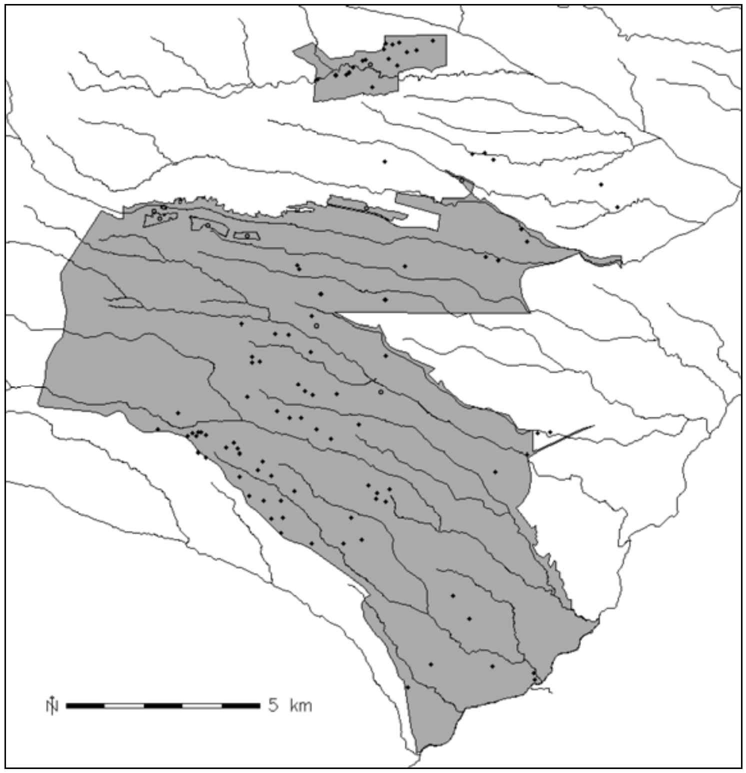


Figure 79.8. Classic period small (one- to three-room) structures.

Table 79.4. Relevant categories and summary statistics of identified archaeological sites.

Period	Type	Sites (*n*)	Mean Elevation (ft)	Number of Rooms (number of sites with estimates)
Coalition	Small (1 to 3 rooms)	146	6864	261 (n = 146)
	Large (>3 rooms)	422	6778	5159 (n = 293)
Late Coalition/ Early Classic	Small (1 to 3 rooms)	46	6865	69 (n = 46)
	Large (>3 rooms)	53	6773	1104 (n = 33)
Classic	Small (1 to 3 rooms)	98	6898	164 (n = 98)
	Large (>3 rooms)	37	6694	1706 (n = 10)

Testing the Change in Agricultural Site Elevation

After computing the mean elevation for each individual site (due to the fine grid resolution of the digital elevation model), it was possible to test Preucel's observation of a change in elevation through time on the Pajarito Plateau. Table 79.5 presents a summary of the frequency of archaeological sites in the same elevation zone categories as in Hill and Trierweiler (1986:Table 7), using the current archaeological site database of categories and types. Brief visual inspection of the table suggests that there is a slight shift in number of sites to higher elevations, but this is based on the assignment of categories with intervals of 350 feet and somewhat arbitrary breaks.

Table 79.5. Frequency of sites by elevation and period, using elevation categories from Hill and Trierweiler 1986:Table 7 and Vierra et al. 2006:Table 9.4). Includes water control and grid garden sites (*n* = 21).

Elevation (m)	Coalition	Late Coalition/ Early Classic	Classic	Elevation (ft)
2400+	0	0	0	7900+
2300–2400	0	0	0	7550–7900
2200–2300	41	5	13	7220–7550
2100–2200	189	38	61	6900–7220
2000–2100	207	37	34	6550–6900
1900–2000	142	22	29	6200–6550
below 1900	2	0	3	below 6200
TOTAL	581	102	140	--

Given the large number of sites within each category, it was determined that formal hypothesis testing should result in the ability to say whether or not the mean elevation of sites actually changed between the Coalition and Classic periods. Two hypotheses were interpreted from the prior hypotheses of Hill and Trierweiler (1986), and they are as follows:

Null hypothesis 1: The mean elevation of all Coalition period sites (μ_1) is equal to the mean elevation of all Classic period sites (μ_2).
Alternative hypothesis 1: $\mu_1 \neq \mu_2$

Null hypothesis 2: The mean elevation of Coalition period small sites (one- to three-room structures; μ_3) is equal to the mean elevation of Classic period small sites (μ_4)
Alternative hypothesis 2: $\mu_3 \neq \mu_4$

Table 79.6 provides a summary of the means, sample sizes, and results of the independent sample tests. In each of these cases, the independent samples test failed to produce a significant result, meaning that currently there is not enough evidence to suggest a change in elevation between the Coalition and Classic periods on the Pajarito Plateau (see also Figures 79.9 and 79.10). It is even more important to note that a misleading feature of Table 79.5 (constructed using the same categories as Hill and Trierweiler 1986:Table 7) is that the observable elevation shift may be due to the fact that the mean elevation for small fieldhouse sites is 6898 feet, and the table breaks elevation at exactly 6900 feet.

Table 79.6. Statistical results of hypothesis testing for mean elevation change of agricultural sites between the Coalition and Classic periods.

Hypothesis	Period	*N* (sites)	Mean Elev. (ft)	St. Dev.	*t*-value	*p*-value
1) All sites	Coalition	581	6798.56	284.86	-1.278	0.202
	Classic	140	6833.96	329.95		
2) Small sites	Coalition	146	6863.94	325.00	-0.803	0.423
	Classic	98	6898.70	340.98		

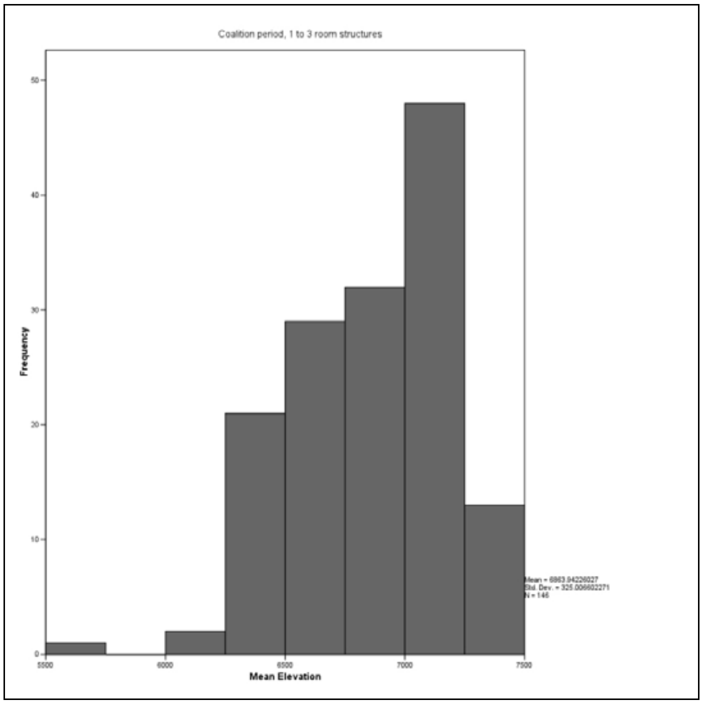


Figure 79.9. Distribution of Coalition period one- to three-room structures with respect to elevation.

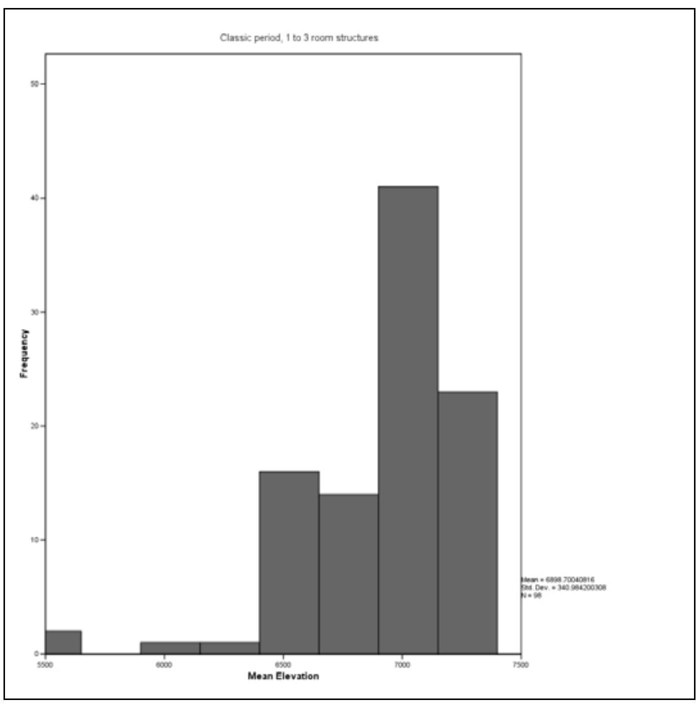


Figure 79.10. Distribution of Classic period one- to three-room structures with respect to elevation.

One may question the ability to reject outright the claims of elevation change in the Classic period, and there certainly may be evidence of an increase in elevation *during* the Classic period, but the chronological resolution for the majority of surveyed sites does not allow the assessment of a more refined chronology than that presented in Table 79.2. Perhaps most important is to note that these tests merely refute the claim that central Pajarito farmers relocated to higher elevations through time *on the central Pajarito Plateau*. The section on population modeling, discussed below, reiterates Crown et al. (1996:195–197) and Orcutt (1999) in showing that population declines sharply on the central Pajarito, with approximately 85 percent of its population moving to the southern Pajarito and, therefore, to lower elevations.

Exploring Other Geographical Features of the Pajarito System

Due to the failure to accept alternative hypotheses about changing elevation through time, it became necessary to conduct a series of exploratory statistical tests so that other features of the landscape that potentially correlate with cultural adaptation were not overlooked based on prior hypotheses.

These tests include two other strictly geographical relationships on the landscape: the geographic distance of each site to the nearest major drainage, and the average slope (degrees) of each site. Hypotheses similar to those for elevation were constructed for each of these variables, resulting in, again, no significant relationship between time and the geographic distance to the nearest drainage. Multiple reasons for a lack of relationship exist. First is the possibility that there truly is no change in the distance of sites to the nearest drainage. Alternatively, since direct Euclidean distance was used for these calculations, it is possible that the landscape has not been accounted for properly regarding cost to travel into, and back out of, canyons to carry water.

A comparison of slope, however, suggests a very strong significant decrease ($t = -6.37$, $p<0.001$) from the Coalition to the Classic periods for the location of sites larger than three rooms. The cultural significance of this change has not yet been investigated, and the substantial difference in number of sites (Coalition = 422, Classic = 37) generates some cause for concern, because the cavate rooms during the Coalition period are outliers (cavates are located in places with the highest slopes) but during the Classic period, they are not. However, Levine's statistic confirms that equal variance in the means can be assumed, given the distribution of the slopes for the two periods. Even without the assumption of equal variance, the test statistic remains significant. To confirm this, a Mann-Whitney test and a Kolmogorov-Smirnov test were conducted, both resulting in significant ($p<0.001$ in both cases) differences between the Coalition and Classic period slopes. As these tests were not originally part of the hypotheses under consideration, they are not explored in more detail here for cultural significance, but they do produce a thought-provoking argument that site location choice shifted at the end of the Coalition period, perhaps in connection with increasing population density and a more stressed environment. On the contrary, the difference could simply be a relic of the small number of large sites during the Classic period. Understanding the relationship between elevation, slope, and distance to major year-round water sources is inherently conjoined with the concept of aggregation on the Pajarito and throughout the U.S. Southwest.

The final missing piece, which is substantial in relation to the tests conducted on large sites, but not so much in connection with those on small sites, is the lack of Tsankawi in the current database, as it is a large Classic period pueblo on the northern Pajarito Plateau but is part of Bandelier National Monument, not LANL. The data for the northern portion of Bandelier have recently been acquired and will be recoded and entered into these tests. However, as the location is on the eastern end of the plateau, the lack of significance between agricultural sites and increased elevation is not likely to change.

Demographic Models of the Northern Pajarito Plateau

Following Orcutt (1999) and Newcomb (1999), it was desirable to subject the current LANL database of sites to the same population estimate models to which the PARP data had been subjected (Orcutt 1999). Past investigators of LANL sites estimated room counts while surveying, and excavated sites have complete counts provided in the field reports. However, the majority of sites recorded in the LANL database lack estimates of room counts; therefore, it was first necessary to develop a methodology for converting site size (generally, the mound size created by structural rubble) into number of rooms (the primary statistic used by both Orcutt and Newcomb for estimating population in the Southwest).

Average mound size, where available, for excavated sites on LANL property was calculated and then compared with the total number of rooms discovered on the site. Additionally, the average room size including wall width for a number of excavated sites, where this information had been documented, was calculated. The numbers are, of course, rough estimates and should not be used to determine specific numbers of rooms for individual sites, except to then calculate regional room counts. Most variation in mound size and room size will be accounted for at the regional scale. On average, it was determined that there is approximately 1.5 m of extra mound in each direction, so that amount was subtracted from mound length/width measurements before dividing total area by the average room size of 9.6 m^2. This was tested with acceptable accuracy on sites with known room counts, and therefore applied to the rest of the sites in the database that had either site maps or mound size estimates in the field notes or Laboratory of Anthropology site files. In total, it was possible to add room counts for 625 of the 802 sites with identified chronological periods.

Orcutt (1999:220–230) used population models to reconstruct room counts and population from the PARP data (Hill and Trierweiler 1986; Preucel 1986). This involved dividing the chronology of the Pajarito into five periods: Early Coalition (AD 1150–1250), Late Coalition (AD 1250–1325), Early Classic (AD 1325–1400), Middle Classic (AD 1400–1550), and Late Classic (AD 1550–1600). Orcutt standardized the number of rooms per period in order to distribute rooms from sites evenly through time. Figure 79.11 reproduces the chart from the PARP data with respect to roomblock area. Reproducing Orcutt's methods as described for number of rooms (1999:224–225), the shape of the curve remains nearly identical (Figure 79.12) even with the addition of hundreds of sites to the database since the PARP. (The sites with room counts in the current database now cover approximately 48% of LANL land. This is lower than the actual amount of LANL land that has been subjected to archaeological investigation, because room counts for 30% of the pueblos are not available at present.)

Figure 79.11. Roomblock area for PARP survey (after Orcutt 1999:Figure 5.1).

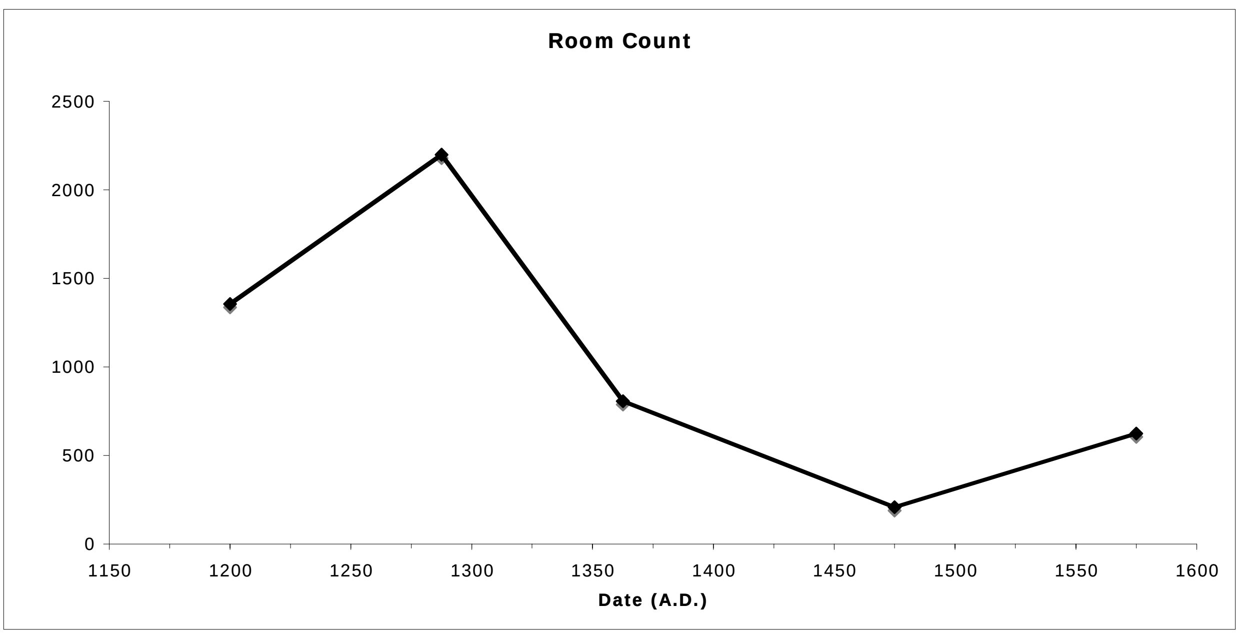


Figure 79.12. Room count on LANL region based on Orcutt (1999) room distribution methodology.

Various methods exist for estimating momentary population from room counts (Newcomb 1999; Orcutt 1999; Plog 1974; Preucel 1990). Following Orcutt (1999:225–229), use-lives of 15, 35, and 50 years were used for the Coalition, Late Coalition/Early Classic, and Classic periods, respectively. Occupancy rates, or the percentage of rooms in use during each specific period, were estimated at 100 percent, 80 percent, and 50 percent for the same respective periods. These numbers were justified by Orcutt (1999:226) as the result of archaeological testing throughout the Southwest. Orcutt lists alternate use-lives and occupancy rates for calculating minimum and maximum populations, but these are not applied at present, given the desire of strictly testing the robustness of the PARP population estimates. Following Kintigh (1985:105) and Schlanger (1988:783), the equation for calculating momentary population is

$$\text{momentary population} = \frac{(\text{num. rooms x occupancy rate) x use - life}}{\text{length of period}} \text{ x people per room} \qquad (1)$$

Five different curves were generated for the LANL Pajarito Plateau, one using Orcutt's five periods (Figure 79.13) and four using the following methodology described by Newcomb (1999; Figure 79.14), all with the same equation (1). The projected population in Figure 79.13 is based on dividing momentary population by 0.48, the approximate percent of surveyed LANL property with room count estimates.

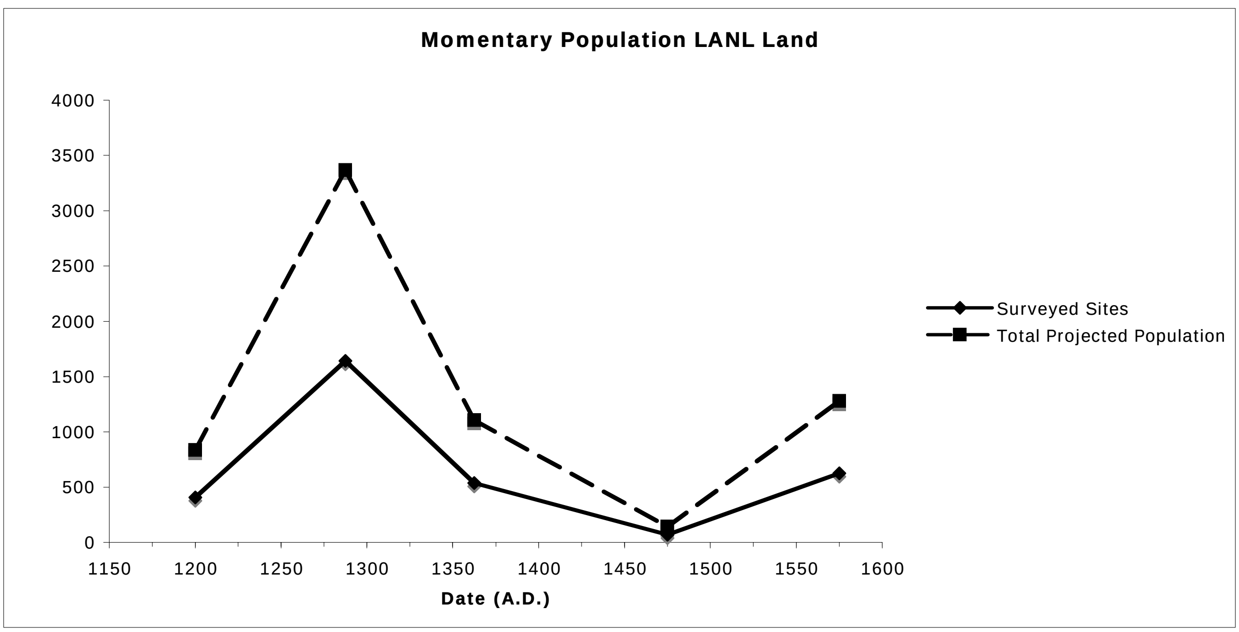


Figure 79.13. Momentary population estimates for LANL region using Orcutt's (1999) methodology

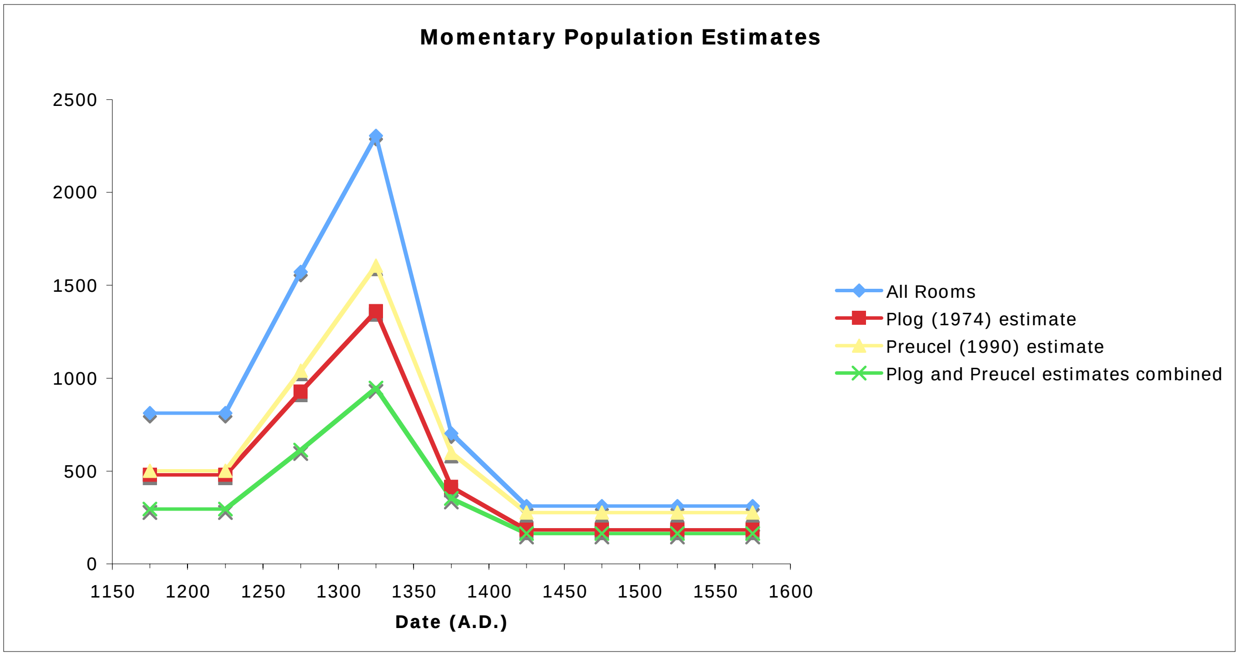


Figure 79.14. Momentary population estimates for LANL region using various strategies: 1) based on all rooms in region; 2) based on removal of 41 percent of rooms (Plog 1974); 3) based on removal of sites smaller than four rooms per period (Preucel 1990); 4) combination of Plog (1974) and Preucel (1990).

Rather than divide the time scale into the five unequal periods of culture chronology, Newcomb advocates dividing the entire span into equal 50-year intervals, and dividing the number of rooms for each site evenly across the periods. For example, a site defined as Coalition period with 40 rooms would result in 10 rooms in each range of 50 years (from AD 1150–1200, 1200–1250, 1250–1300, and 1300–1350). A site defined as Late Coalition/Early Classic with 60 rooms would result in 20 rooms each from AD 1250–1300, 1300–1350, and 1350–1400. The use-lives and occupancy rates remain consistent with Orcutt's, and people per room in all cases is constant at two, again consistent with Orcutt's assessment for the Pajarito Plateau (Orcutt 1999:226).

The variation in population estimates based on Newcomb's calculations is due to several realizations and corrections of assumptions (Newcomb 1999:40–41). First, it is highly unlikely that throughout the study region there was year-round occupation of all rooms every year. Second, seasonal occupation of small sites, such as the extremely large number of one- to three-room structures, has the potential to nearly double the population during the Early and Late Coalition, and make the population appear 10 percent to 15 percent larger throughout the Classic period. Finally, Orcutt's initial population reconstruction, and the curve based on it in this study (see Figure 79.13), assumes that all rooms are habitation rooms.

Plog (1974) and Newcomb (1999:43–44) proposed that after AD 1150, 41 percent of rooms should be subtracted from the total, to account for seasonality, storage, and manufacturing rooms. Doing so produces the second curve in the legend of Figure 79.14. Preucel (1990:165) suggests that small sites may act as territorial markers rather than habitation sites, and Newcomb

(1999:44-45) also argues that the removal of small sites (less than four rooms per 50-year period), especially after aggregation occurs, may help to account for this. The third curve in Figure 79.14 reflects the removal of small sites. Combining the propositions by Plog and Preucel, the fourth population curve is produced, which greatly reduces the overall population, but also reduces the drastic increase at AD 1325, and subsequent sharp decline post-1325. Figure 79.15 shows the momentary population of the entire LANL region, divided by the 48 percent survey value. Figure 79.16 shows the same line, but smoothed.

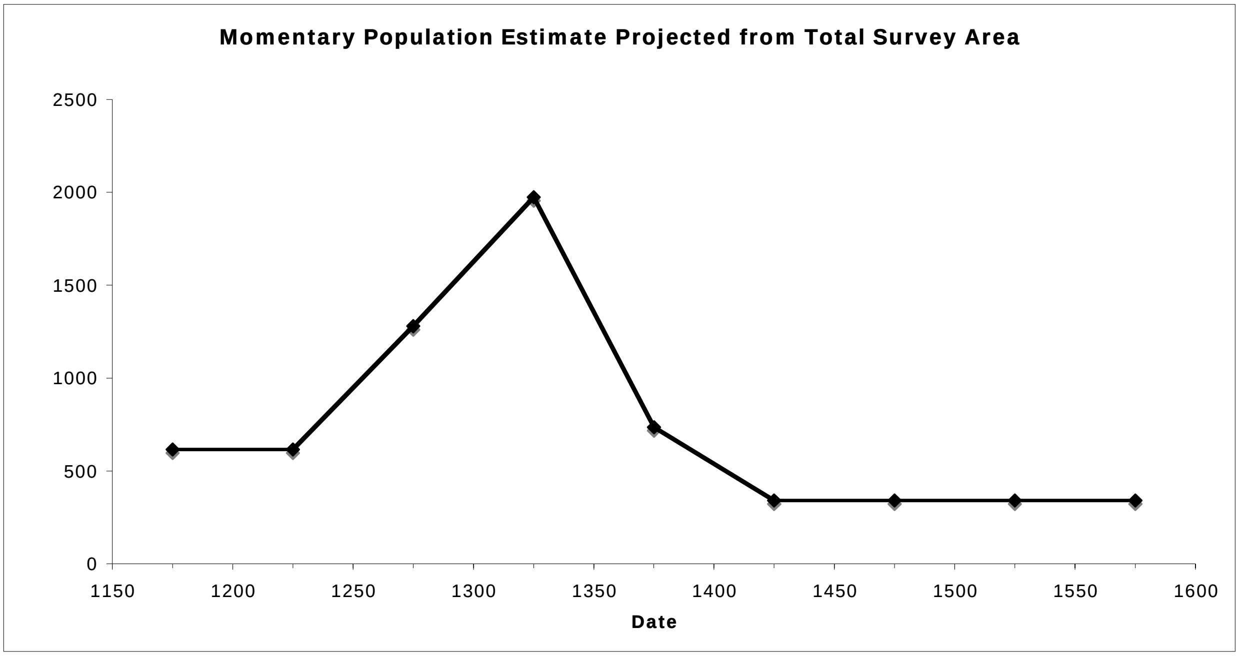


Figure 79.15. Momentary population estimate for LANL region, projected for the entire LANL-owned property, both surveyed and unsurveyed, based on the combined Plog (1974) and Preucel (1990) population estimate method.

All of the curves reflect the same basic population trajectory; it should be noted that the population of the Classic period should be adjusted upward to account for Tsankawi—as noted above, the sites in the Tsankawi member of Bandelier National Monument will be added to the database in the near future. The importance of determining accurate representations of momentary population enters the picture as the intended models based on these data become more complex. Once the methods for reconstructing population are proven to be robust, they can be used within later modeling techniques to distribute agents on the landscape. Additionally, the amount of space "leftover" from the total number of rooms available provides a starting point for determining if there is enough storage and activity space available for populations of the projected size. Obviously, these numbers will be in constant flux; as number of occupied rooms increases, the number of observed storage rooms decreases even though it is a fact that the amount of storage space should necessarily increase as well.

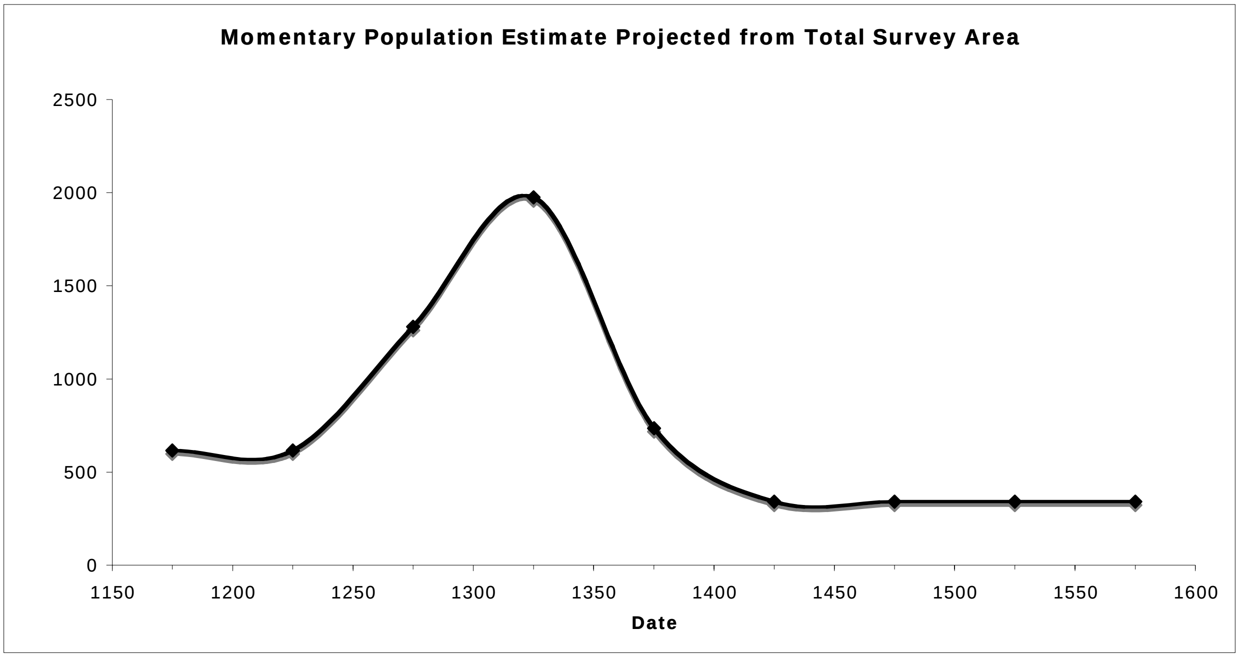


Figure 79.16. Momentary population from Figure 79.15, smoothed through time.

A final note about the room count and population estimates must be stated. There is reassurance of sound information based on the much smaller PARP sample sizes. The curves, though slightly varying, are generally equivalent in trajectory. This is good news for the usual 8 percent to 10 percent surveys that are conducted in most areas.

What Can Adaptive Cycles Reveal about Pueblo Adaptation?

Incorporating these data into the adaptive cycle heuristic model is largely theoretical, but may provide a framework for understanding change on the Pajarito Plateau as more than simple responses to climate change via relocation. The story of the Pajarito system from the Archaic through the Developmental periods (until AD 1150), and likely even through AD 1230–1250, is one of expansion, adaptation, and resource specialization—the r phase of the adaptive cycle (see Figure 79.1). This is known as the period of exploitation, where the species in a given ecosystem are not yet packed. Those occupants—in this case, including Ancestral Puebloans—continue to expand their ecological niche, and in many cases begin to specialize.

However, as this population is, on its own, reaching the K, or conservation, phase, the Great Drought begins *and* there is a migration of the San Juan Basin people to the Pajarito Plateau. This influx of peoples is well-represented by the K phase, given the immediate and widespread impact on the Pajarito environment. This occurs at the same time as the other half of the SES, the environment, is in a period of drought—a LFP (low-frequency process) that is of lower magnitude than droughts that pre- and post-date it; however, the timing of this drought with an influx of people—and therefore an increased stress on wild food resources in addition to resources stored in the soil for agriculture—provided the unfortunate combination of circumstances that caused a rapid release phase (Ω; see Figure 79.1; Figure 79.17; Dean 1988:26–36).

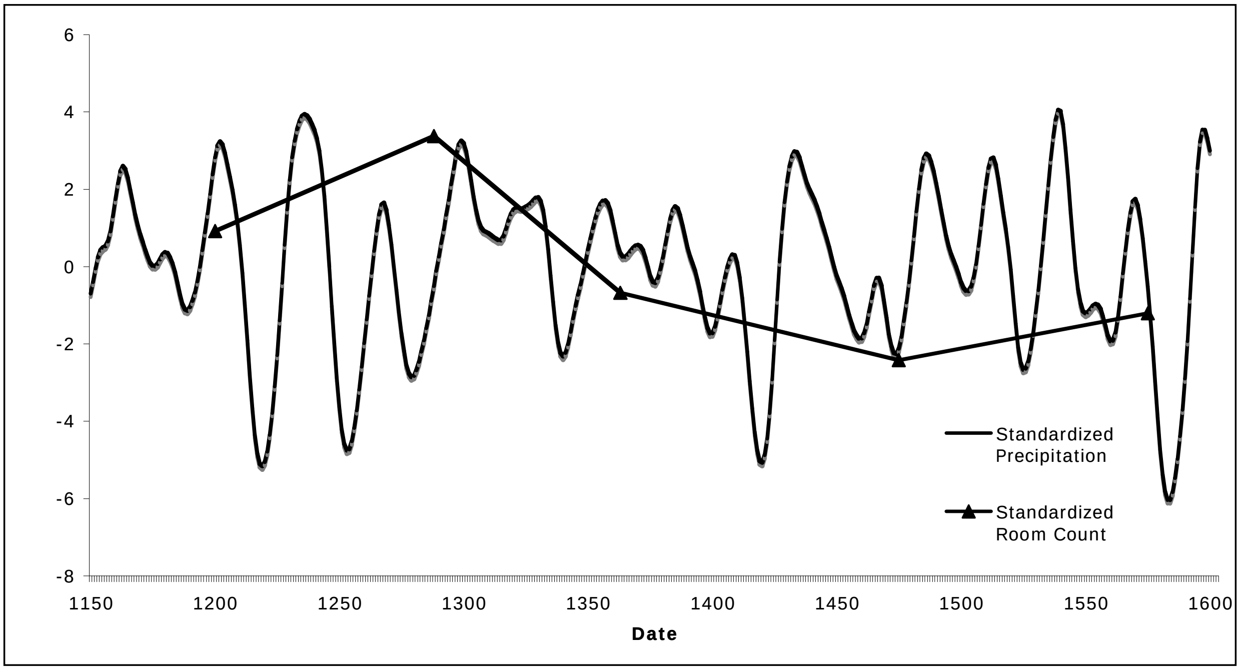


Figure 79.17. Room count for LANL region matched against precipitation reconstructed from tree-ring indices (20-year spline; Chapter 7, Volume 1) shows the greatest population increase for the region during the middle of the Great Drought (AD 1276–1299).

Why did population drop, and so rapidly, after AD 1325? Newton's infamous Third Law proposes that every action is responded to by an equal and opposite reaction—the influx of too many people + a strained environment = one of two things: 1) a decrease of population through out-migration, or 2) at worst, conflict over resources resulting in the death of many people, possibly simply through starvation.

The rapid release, though, also causes an immediate reorganization phase, and the potential for leaving one cycle and entering another. The migrants arrived on the Pajarito Plateau, began building large aggregated communities. After the release, this structure continued to develop, expand, produce more crops, add to storage and surplus when possible, and likely become more selective about where to plant and live each season. The development of more complex social systems of hierarchy, property ownership, common law, and ceremonial activity would have been inevitable.

DISCUSSION

Future work will involve an attempt to piece together this story, especially the bit discussed immediately above. Analysis within the GIS framework using spatial logistic regression models should be able to reveal more descriptive settlement patterns. A major goal will be to identify whether later settlements occupied a more refined, selective subset of the previous Coalition period's wide range of occupied elevation, soil types, geologic landforms, and vegetation communities (Vierra et al. 2006:226).

Would the Puebloans have responded the same under different environmental conditions? Or in a region with very different topography from the undulating finger mesas of the Pajarito Plateau? Agent-based modeling using the GIS framework will reveal much of this information. The understanding of the Pajarito Plateau Puebloan communities as complex systems will aid in developing an understanding of aggregation as a potential, but not necessarily, emergent property.

CONCLUSION

The Pajarito Plateau archaeological study area is a data-rich test area for the analysis of pueblo aggregation against the adaptive cycle model. The time-depth of the archaeological past, combined with the high-resolution nature of archaeological and chronological data in northern New Mexico, provides the essential combination necessary for testing traditional hypotheses of processes driving prehistoric aggregation.

It has been argued that previous hypotheses about changing elevation on the Pajarito Plateau through time are not supported by the current data. The implications of this conclusion are potentially far-reaching, for the continuous occupation of similar elevations creates more questions than it answers. This research also suggests that mean slope of site locations changes through time, and this may or may not be significant to the past cultural behavior; further investigation will inform this idea.

Further models revealing the full range of ecological habitat selection on the central Pajarito are under construction, taking into account regional vegetation, soils, hydrological features, geological formations, reconstructed precipitation, and social variables (including distance to contemporaneous sites and prehistoric trail locations). Models of population size and trajectory are robust and can be confidently used in the next generation of models of Puebloan communities in this region. The demographic models support population trends proposed by PARP (Hill and Trierweiler 1986) data.

Utilizing the demography models within an agent-based model ensures that population is not under- or overestimated differently in each period. With the support of data and models of the Pajarito Plateau system, long-term cross-cultural comparisons should be possible. There are many separate pueblo groups in prehistory that may have been driven to large, aggregated structures by similar processes to those on the plateau, but until these models are formed, tested, and applied elsewhere, the problem will remain unsolved. Additionally, there are various native groups still occupying different niches in the modern Southwest, and these models will lead to a detailed understanding of the scales and processes on which their behavior operates.

CHAPTER 80
ELK REMAINS AT ARCHAEOLOGICAL SITES IN THE SOUTHWESTERN UNITED STAES

Kari M. Schmidt

At archaeological sites throughout the American Southwest, elk (*Cervus elaphus*) remains are often less abundant (or non-existent) relative to other artiodactyl remains (e.g., pronghorn, deer, and bighorn sheep) in faunal assemblages (see Table 80.1). In xeric areas of the Southwest (i.e., lowland areas), this is to be expected given the lack of suitable grassland habitat for elk populations. In more mesic areas (i.e., upland areas), such as is found in the Jemez Mountains and on the Pajarito Plateau, the prehistoric absence of elk is purported to be anomalous since research suggests that habitat composition may have been just as, if not more, favorable to supporting and sustaining elk populations. Some researchers in the northern Rio Grande area have argued that elk were not indigenous to the area, and that they were a recent introduction (Allen 1996, 2004; Bryant and Maser 1982; Eberhardt et al. 1996; Kay 1994; Truett 1996; White et al. 1998).

To address the apparent dichotomy between the expected and observed occurrences of elk at archaeological sites, I conducted an extensive review of the archaeological literature from all areas of the Southwest to see if and where elk remains were recovered in archaeological faunal assemblages. I present the data recovered in the literature review, which show that elk remains were recovered at a number of archaeological sites (Table 80.1), including in areas of the Pajarito Plateau and Jemez Mountains. Elk were identified in a variety of areas in Arizona, New Mexico, Colorado, and Utah. Additionally, occurrences of elk are also noted in both open lowland areas (e.g., the Donaldson site in the Cienega Valley, Arizona, University Indian Ruin in the Tucson Basin, and Bat Cave in New Mexico) and more wooded upland areas (e.g., Mogollon Village in New Mexico, McEuen Cave in Arizona, and many sites in the Mesa Verde/Mancos area of Colorado). Finally, elk were identified in assemblages that span over 9000 years from Early Archaic sites in Colorado to the original Tucson Town Site (1890–1914) in Pima County, Arizona.

Table 80.1. Elk remains at archaeological sites in the southwestern United States.

Location	Citation/Source	Habitat type	Elevation (ft)	NISP[1]	Elements	Date/context	Curation location
Donaldson Site (AZ EE:2:30), Cienega Valley, Arizona	Huckell (1995), Eddy (1958, Table 11)	grassland	4500 (average)	4	Antler	800–400 BC	ASM, Tucson
McEuen Cave (AZ W:13:6), Graham County, Arizona	Schmidt (2001)	Oak-juniper woodland	4400	2	Thoracic vertebra, distal humerus	AD 200 to present; Pit Feature	UNM, Maxwell
Kinishiba Pueblo, Fort Apache, Arizona	Cummings (1940)	P/J	?	4	Antler	AD 1050–1350	?
Tse-Ta'a (White House Ruin), Cañon de Chelly, Arizona	Mathews (1966)	?	?	1	Subadult long bone	AD 1300–1600	?
Tse-Ta'a (White House Ruin), Cañon de Chelly, Arizona	Mathews (1966)	?	?	5*	?	AD 1300–1600	?
Show Low Ruin (AZ P:12:3), Forestdale Valley, Arizona	Haury (1985) citing Hough (1903) and Haury and Hargrave 1931	P/J	?	?	?	AD 1300–1400, Canyon Creek Phase	?
Pottery Hill Ruin, Forestdale Valley, Arizona	Haury (1931) citing Hough (1903)	P/J	?	?	?	AD 1200–1300, Linden Phase	?
AZ O:11:91, Star Valley, Gila County, Payson, Arizona	Lindauer et al. (1991)	Semi-desert grassland	5000	1	?	AD 1000–1350	?
University Indian Ruin, Pantano Wash, Tucson, Pima County, Arizona	Hayden (1957)	Lower Sonoran	2500	?	Long bones, antler, and worked specimens	AD 1200–1400	?
Original Tucson Town	Jones (1997)	Lower	2375	2	Mandible, long	AD 1870–1914	?

Location	Citation/Source	Habitat type	Elevation (ft)	NISP[1]	Elements	Date/context	Curation location
Site, Block 180, Pima County, Arizona		Sonoran			bone shaft		
AZ AA:16:346 (West Branch Site), Pima County, Arizona	Szuter (1986)	Lower Sonoran	2300	3*	?	AD 900–1100	?
AZ BB:2:2 (Big Ditch Site), Arizona	Johnson (n.d.)			4			
AZ EE:2:116, Anamax-Rosemont Project	Glass (1984)			1*			
Gayler Ranch, AZ EE:2:76, Anamax-Rosemont Project	Glass (1984)			4*			
Ballcourt, AZ EE:2:105, Anamax-Rosemont Project	Glass (1984)			22*			
Bumblebee, AZ EE:2:113, Anamax-Rosemont Project	Glass (1984)			10*			
AZ EE:2:129, Anamax-Rosemont Project	Glass (1984)			1*			
Dairy Site (AA:12:285), Pima County, Arizona	Szuter (1987)			4*		Early Colonial Period	
Hodges, (AA:12:18), Pima County, Arizona	Yoshikawa (1986)			3*			
Las Colinas AZ T:12:10	Szuter (1989)			15*			
El Polvoron AZ U:15:59, Salt Gila Aqueduct Project	Szuter (1984a, b)			2*			
Las Fosas AZ U:15:19	Szuter (1984a, b)			94*			

Location	Citation/Source	Habitat type	Elevation (ft)	NISP[1]	Elements	Date/context	Curation location
Tanque Verde Wash, (BB:13:68), Pima County, Arizona	Szuter and Brown (1986)			1*		Tanque Verde Wash I	
Tanque Verde Wash, (BB:13:68), Pima County, Arizona	Szuter and Brown (1986)			1*		Tanque Verde Wash II	
Tanque Verde Wash, (BB:13:68), Pima County, Arizona	Szuter and Brown (1986)			8*		Tanque Verde Wash III	
The Jurgens Site, Greeley, Colorado	Wheat (1979)	?	?	15	Axis, C Vert, L Vert, premaxilla, tooth, antler	9070 +/- 90 BP	?
Gordon Creek Burial, Lindenmeier, Colorado	Cassells (1983)				Perforated and broken incisors interred with a female skeleton	7700 BC	
Castle Park, Dinosaur National Monument, Colorado	Burgh and Scoggin (1948)	P/J (Upper Sonoran)	5500	?	?	AD 400–800	?
Mustoe Site, Hovenweep/Cortez, Colorado	Gould (1982)	P/J	6740	9	4 proximal ulnae (1 burned), 1 calcaneus, 1 1st phalanx, 1 distal phalanx, 1 distal tibia. 3 MNI	PII-PIII (AD 900–1231); 1 in PII, 3 in PIII	?
Site 875, Mesa Verde, Colorado	Lister (1965)	P/J	7700	?	?	AD 950–1075	Boulder?
Badger House (Site 1676), Mesa Verde Nat'l Park, Colorado	Hayes and Lancaster (1975)	P/J	6888	6	?	AD 631–700	?
Badger House (Site	Hayes and	P/J	6888	1*	Antler	AD 631–700	?

Location	Citation/Source	Habitat type	Elevation (ft)	NISP[1]	Elements	Date/context	Curation location
1676), Mesa Verde Nat'l Park, Colorado	Lancaster (1975)						
Mug House, Mesa Verde Nat'l Park, Colorado	Rohn (1971)	P/J	6888	1	Antler	AD 700–800	?
Lion House (5MTUMR2156), Mancos Canyon, Mesa Verde, Colorado	Nickens (1981), Harrill (1976)	P/J	6806	14*	?	AD 1150–1250	Fort Lewis College?
Hoy House (5MTUMR2150), Mancos Canyon, Mesa Verde, Colorado	Nickens (1981), Harrill (1976)	P/J	6806	2	?	AD 1100–1250	Fort Lewis College?
Mesa Verde National Park, Colorado	Anderson (1961)	P/J	6920	?	?	AD 1961	Historic sighting
5MTUMR 2785, Mancos, Colorado	Emslie (1977)	P/J (Upper Sonoran)	5640	1	Vert. fragment	Mancos Phase, AD 975–1075	?
5MTUMR 2785, Mancos, Colorado	Emslie (1977)	P/J (Upper Sonoran)	5640	1	Immature animal	McElmo Phase, AD 1075–1150	?
5MTUMR 2559, Mancos, Colorado	Emslie (1977)	P/J (Upper Sonoran)	5560	1	phalanx	Mancos Phase, AD 975–1075	?
5MTUMR 2346, Mancos, Colorado	Emslie (1977)	P/J (Upper Sonoran)	5520	1	Immature animal	Mancos Phase, AD 975–1075	?
5MTUMR 2347, Mancos, Colorado	Emslie (1977)	P/J (Upper Sonoran)	5440	1	Metapodial, bone awl fragment	Piedra Phase, AD 675–900	?
5LP478B, La Plata	Akins (1988)	?	?	2*	Antler	AD 750–800	?

Location	Citation/Source	Habitat type	Elevation (ft)	NISP[1]	Elements	Date/context	Curation location
County, Colorado							
5LP630, Durango, Colorado	Duke (1985)	P/J	8200	3	2 parietals, 1 metacarpal	AD 700–900	?
5LP110, Durango, La Plata County, Colorado	Gooding (1980)	P/J	6478	10	Antler (1 worked)	AD 650–750	?
5LP111, Durango, La Plata County, Colorado	Gooding (1980)	P/J	6478	1	Antler (rubbing tool)	AD 650–750	?
Ken-Caryl Ranch, Felteron? County, Colorado	Somer (1997)	Plains grassland	6300	?	?	AD 1970 (Historic sighting)	?
Pueblo Bonito, Chaco Canyon, McKinley County, New Mexico	Pepper (1920)	Grassland, scrub	6500	3*	All scrapers from a humerus	AD 1050–1150	UNM, Maxwell?
Pueblo del Arroyo, Chaco Canyon, McKinley County, New Mexico	Judd (1959)	Grassland, scrub	6500	At least 2	Antler, tibia dagger	AD 1050–1150	UNM, Maxwell?
BC 51, Chaco Canyon, McKinley County, New Mexico	Kluckhohn and Reiter (1939)	Grassland, scrub	6500				UNM, Maxwell?
Pueblo Alto, Chaco Canyon, McKinley County, New Mexico	Mathien (1985)	Grassland, scrub	6800	1	Mandible	PII/PIII, AD 920–1020	UNM, Maxwell
Chaco Project, 29SJ 423, Chaco Canyon, McKinley County, New Mexico	Mathien (1985)	Grassland, scrub	6500	2	Metapodials	BMIII/PI, AD 500–600	UNM, Maxwell
Chaco Project, 29SJ 627, Chaco Canyon, McKinley County, New Mexico	Mathien (1985)	Grassland, scrub	6500	5	Innominate, meta-carpals, metatarsals	PII/PIII, AD 1000–1080	UNM, Maxwell

Location	Citation/Source	Habitat type	Elevation (ft)	NISP[1]	Elements	Date/context	Curation location
Chaco Project, 29SJ 628, Chaco Canyon, McKinley County, New Mexico	Mathien (1985)	Grassland, scrub	6500	1	Innominate	BMIII, AD 700–820	UNM, Maxwell
Chaco Project, 29SJ 629, Chaco Canyon, McKinley County, New Mexico	Mathien (1985)	Grassland, scrub	6500	1	Metapodial	PII/PIII, AD 975–1040	UNM, Maxwell
Leyit Kin, Chaco Canyon, McKinley County, New Mexico	Dutton (1938)	Grassland, scrub	6500	?	?	AD 1000–1050, Area NE of Kiva A, Kiva B	MONM?
The Crawford Site (LA 26749), Crownpoint, McKinley County, New Mexico	Whitten (1982)	Open grassland and P/J	6810	1	Rib	AD 700–900	?
Shabik'eshchee Village, Chaco Canyon, McKinley County, New Mexico	Roberts (1929)	Grassland, scrub	6500	1	Antler (flaking tool)	AD 700–900	?
LA 50364, Ambrosia Lake, McKinley County, New Mexico (Chaco outlier)	Bertram (1990)	Open grassland	6979	4	Antler	AD 1050–1200	?
LA 73518, Horse Canyon, San Juan County, New Mexico	Bertram (1996)	P/J	5920	8	Antler and long bone fragments	AD 1100–1300	?
LA 81694, Los Pinos River, San Juan County, New Mexico	Bertram (1999)	P/J	6680	1**	Tibia	AD 640–875	?
LA 81694, Los Pinos River, San Juan	Bertram (1999)	P/J	6680	--	--	1999	Historic sighting

Location	Citation/Source	Habitat type	Elevation (ft)	NISP[1]	Elements	Date/context	Curation location
County, New Mexico							
Salmon Ruins, San Juan County, New Mexico	Harris (1980)	P/J, open grassland	5500	1	?	AD 1050–12500	San Juan County Museum
LA 2506, Muddy Wash Site, Tohatchi Flats, San Juan County, New Mexico	McVickar and Kearns (1998)	Open grassland	6099	15*	Antler	AD 500–700	?
LA 11568 (Mogollon Village), Alma, Catron County, New Mexico	Cannon (1999b)	P/J woodland	5150	3*	Antler	2 from Feature 43, 1 from Feature 44, both AD 200–550	OU, Norman, or Maxwell
LA 11568 (Mogollon Village), Alma, Catron County, New Mexico	Cannon (1999b)	P/J woodland	5150	2	Cheek tooth fragments	Feature 12, AD 700–825	OU, Norman, or Maxwell
Tularosa Cave, Catron County, New Mexico (near Apache Creek)	Heller (1976)	P/J (Upper Sonoran)	6762	7**	Long bone (GT); dentary, rib, long bone, sesamoid (SF); rib and long bone (Tularosa)	AD 500–700 Georgetown; AD 700–900, San Francisco; AD 1100–1250 Tularosa phases	MONM
Tularosa Cave, Catron County, New Mexico	Hall and Kelson (1959), Findley et al. (1975)	P/J (Upper Sonoran)	6762	?	?	AD 1976	Historic sighting
Cave 3, Gila Cliff Dwellings, Catron County, New Mexico	Anderson et al. 1986	P/J (Upper Sonoran)	6000	4	?	AD 1200–1300	?
Caves 4-5, Gila Cliff Dwellings, Catron County, New Mexico	McKusick (1986b)	P/J (Upper Sonoran)	6000	1	?	AD 1200–1300	?

Location	Citation/Source	Habitat type	Elevation (ft)	NISP[1]	Elements	Date/context	Curation location
Bat Cave, Horse Springs, New Mexico (Catron County)	Dick (1965b), Wills (1988)	Grassland (plains of San Augustin)	6800	?	?	1500 BC	Maxwell Museum? Peabody?
LA 676 (Mattocks), Mimbres Valley, Grant County, New Mexico	Gust-Schollmeyer (1999)	P/J	5750	2	?	AD 1000–1130	UNM, Maxwell
Disert Site, Mimbres Valley, Grant County, New Mexico	Nelson & LeBlanc (1986)	P/J, riparian	5650	1	Mandible fragment	AD 1350–1430	UCLA? or Maxwell
Ormand Village, Cliff, Grant County, New Mexico	Wallace (1998)	Grassland, scrub	4522	24*	Antler	AD 1250–1450	MONM?
Wind Mountain, Cliff, Grant County, New Mexico	Olsen and Olsen (1996)	P/J	5680	2	Proximal humerus (OO), C vert Room 3)	AD 890–1160; House OO, Surface Room 3	Amerind Foundation, Dragoon, AZ
Ridout Locus, Wind Mountain, Cliff, Grant County, New Mexico	McKusick (1986a, b)	P/J	5680	?	?	AD 620–710 (Georgetown)	Reference in McKusick 1986 to elk but I couldn't find any id's to elk
LA 49000, Black Range, Sierra County, New Mexico	Gust-Schollmeyer (1999)	P/J		1	?	AD 1000–1130	UNM, Maxwell
LA 3769, Black Range, Sierra County, New	Gust-Schollmeyer (1999)	P/J		2	?	AD 1130–1200	UNM, Maxwell

Location	Citation/Source	Habitat type	Elevation (ft)	NISP[1]	Elements	Date/context	Curation location
Mexico							
LA 613, Black Range, Sierra County, New Mexico	Gust-Schollmeyer (1999)	P/J		7	?	AD 1130–1200	UNM, Maxwell
LA 82575, Valle Grande, Sandoval County, New Mexico	Acklen (1997)	Ponderosa pine	8590	1**	Long bone shaft fragment	AD 1278–1663	?
LA 66870 (SW of Abiquiu), Rio Arriba County, New Mexico	Acklen (1997)	P/J	7800	1	Tooth	AD 900–1200	?
LA 82615 (SW of Abiquiu), Rio Arriba County, New Mexico	Acklen (1997)	P/J	7900	1	Antler	2290–1528 BC (Feature 1; large thermal feature)	?
LA 66868 (SW of Abiquiu), Rio Arriba County, New Mexico	Acklen (1997)	P/J	7880	13	2 mandible frags, 2 radii, 1 innominate, 2 tibiae, 1 astragalus, 1 1st Phalanx, 1 2nd Phalanx, 3 3rd phalanges		?
Poshuouinge, Chama River near Abiquiu, Rio Arriba County, New Mexico	Jeancon (1923)						
LA 12117, Cochiti Lake, Sandoval County, New Mexico	Guthrie (1982a)	P/J	5600	6	?	1000 BC to AD 1600	WACC, Tucson
LA 13659 (Supply Cave), Cochiti Lake,	Guthrie (1982a)	P/J	5600	2	?	1000 BC to AD 1600	WACC, Tucson

Location	**Citation/Source**	**Habitat type**	**Elevation (ft)**	**NISP[1]**	**Elements**	**Date/context**	**Curation location**
Sandoval County, New Mexico							
LA 60550, Frijoles Canyon, Sandoval County, New Mexico	Trierweiler (1989)	P/J	6800	1	Tibia shaft, worked	AD 1375–1525	WSU? MONM?
Arroyo Hondo (LA 8874), Santa Fe County, New Mexico	Lang & Harris (1984)	P/J	7100	1	?	AD 1300–1315	MONM
Arroyo Hondo (LA 8874), Santa Fe County, New Mexico	Lang & Harris (1984)	P/J	7100	1*	?	AD 1300–1315	MONM
Arroyo Hondo (LA 8874), Santa Fe County, New Mexico	Lang & Harris (1984)	P/J	7100	1	?	AD 1315–1330	MONM
Arroyo Hondo (LA 8874), Santa Fe County, New Mexico	Lang & Harris (1984)	P/J	7100	1*	?	AD 1315–1330	MONM
Arroyo Hondo (LA 8874), Santa Fe County, New Mexico	Lang & Harris (1984)	P/J	7100	3	?	AD 1330–1340	MONM
Arroyo Hondo (LA 8874), Santa Fe County, New Mexico	Lang & Harris (1984)	P/J	7100	20*	?	AD 1330–1340	MONM
Arroyo Hondo (LA 8874), Santa Fe County, New Mexico	Lang & Harris (1984)	P/J	7100	1	?	AD 1340–1355	MONM
Arroyo Hondo (LA 8874), Santa Fe County, New Mexico	Lang & Harris (1984)	P/J	7100	25*	?	AD 1340–1355	MONM
Arroyo Hondo (LA 8874), Santa Fe	Lang & Harris (1984)	P/J	7100	2*	?	AD 1355–1365	MONM

Location	Citation/Source	Habitat type	Elevation (ft)	NISP[1]	Elements	Date/context	Curation location
County, New Mexico							
Arroyo Hondo (LA 8874), Santa Fe County, New Mexico	Lang & Harris (1984)	P/J	7100	4*	?	AD 1365–1370	MONM
Arroyo Hondo (LA 8874), Santa Fe County, New Mexico	Lang & Harris (1984)	P/J	7100	3	?	AD 1380–1410	MONM
Arroyo Hondo (LA 8874), Santa Fe County, New Mexico	Lang & Harris (1984)	P/J	7100	3**	?	AD 1380–1410	MONM
Arroyo Hondo (LA 8874), Santa Fe County, New Mexico	Lang & Harris (1984)	P/J	7100	4	?	AD 1410–1425	MONM
X29SF6, Nambe Falls Reservoir, Santa Fe County, New Mexico	Skinner et al. (1980)	P/J	?	2	Rib fragment, sacrum fragment	AD 900–1600	?
X29SF7, Nambe Falls Reservoir, Santa Fe County, New Mexico	Skinner et al. (1980)	P/J	?	2	Calcaneus, metatarsal	AD 900–1600	?
LA 71 (Howiri Pueblo), Ojo Caliente, Taos County, New Mexico	Mick-O'Hara (1987)	P/J, grassland	6380	1	Proximal right radius	AD 1400–1450, Plaza Room 5	MONM?
Picuris Pueblo (San Lorenzo), Taos County, New Mexico	Adler and Dick (1999)	P/J	7300	1	?	AD 1375–1490	UTEP?
Taos Pueblo, Taos County, New Mexico	Bodine (1979)	P/J	7098	?	?	Reference to elk still present and used in 1840	?
Pot Creek Pueblo, Taos, Taos County,	Wetherington (1968)	P/J (Upper	7400	At least	1 metapodial bone flesher,	AD 1000–1300	Fort Burgwin

Location	Citation/Source	Habitat type	Elevation (ft)	NISP[1]	Elements	Date/context	Curation location
New Mexico		Sonoran)		1	several bone awls		Research Center or Maxwell
Pot Creek Pueblo, Taos, Taos County, New Mexico	Wetherington (1968)	P/J (Upper Sonoran)	7400	?	?	1968	Historic sightings around Taos
Tijeras Pueblo, (LA 581), Bernalillo County, New Mexico	Young (1980)	P/J	6500	9	?	AD 1200–1325	MONM
Paa-ko (LA 162), San Antonito, Bernalillo County, New Mexico	Lambert (1954)	P/J, Ponderosa pine	6250	?	Antler, modified long bones (metatarsal), and food remains (no counts)	AD 1300–1450	MONM?
LA 53662 (Belen Bridge Site),Valencia County, New Mexico	Akins (1994)	Semi-desert grassland to grassland	4825	4*	Antler	AD 1200–1300	MONM?
Rowe Pueblo (LA 108), Pecos, San Miguel County, New Mexico	Cordell (1998)	P/J	6800	8	?	AD 1350 (BHT2), T305, T306	On site-Sandoval family (San Miguel county)
Pecos, San Miguel County, New Mexico	Kidder (1932)	P/J, Ponderosa pine	6900	?	Antler, modified long bones (metatarsal), and food remains (no counts)	AD 1250–1800	MONM?

Location	Citation/Source	Habitat type	Elevation (ft)	NISP[1]	Elements	Date/context	Curation location
Las Humanas (Mound 7), Gran Quivara, Torrance County, New Mexico	McKusick (1981)	P/J, grassland	6800	1	Antler, worked	AD 1300–1672	?
Crockett Canyon (LA 2315), Angus, Lincoln County, New Mexico	Speth and Scott (1992)	P/J, Ponderosa pine	6974	6	4 skull frags, 1 metatarsal, 1 2nd phalanx	AD 1000–1350	MONM?
Clovis, Curry County, New Mexico	Cotter (1938)	Open grassland	?	?	?	Paleoindian 9500–5500 BC	?
Townsend Site, Roswell, New Mexico	Akins (personal communication)			1	Acetabulum	500 BC to AD 1150	
Peña Blanca (LA 6170), Cochiti, New Mexico	Akins (personal communication			At least 11***	Articulated hind foot, tooth, vertebra (1), ribs (4), scapulae (2), distal tibia, femur	AD 600–900	?
Peña Blanca (LA 6170), Cochiti, New Mexico	Akins (personal communication			1	?	AD 900–1200	?
LA 3333, Galisteo Basin, New Mexico	Akins (personal communication)						
San Antonio, Tijeras Canyon, New Mexico	Akins (personal communication)						
Chiricahua Apache	Opler (1941:325)	Various	Various	?	?	PV (AD 1600 to AD 1850)	"there were plenty of elks" and "the elk is not as smart as the deer

Location	**Citation/Source**	**Habitat type**	**Elevation (ft)**	**NISP[1]**	**Elements**	**Date/context**	**Curation location**
							and is easier to get”
42SA6396, Bluff, San Juan County, Utah	Emslie (1985)	Open grassland	5610	1	Split metatarsal (worked)	AD 750–850	?
Alkali Ridge, San Juan County, Utah	Brew (1946)	P/J	6400	?	?	AD 700–1300	?

[1]NISP is number of identified specimens *Cervidae (*Cervus/Odocoileus*); ***Cervus elaphus/Bison bison* (elk or bison); *** includes portions of an articulated hind foot

CHAPTER 81
ANCESTRAL PUEBLO TRAILS OF THE PAJARITO PLATEAU: A SUMMARY OF RECENT RESEARCH

James E. Snead

Old-time trails across the rock
Knee-deep nearly, sheerly worn
Here converge and interlock
Old when Babylon was born

- From "Tsan-Ka-Wi," by John H. Underwood; *El Palacio* 1916 4(3):9

INTRODUCTION

The Ancestral Pueblo trails of the Pajarito Plateau have been a source of curiosity and contemplation since Euro-American explorers first entered the region in the late 19th century. Thoroughly photographed, described in letters, articles, even poems, as the excerpt above, referring to trails near the pueblo now called Tsankawi, indicates, these features have nonetheless confounded archaeological analysis. Hard to follow, difficult to date, enigmatic in design, trails (or paths) are difficult to understand through standard approaches. They also subvert our traditional categories, since they are not truly *places*; no one lived on a trail, or grew their crops in its ruts, or made tools there, except perhaps, in passing. Instead, trails represent the linkages *between* places. They are thus the physical embodiment of immaterial processes such as movement and relationships, things incompletely captured by pottery, stone, and bone. Only recently have archaeologists realized that these connections are of equal value to the places that they join together, and that, in certain, favorable conditions, we can study such relationships through the traces of the process itself.

The Pajarito is one of the rare regions where such evidence is preserved for the archaeologist. The consolidated, pyroclastic ash flows that represent the foundation of the plateau are sufficiently erosive so that the passage of foot traffic over time wears a groove directly into the rock. The soft surface can also be intentionally carved and shaped, a phenomenon that gave rise to the famous cave dwellings of the vicinity but which also means that stairways and even trails themselves could be pecked out by hand. These circumstances, and the fact that the mesas and portreros of the region were relatively isolated throughout most of the post-Columbian period, mean that in the present day it is possible to literally walk in the footsteps of the ancestors.

The archaeological challenge presented by this pattern is to sort out the evidence of the trails created and used by the Ancestral Pueblo people of the Pajarito, but to also unravel their meaning. The Pajarito Trails Project (PTP) was created with that purpose in mind; this report collates three seasons of fieldwork (1991, 1999, and 2001) with scattered records from other projects that have recorded trails in the region. As with most archaeological efforts it is a work in progress, part method, part data, with a few tentative conclusions. The extraordinary cultural landscape of the Pajarito provides a great opportunity for archaeology: trails, while merely one element of this complex whole, represent one way to draw us into that world, and to let us see it through other eyes.

METHOD

The study of ancient trails and paths is in its infancy. Archaeologists have made a sharp distinction between these features, argued to be informal and ephemeral, and *roads*, which, by virtue of their greater formality, are more visible and present fewer problems of method (Trombold 1991:3). Their functional implications and labor requirements have meant that roads are also considered a hallmark of complex social systems, long a subject of archaeological interest (cf. Earle 1991). Thus, while a number of substantive studies of ancient roads have been published (Hererra and Cardale de Schrimpff 2002; Hyslop 1984; Laurence 1999; Vermuelen and Hageman 2001), issues of evidence and preconceptions about the "significance" of trails have hindered research.

In the absence of formal roads, discussion of movement through the landscape has traditionally adopted a large scale and emphasized *routes*, rational patterns of travel mandated by topography. Archaeologists are familiar with maps that feature lines and arrows "documenting" directions of trade and interaction, often based upon the watercourses, passes, and similar features of terrain that make such movement possible. Physical evidence for the use of such routes is often sought in the distribution of artifacts and raw materials across space, rather than in documentation of the process of movement itself. Such an approach is unsatisfactory on several counts, among which are the vast scale at which such models must be structured and the multitude of natural/cultural factors which can account for artifact distribution. By emphasizing exchange, this approach also emphasizes only one of the many different types of movement that would have occurred along such routes, skewing our perception of those doing the traveling.

In some cases, evidence for routes of transit is sought in historical records. In the mid-20th century, considerable effort was devoted to combing documentary sources for information about Native American trails in colonial North America (cf. Ayres 1940; J. Davis 1963; Hindes 1959; Myer 1929; Sample 1950). In most cases no physical evidence for any of these routes was available. Even in cases where eyewitness descriptions of trails were relatively recent, identifying them "on the ground" proved challenging, as the experience of a 1960s project to find the historically documented "Comanche War Trail" in southwest Texas suggests. "We found many abandoned roads and numerous animal trails, but nothing identifiable as a Comanche trail. As a matter of fact, we found no artifacts that could be identified with the Comanche" (Campbell and Feld 1968:140).

It is evident, however, that in some cases material evidence for trails and paths *is* preserved in the archaeological record. This is particularly true in arid locations. Several studies in the Mohave and Colorado deserts, for instance, have documented long-distance trails with clear pre-Columbian associations (Campbell 1931; Harner 1957; F. Johnson and Johnson 1957; Rogers 1966:47; Von Werlhof 1988). Trails associated with springs and water catchments were recorded in the Great Basin (Ives 1946) and the Southwest (Britt 1973), while evidence for trails in the Great Plains has also been recorded (Blakeslee and Blasing 1988). With the urging of Carling Malouf (1961, 1980), a number of studies were conducted on trails in the northern Rockies, culminating in an entire issue of *Archaeology in Montana* [21:3] devoted to the archaeology of trails (1980).

Failure to incorporate data for trails into our interpretations of the past can thus be more a question of research bias than of evidence, per se. With increasingly detailed recording of archaeological data, trails and related features are now commonly noted in archaeological reports (e.g., Boyer et al. 2002; Van Zandt 1999). Systematic analysis remains uncommon, however, and the discussion of movement continues to emphasize routes and roads. Recent literature on the Chaco period in the greater San Juan Basin of New Mexico, for instance, features a flourishing discussion of the formally constructed Chaco "roads" (cf. Hurst et al. 1993; Kanter 1997; Marshall 1997; Mathien 1991; Roney 1992; Severance 1999; Vivian 1997a, b; Windes 1991). References to the network of trails that must also have been a component of the Chacoan landscape, in contrast, are scarce. The fact that 148 stairways or sets of steps were documented in the course of the Chaco surveys (Pattison 1985:63), most of which would necessarily have been associated with local trail systems rather than the roads themselves, is an indication that when such data appeared they were relegated to the back pages of reports.

In addition to the fact that "evidence" for trails is increasingly difficult to ignore, the body of ethnographic and theoretical discussions of these features increasingly makes the case for their importance. Indigenous perceptions of pathways are much more elaborate than previously credited; more than expedient means to get back and forth, trails are complex, tangible metaphors of interaction and association (cf. Ballard 1994; Laird 1976; Parmentier 1987; Weiner 1991). Recent reports on trails in the Southwest have also emphasized this ethnographic dimension (e.g., Hart and Othole 1993; Stoffle et al. 1977). Finally, "paths" are an important part of the evolving theoretical discussion of landscape, space, and place in archaeology (see Barrett 1994:141; Ingold 1993:167; Thomas 1996:90; Tilley 1994:31; Zedeño and Stouffle 2003).

It is within this increasingly productive context for the archaeological study of paths and trails that recent field research in the Southwest has developed. Consideration of trails at Hopi (Zedeño 1997), Hohokam "roads" (Motsinger 1997), and Navajo pathways at Cañon de Chelly (Jett 2001) all point to the importance of understanding how people of the southwestern past moved through their landscape. My own work, published (Snead 2002a, c) and unpublished (Snead 2000, 2001b), has made use of the optimal preservation conditions for trails on the Pajarito Plateau to develop ideas about the history of settlement in the region, political interaction, and the human role in the structuring of the landscape. From this expanding body of work it is evident that the traditional distinction between *roads* and *trails* is no longer tenable. Both serve, in the words of one author, as "paths of political control, of social rhythms, military tactics, religious observances, and economic endeavors" (Darnell 2002: 114). The complexity of paths and trails as categories of information should not interfere with our acknowledgment of their importance, but instead spur us to find new and creative ways to redress the limits of our methods.

Recording Strategies

All of the archaeologists that work with trails and paths grapple with three linked problems of evidence:

A. Chronology. Trails are very difficult to date directly, since almost by definition they are worn down rather than built up. Does a trail across the mesa top date to the Ancestral Pueblo period, or is it a 19th century stockmen's route?

B. Association. Since the use of a trail may leave very little evidence beyond footprints, linking trail-related activity with other evidence from the surrounding area is particularly complicated. A cairn may mark the course of a trail, but does it date to the era when the trail was initially blazed, or is it a more recent addition?

C. Contiguity. Because trail preservation is a factor of local geology, topography, and ground cover, it is rarely possible to estimate their true extent and interrelationships. Does this trail climbing out of a canyon relate to the small fieldhouse on top, or did it eventually connect with the major trail running along the mesa? Or both?

There is obviously no simple answer to these problems, but they figure heavily in limiting the amount of research on trails that has been conducted in the Southwest. In a case from the early stages of the recent Bandelier Archaeological Survey (BAS), a major Ancestral Pueblo trail and staircase entering Frijoles Canyon was initially recorded as an "isolated occurrence" from which minimal information was collected. The recording protocol had no category for such a feature, which was of uncertain extent, and, regardless, couldn't be dated directly. Ultimately it was re-recorded, but the dilemma facing the crew that first encountered it is real.

The critical approach to analyzing trails in the archaeological record concerns establishing *context*. Trails in isolation appear as enigmatic fragments, but trails in context with other trails and the surrounding cultural landscape become much more comprehensible. In this way it is possible to compare trails with each other to identify salient characteristics, shared and different. It also becomes possible to more clearly identify nodes and places linked by particular trails; since those features are often more "datable" than the trails themselves, they introduce a more specific chronology. It is certainly true that some trails, once established, will remain in use for centuries or millennia. Patterns of human movement do change over time, however, and trails, like the places they connect, may not only go out of use, but also undergo structural change as the nature of use shifts. In a simple example, the routes taken by the US interstate highway system parallel, but do not entirely obliterate, earlier roads, which were built for different types of traffic and often go in slightly different directions. Trails function in similar ways, and in many cases the resultant differences can be seen archaeologically.

Trails as a category of archaeological information are a poor fit for the traditional idea of the "site." Sites are usually contiguous or closely proximate clusters of features and artifacts, distributed across finite space. We use this concept to divide a complex body of information into units that are manageable and can be compared with each other. Trails, in contrast, are "anti-sites," being the tangible connection *between* sites. They may go on for miles, but are usually intermittent, and also will intersect with other trails that, at least in theory, extend throughout a region. They are understandable only in a landscape context, in which they exist in various relationships with an array of other features across an unbounded space.

In practice, I have approached trails as assemblages of different but related types of evidence. A recording protocol developed in the course of the Pajarito research (Snead 2000) and under continual revision, goes some way toward addressing these concerns, and has three basic components:

A. Recording of trail features as segments. It is increasingly standard practice among archaeologists working on trails and roads to record them as segments of a potentially larger feature (e.g., Marshall 1991). Segments, of which an infinite number are possible, can be distinguished by visibility, surrounding terrain, or any other characteristic that distinguishes parts from the whole. Decisions as to what this "whole" may consist of (and whether it should be classified as a "site") are thus left in abeyance until later in the analysis.

B. Consideration of trail structure. This includes both the *fabric* of the trail itself, the characteristics (width, depth, steps/stairs, etc.) of the feature underfoot, but also *associated features* (cairns, walls, etc.). Not all elements of trail structure need be contemporary, but all are functionally related to the trail itself. Treating this array of features collectively allows for the complexity of the trail to be accurately portrayed.

C. Evaluation of the trail network. The spatial organization of an array of trails, both as they potentially connect with each other and as they articulate with other nodes in the landscape, provides critical evidence regarding the context of the entire system. In this case neither trails nor their destinations are treated generically, but instead as aspects of a larger, interconnected landscape.

These approaches are sufficiently general to be adaptive to different circumstances; my application of them to the Pajarito case is outlined below. In principle, however, they provide a way for us to bring a fresh perspective to the archaeological study of paths and trails. This potential is seen in a wave of recent studies on the subject, ranging from using remote sensing to study trails buried by volcanic ash deposits in Costa Rica (Sheets and Sever 1991), historical records to augment fieldwork on indigenous Hawaiian trails (P. Mills 2002), and geographic information system analysis to identify routes of local travel in prehistoric Europe (Bell and Lock 2000; Bell et al. 2002). As the roads/trails dichotomy breaks down, the greater potential for developing an archaeology of human movement is realized, enriching our knowledge of the cultural landscape.

BACKGROUND

Natural and Cultural Setting

The Pajarito Plateau is a region of north-central New Mexico bounded by the Jemez Mountains to the west and the Rio Grande to the east, extending from roughly Santa Clara creek on the north side to the Rio Chiquito on the south. The plateau itself consists of a basalt substrate overlain by consolidated pyroclastic flows of Pleistocene date (Ross et al. 1961). Erosion of this friable material has created a topography of flat-topped mesas and "portreros" separated by sheer-walled canyons. Permanent water flows in a small number of these streams; the lower elevations of the plateau along the Rio Grande are dominated by piñon pine and juniper, with ponderosa more prevalent towards the Jemez further west.

Ownership of the Pajarito is divided up several ways. Most of the southern plateau falls within Bandelier National Monument, while the central plateau is under the jurisdiction of Los Alamos National Laboratory (LANL), with sizable acreage also governed by San Ildefonso Pueblo. Smaller tracts include substantial private land around the town of White Rock and the Tsankawi Unit of Bandelier National Monument. Much of the northern plateau is part of the Española Ranger District of the Santa Fe National Forest, with Santa Clara Pueblo owning land along Santa Clara creek. The diverse ownership of land on the Pajarito Plateau has had a demonstrative affect on trail archaeology in the region, as will be seen below. From a preservation perspective, however, the significant level of public ownership and the relative remoteness of the area (until recently) has provided remarkable protection for local archaeological resources.

This evidence suggests that Archaic period hunter-gatherers were the first inhabitants of the Pajarito, but the primary Ancestral Pueblo occupation of the area began during the AD 1100s. During the Coalition (AD 1150–1325) and subsequent Classic (AD 1325–1550) periods, the region was home to a significant human population, who farmed the canyon bottoms and mesa tops (for an overview, see Powers 2005; Powers and Orcutt 1999b). An initial pattern of dispersed small residences close to the fields evolved into one characterized by a few large "community houses" surrounded by hinterlands with seasonally occupied fieldhouses. The most prominent of these are (from north to south) Puyé, Otowi, Tsankawi, Navawi, Tsirege, Tyuonyi, and Yapashi, although dozens of smaller pueblos as well as extensive cliffside cavate pueblos are preserved. Other elements of a diverse cultural landscape include petroglyphs, reservoirs, field systems, shrines, and trails. The permanent population of the plateau appears to have declined over the course of the late pre-Columbian period, and by the early 1600s it seems to have been used largely as a seasonal hunting ground. Descendant populations of the Pajarito inhabitants are to be found in the Tewa pueblos of Santa Clara and San Ildefonso as well as the Keres pueblo of Cochiti.

Previous Research

The first recorded mention of the Ancestral Pueblo trails of the Pajarito Plateau comes from Col. James Stevenson of the Smithsonian's Bureau of Ethnology, who mentioned trails at the Pueblo of Puye in 1880 (J. Stevenson to J. W. Powell, 27 October 1880:BAE). Adolph Bandelier's

Cochiti guides took him along the old trails further south on the Pajarito during the same period (Bandelier 1892:147), routes used by many others over the subsequent decades (cf. Prince 1903). A typical experience was recorded by J. A. Jeancon, reporting to Edgar Lee Hewett about a visit to Tsankawi. "The trail leading across the solid stone is worn in some places to a depth of three feet," he wrote. "This is most remarkable when one stops to consider that the Indians wore only moccasins or went barefoot" (89ELH.081; LOA). Hewett's own work contains numerous references to trails, including several published photographs (cf. 1909:437; 1953). Although he described plans to publish a report focusing on trails (1908b:18), it was never completed. Related ethnographic information was collected by J. P. Harrington, whose *Ethnogeography of the Tewa* contains descriptions of 17 different trails, including several on the Pajarito (1916:412).

Trails make only rare appearances in discussions of Pajarito archaeology over the next two generations, circumstances that I have argued reflect the dominance of a "chronological perspective" in Southwest archaeology for which landscape features were largely irrelevant (Snead 2002b). It wasn't until the 1970s, when surveys of lands associated with LANL were begun, that interest in the archaeological potential of trails reemerged. Charlie Steen (1977) documented several individual trails in the central plateau, which although lacking in detail provided a baseline for future research.

A new and more systematic approach for Pajarito archaeology was inaugurated in the late 1970s with the Pajarito Archaeological Research Project (PARP), which conducted intensive surveys to test hypotheses concerning the response of the Ancestral Pueblo population to environmental stress. In the process, more than 800 sites were recorded from all parts of the plateau, including numerous trails (see Hill and Trierweiler 1986; Hill et al. 1996). Despite the processual strategy and the more rigorous fieldwork, however, the PARP analysis was similar to more traditional research in its concentration on chronological information and residential sites. Landscape features such as trails were recorded, but did not play a substantive part of the discussion. A more holistic strategy was adopted by the BAS in the 1980s; over five years more than 3000 sites of 50+ types were recorded within the national monument. The discussion of trails in the project's final report was brief but substantive, notable in view of the extraordinary quantity of archaeological data that had been generated (Van Zandt 1999).

As of the early 1990s the Ancestral Pueblo trails of the Pajarito were thus widely known among archaeologists but had never been systematically documented. The considerable information provided by the PARP and BAS field crews, however, had generated a detailed landscape within which the trails could be placed. Attempts to use existing information to evaluate the trail networks themselves, however (Snead 1991) were problematic, largely because of the methodological issues discussed in the introduction. It was often impossible to tell from existing site records, for instance, whether trails on adjacent sites were actually different segments of the same larger-scale feature or were entirely unrelated. On another level, the different jurisdictions on the plateau created obstacles for trail recording, since they rarely stopped at modern boundaries. If the Pajarito trails were to contribute to our understanding of the Ancestral Pueblo world, then a new project would have to be developed to address the issue directly.

The Pajarito Trails Project

The PTP began in 1991 as an exploratory survey of land belonging to San Ildefonso Pueblo in the vicinity of the Navawi community house (Snead 2002c). Working with a permit from the pueblo, I spent two weeks documenting a series of trails and related features associated with Navawi and other habitation sites in the area. This work produced substantial new information, particularly since the area had not been the scene of archaeological work for decades; but the level of documentation was uneven, particularly since it was only after beginning that I became aware of many of the complexities of trail recording.

The PTP was revived in 1999, when an opportunity for fieldwork in both Bandelier and Los Alamos lands opened up. In the meantime a number of new theoretical approaches to space and landscape had also been developed, making the work timely in a way that it had not been eight years before. Accordingly, three weeks in 1999 and one week in 2001 were devoted to the recording of trails in the central and southern portions of the plateau.

The methodology of the project developed largely along the lines discussed above. Rather than survey entirely new areas, the project focused on the re-recording of trail sites that had already been identified. Seven areas, containing 32 recorded trail sites, were emphasized. These include: Frijoles Canyon (Bandelier), White Rock Canyon (Bandelier), Lummis Canyon (Bandelier), Yapashi (Bandelier), Capulin Canyon (Bandelier), Tsankawi (Bandelier), and Otowi/Sandia Canyon (LANL).

The characteristics of trail structure (Table 81.1) were derived from existing records and modified in the field. Since many of the terms developed at the time will appear in the following section, I will reproduce them here:

A. Fabric

1. <u>Cleared talus</u>. Cleared talus indicates construction of a trail by moving larger stones and cobbles from its path (Figure 81.1).

2. <u>Wearing.</u> Wearing, also called "incision," "erosion," etc., refers to areas where the trail has been worn into the bedrock surface by friction caused by foot traffic, leaving a tangible imprint (Figure 81.2). Trail wearing can range from a faint "shadow" on the ground to deep worn segments a meter or more in depth.

3. <u>Construction</u>. Construction indicates formal excavation of trail into the ground or physical modification of the trail surface by means other than gradual erosion (i.e., wearing). It is assumed that this means pecking or grinding through the use of tools made of basalt or other hard stone (Figure 81.3). Construction is considered to reflect a formal process of trailbuilding. Construction must also be argued rather than assumed, since it is difficult in most cases to distinguish wearing from construction. The dilemma is illustrated in Van Zandt's summary of BAS trail data, which lists nine "pecked" trails, 20 "excavated" trails, 32 "worn" trails, and nine considered to represent a "mixture" of fabrics (41). These categories reflect the assessment of field teams, rather than any standard measure. Steps and similar features, while more clearly evidence for formal construction, are covered by their own category, below.

Table 81.1. Characteristics of trail structure developed for the recording of Pajarito trails (modified after Table 1 in Snead 2000).

Trail Structure (Pajarito)	
Fabric	**Associated Features**
Wearing	Berms
Cleared Talus	Flanking Walls
Construction	Shoring
Braiding	Cairns
Switchbacks	Trail Markers
Hand and Toe Holds	Architecture
Steps (One-foot, Two-foot, and Basin)	
Stairs	
Ramps	

Figure 81.1. LA 134901 as it descends from the Portero del Rito into White Rock Canyon, illustrating cleared talus trail construction.

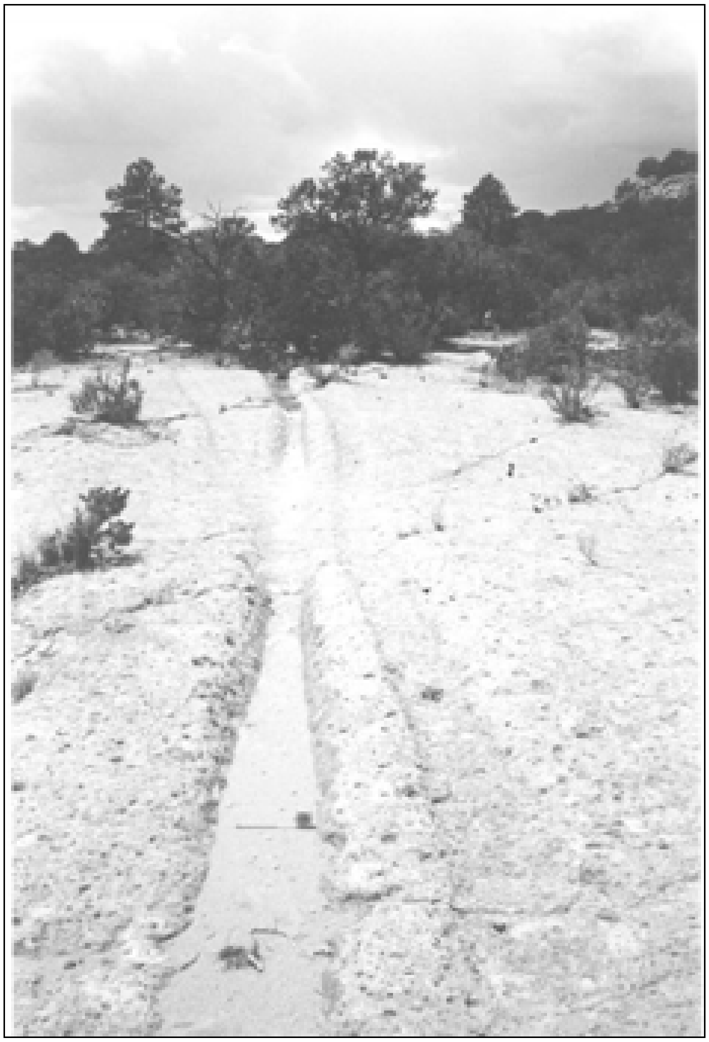


Figure 81.2. LA 66885, the Sandia Canyon Trail Network (Segment 03), illustrating wearing and braiding (10 cm scale).

4. Braiding. Braiding, also called "multiple routes," is the duplication of a trail into parallel and often interwined paths within a relatively restricted area. Operationally, braided trails are usually no more than 10 m apart, or they were considered separate (if possibly related) segments (see Figures 81.4 to 81.6). It should be noted that braiding can be both informal (a product of slight modifications in a trail's route over a period of time) and formal (the intentional re-alignment or re-construction of a trail). Distinguishing the two is not straightforward and has been done inconsistently by the PTP. The trail depicted in Figure 81.2 illustrates braiding as an informal process, while the braided trails in Figures 81.7 and 81.8 show evidence of more formal construction.

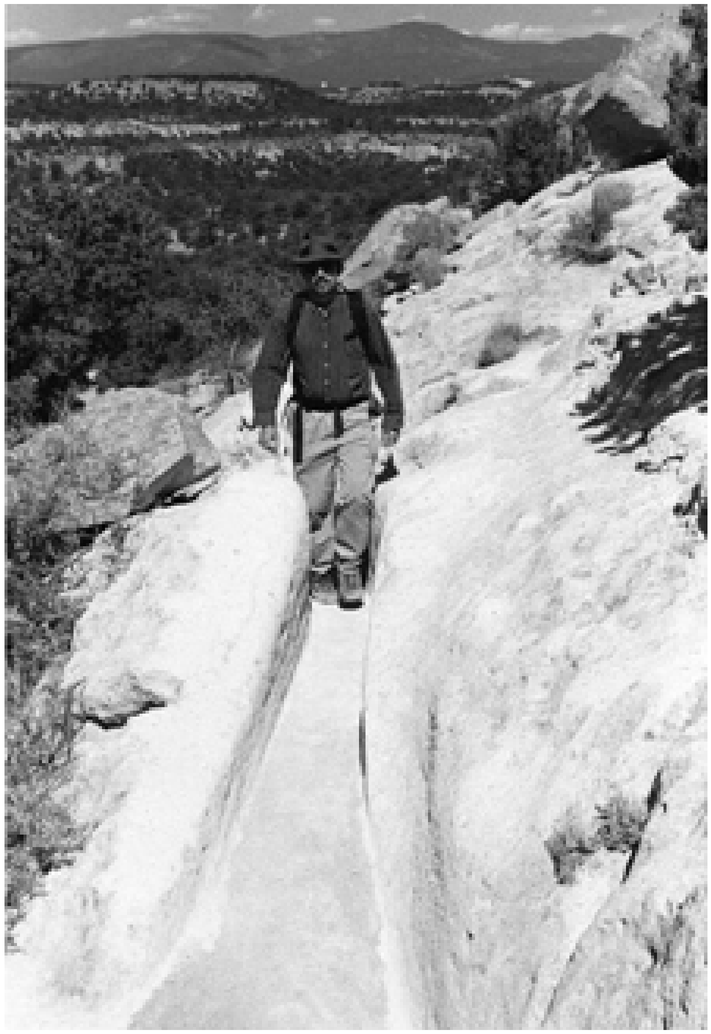


Figure 81.3. LA 70989, the Tsankawi Mesa Trail network (Segment 01), illustrating wearing and probable construction. J. Snead in photo.

5. Switchbacks. Switchbacks refer to trails that angle back and forth across a slope. Switchbacks are sometimes thought of as a Euro-American introduction, but also appear on trails that are clearly associated with the Ancestral Pueblo period.

6. Hand and toe holds. Hand and toe holds are modifications of the tuff surface designed to facilitate climbing up steep boulder/cliff faces. Hand and toe holds usually consist of shallow "cups" pecked into the rock surface and demonstrate a minimum of effort. In some cases hand holds are found in association with steps.

7. Steps. Steps are modifications of the trail surface designed to facilitate climbing moderate slopes. They are generally larger and wider than hand and toe holds. Three general morphological characteristics of steps have been noted:

Figure 81.4. "One-foot" steps on Tsankawi Mesa. 1 m scale.

Figure 81.5. LA 77779, illustrating "basin steps." 10 cm scale, view from above.

Figure 81.6. LA 70989, the Tsankawi Mesa trail network, illustrating worn segment and associated steps. 1 m scale.

a. one-foot steps. These are steps large enough for a single foot. Unlike hand and toe holds, they have been cut straight down into the rock surface and are thus "open" at the top (Figure 81.4).

b. two-foot steps. Steps large enough for two feet side by side.

c. Basin steps. These are large steps that by design or subsequent erosion have a concave profile (Figure 81.5).

8. Stairs. Stairs are aligned sets of steps. Operationally, a set of five or more steps is here suggested to define "stairs" in relation to "steps." The term “staircase” is used for stairs that are qualitatively distinct (Figures 81.14 to 81.17).

9. Ramps. A ramp is a constructed or modified inclined plane by which a trail ascends or descends a section of slope. A ramp may be a section of bedrock that has been shaped to facilitate foot traffic down a short drop.

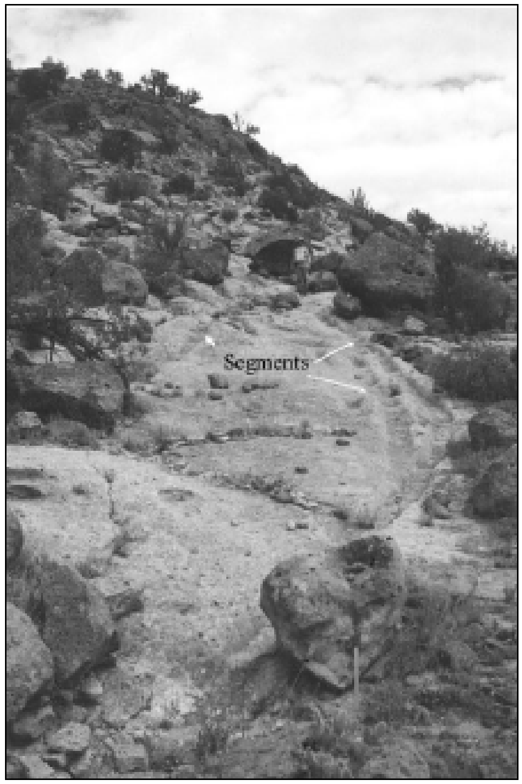


Figure 81.7. LA 65581, illustrating braiding associated with the Capulin Staircase.

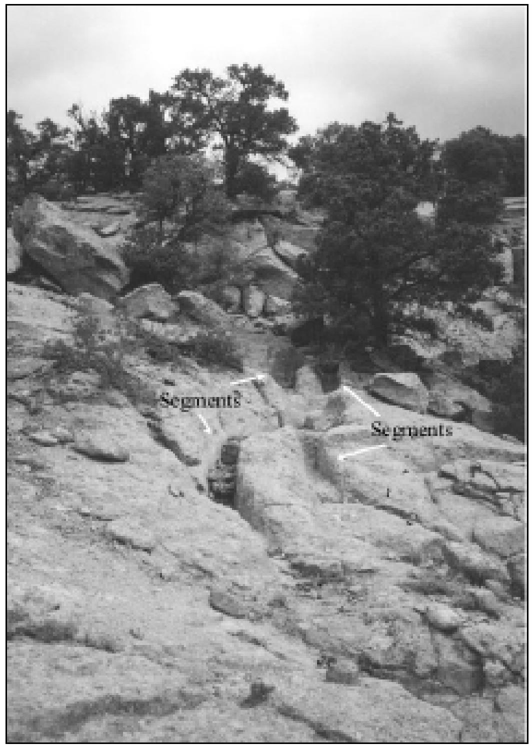


Figure 81.8. LA 66885, the Sandia Canyon trail network, illustrating braiding on Segment 6.

B. Associated Features

1. <u>Berms</u>. Berms are linear mounds of stacked cobbles and boulders found along trail margins parallel to the trails themselves. Typically, berms function to bound a trail's downhill side (Figure 81.13). Berms are another feature of possible Euro-American introduction, although in at least one case—LA 90799, associated with the Caja del Rio North community house—large piñon and juniper trees growing in the path suggest that the construction of the associated berm is of some antiquity. This trail is also quite distinct from an obviously historic example nearby, making a credible case that the berms at LA 90799 are Ancestral Pueblo in origin.

2. <u>Flanking walls</u>. Walls of stacked shaped/unshaped cobbles set perpendicular to the course of a trail. Flanking walls are typically found at mesa rims and appear to have been designed to limit access to the mesa tops by people traveling on the trail (Figure 81.9).

Figure 81.9. LA 125383, illustrating Segment 1 with flanking walls.

3. Shoring. Shoring refers to the stacking of cobbles or other construction material to level the downslope side of a trail.

4. Cairns. Cairns are piles of unshaped cobbles placed alongside trails to mark their routes. Dating is a particular challenge regarding associated features of these types. Most are associated with Historic period trail construction, but are present in sufficient numbers on trails that otherwise are clearly associated with the Ancestral Pueblo period that each must be considered on its own merits (Figure 81.10).

Figure 81.10. LA 84137, illustrating associated cairns of possible Ancestral Pueblo date.

5. Trail markers. Trail markers consist of petroglyph panels or isolated elements that mark trail routes. While some trails may lead to or pass near larger petroglyph panels, trail markers are directly associated with trails themselves (Figure 81.11).

6. Gametraps. Gametraps are pits excavated into the tuff bedrock that are believed to have been used in the hunting of deer. Several gametraps have been found in direct association with Ancestral Pueblo trails (Figure 81.12). My interpretation of these features, following Steen (1977:29), is that they date from the colonial or early modern eras, and were used by Pueblo hunting parties who came up on the plateau when the full-time residential population had largely departed. Otherwise they would have represented a dangerous obstacle for people using the trails.

It should be evident from this list that the Pajarito trails can be complex and quite variable, since some major trails included most of these aspects of trail structure. The results of the project were documented in three reports (Snead 2000, 2001b) and one publication (Snead 2002a) that focused on the trail segments of the southern plateau.

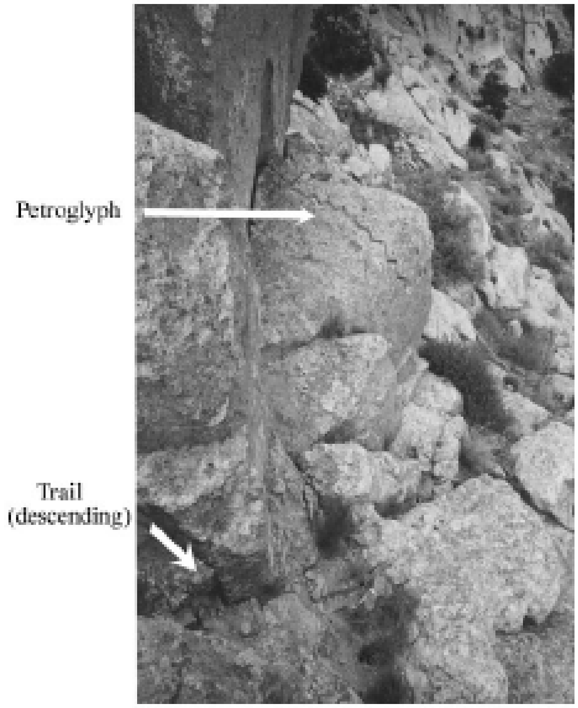


Figure 81.11. LA 21602, the Kwage Mesa trail network, illustrating Segment 4 with petroglyph trail marker.

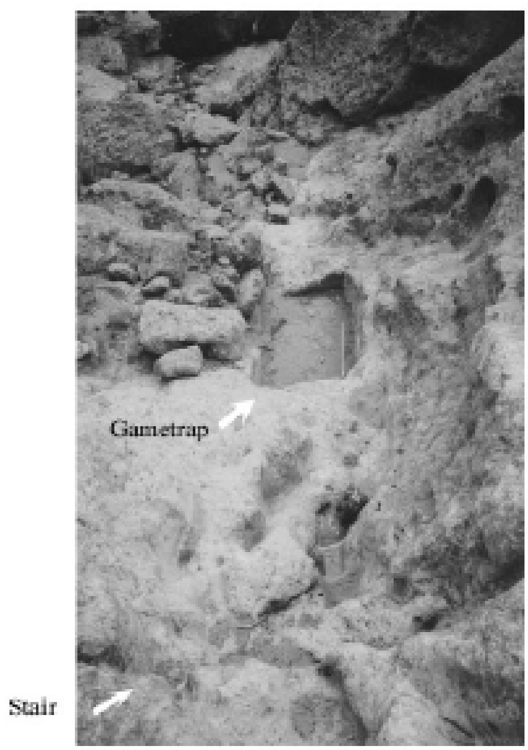


Figure 81.12. LA 66885, the Sandia Mesa trail network, illustrating Segment 6, with a game trap overlying descending stairs. View downhill, 1 m scale.

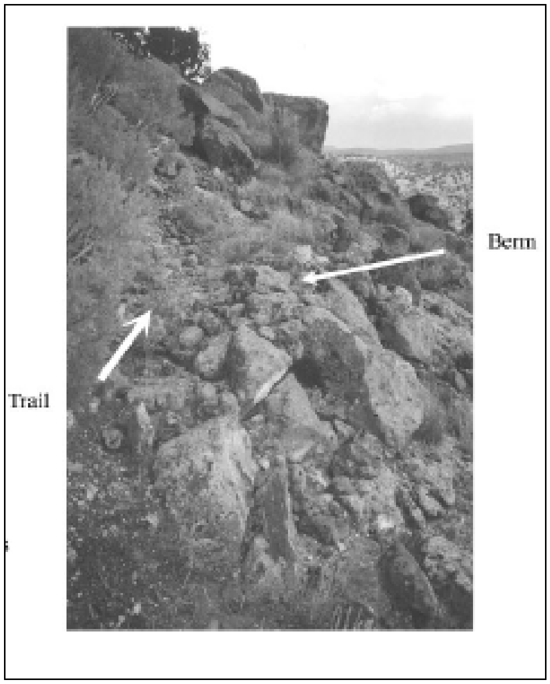


Figure 81.13. LA 84137, illustrating cobble berms associated with trail.

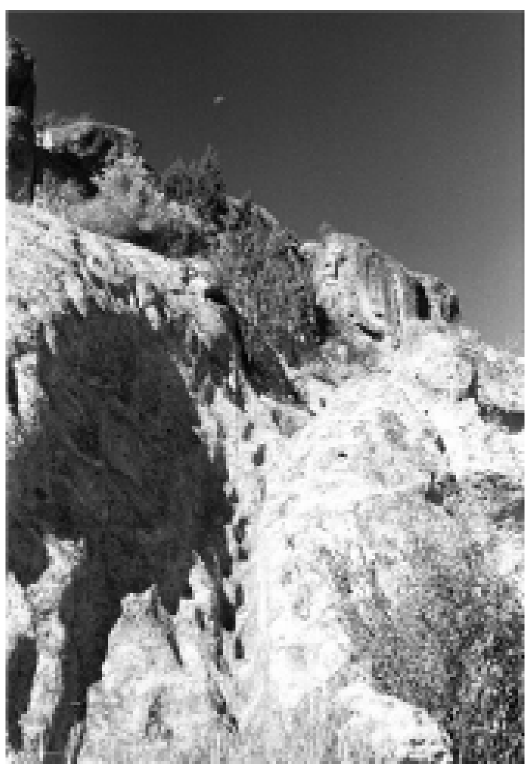


Figure 81.14. LA 70989, the Tsankawi Mesa trail network,
illustrating Segment 69, part of the Tsankawi North Staircase.

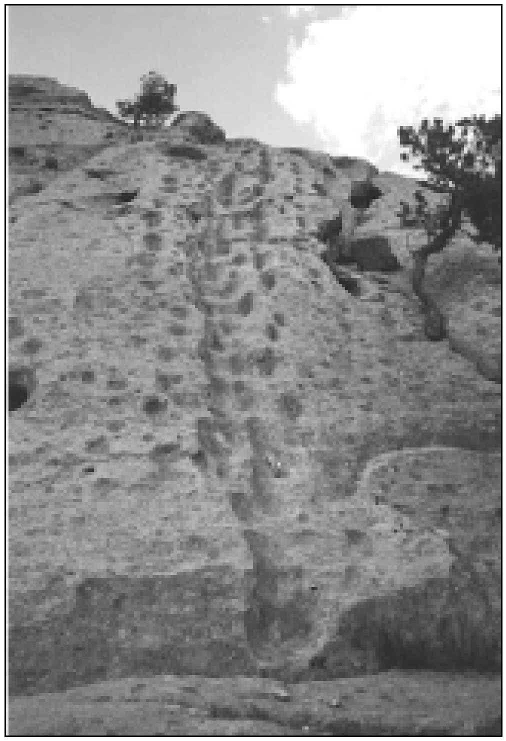


Figure 81.15. LA 21585, the Otowi Mesa trail network, illustrating Segment 07, part of the Bayo Staircase. 10 cm scale.

Figure 81.16. LA 134111, illustrating Segment 3, part of the Frijoles Staircase (detail).

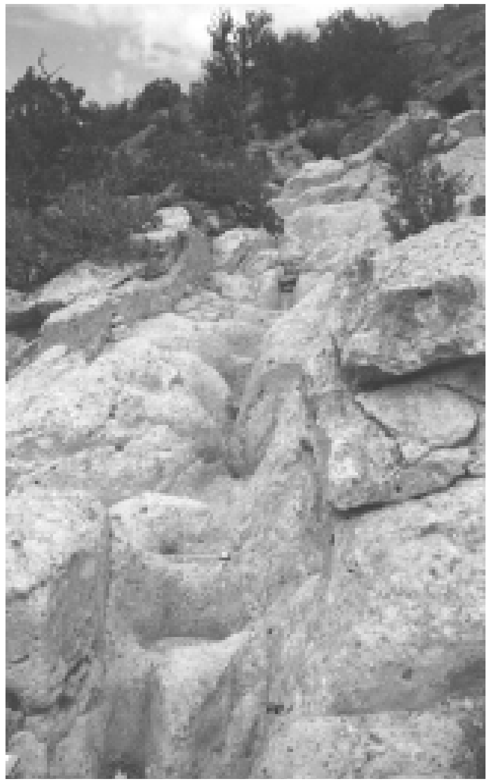


Figure 81.17. LA 65581, illustrating Segment 2, part of the Capulin Staircase. 10 cm scale.

ANCESTRAL PUEBLO TRAILS

In the following three sections I provide an overview of recorded Ancestral Pueblo trails of the Pajarito Plateau. They are the *Northern Pajarito*, defined as the area between Guaje and Santa Clara canyons; *Central Pajarito*, between Ancho and Guaje canyons; and *Southern Pajarito*, from Ancho Canyon south to the Rio Chiquito.

For several reasons, I do not provide a figure for the total number of sites recorded as trails in the Pajarito region. Detailed field checking has failed to confirm the presence of some of these features. Since many trails have been recorded as secondary features associated with residential sites, it is also often difficult to pick them out of site forms or databases. Hand and toe holds, for instance, are present at many sites but receive little or no mention. This would suggest that the number of sites that include trails or trail features is actually larger. In contrast, many of the more visible trails have been re-recorded or assigned different site numbers at different points along their length, as they pass near other features. In my own work, for instance, I have suggested that site numbers be assigned to particular, functionally interrelated trails, which would often subsume several different numbers. Numbers of trail sites thus reflects dueling strategies of record-keeping that only distantly approximate “real” conditions on the ground.

In the spirit of the "landscape" perspective towards archaeological trails that I advocate, however, recorded features presented below are divided into two categories. These are a) *local trails*, which appear to have had significance only to people living in the immediate vicinity, and *trail networks*, which either ran for longer distances or where multiple segments appear to have been functionally interlinked. Typically the local trails are identified by the LA number that has been assigned to them or another associated feature. They are listed in the associated table. I will list the LA numbers associated with the trail networks as well, but will also refer to them by names that represent the collective whole and will discuss them in the text.

The methodological difficulties described above will make it challenging to present trail data with any consistency until they are all re-recorded. This is particularly true since I am suggesting that some of the Pajarito trails have been erroneously recorded under different LA numbers, and that these should be consolidated. Thus in the case of trails and trail networks recorded by PTP, I indicate the LA numbers originally associated with the trail, the number under which I recommend that this information be consolidated, and the suggested name of the network. In cases where trails haven't been formally re-recorded but for which other information suggests that they form a network, I will list the relevant LA numbers and suggest a name for the network itself.

Northern Pajarito

Despite the fact that the Ancestral Pueblo trails of the northern Pajarito Plateau were the first to be noted by archaeologists, at present they are the least well-documented. This is in part because of the vagaries of land ownership and recent research; the area around Puyé (LA 47) has not been archaeologically examined in recent decades, and although numerous sites in Garcia, Chupaderos, and Guaje canyons were recorded by PARP, their sample transect strategy was ill-suited to the identification of trails. There is considerable anecdotal evidence for local trail networks throughout these canyons but formal documentation is almost entirely absent. Steen describes two sets of formal staircases associated with the Guaje Mesa site (LA 12900), both of which had been destroyed in recent rockfalls: "[t]he stairs were approximately 1.5 m wide and had fairly uniform risers of about 20 cm and treads of about 30 cm" (1977:30).

The only two trails that have been formally recorded in the area, LA 21444 and LA 21460, indicate the potential for further research. These trails are closely associated, running east (LA 21444) and west (LA 21460) from a prominent saddle on Chupaderos Mesa, the portrero separating Garcia and Chupaderos canyons. The saddle may be a node in the major north-south axis connecting more southerly areas with the vicinity of Puyé, with which these trails are closely articulated. A substantial Coalition community is present on Chupaderos Mesa (LA 21605), to which LA 21460 provides access from the west and north.

Another important northern Pajarito trail that has never been formally recorded is what I call the "Garcia staircase." The stair, located on a saddle between Garcia and Corral canyons, was originally noted by Hewett, who described the associated trail as "worn hip-deep in the rock by the attrition of human feet" (1906:16). A photograph of the stair was published in a subsequent report (Hewett 1908b:11). The Garcia staircase is a compact set of formal, constructed, braided steps climbing the west side of the canyon, not as long as many of the other Pajarito staircases but perhaps the most elaborate. Numerous minor trails/stairs are associated with the mesa top community to the west. The unique character of the Garcia staircase and its location roughly opposite the saddle associated with LA 21444 and LA 21460 suggests that it is probably related to the same north-south axis.

Central Pajarito

Research at the prominent community houses of the central Pajarito by Hewett and others in the early 20th century meant that attention was also paid to the associated trails. Photographs of the trails at several of the sites were published (cf. Hewett 1908b, 1909), and they appear on site maps (cf. Hewett 1906). These references, plus the recording of trail features by Steen, PARP, BAS, and LANL, have created a vastly larger body of data than is present for areas further north. This information was augmented by PTP work, first on San Ildefonso land in 1991 (see below), and subsequently on National Park Service (NPS) and LANL jurisdiction in 1999 and 2001.

Table 81.2 lists the different LA numbers associated with trails on the central plateau. Trails associated with Otowi, Tsankawi, and Sandia Canyon are described in greater detail in the relevant PTP reports (Snead 2000, 2001a). The list includes 129 trail segments grouped into 32 sites with LA numbers, representing four local trails, one major trail, and six trail networks. Trails in the San Ildefonso sacred area, which have not been assigned LA numbers, are treated separately.

Table 81.2. Ancestral Pueblo trails on the central Pajarito Plateau, listing alternative numbers and suggested names. The underlined LA number is that recommended for use when the different segments of a trail network are "consolidated."

LA #	PARP	LANL	PTP	NAME	SEGS	TYPE
12609				Sandia Pueblo Trail Network		?
16803				N/A		?
21585	266		4/5	Otowi Mesa Trail Network/Bayo Staircase	11	N
21602	500			Kwage Mesa Trail Network	11	N
21624	42			Old Pajarito Trail?	1	M
21629	47		6	Sandia Canyon Trail Network		
21632	50		6	Sandia Canyon Trail Network		
21634	52		6	Sandia Canyon Trail Network		
21635	53		6	Sandia Canyon Trail Network		
30639		TI-8		N/A		?
50976				Tsankawi Mesa Trail Network		
65661				Tsankawi Mesa Trail Network		
65683				North Mesa Trail Network		
65687				North Mesa Trail Network		
65714				Tsankawi Mesa Trail Network		
65716				Tsankawi Mesa Trail Network		

LA #	PARP	LANL	PTP	NAME	SEGS	TYPE
65738				North Mesa Trail Network	8	N
65740				North Mesa Trail Network		
65741				North Mesa Trail Network		
65743					7	L
65752				Tsankawi Mesa Trail Network		
65753				Tsankawi Mesa Trail Network		
65754				Tsankawi Mesa Trail Network		
65755				Tsankawi Mesa Trail Network		
65756				Tsankawi Mesa Trail Network		
65757				Tsankawi Mesa Trail Network		
66885		L-38	6	Sandia Canyon Trail Network 9	9	N
70956				Tsankawi Mesa Trail Network		
70989				Tsankawi Mesa Trail Network	74	N
70993					1	L
125383					3	L
127693		Q-29	3	Otowi East Trail Network	4	N

Segs = number of recorded trail segments; L = local (minor) trail; M = part of major (regional) trail; N = network of related trails

LA 12609. LA 12609 is the Sandia Pueblo trail network and is a series of stairs and trails leading up the north side of Mortandad Canyon to the mesa top community house. These trails have not been recorded in any substantive way. There is evidence that Sandia Pueblo is linked to the Sandia Canyon trail network (LA 66885), but this has not been confirmed by fieldwork.

LA 16803. LA 16803 is an unnamed trail on the north side of Mortandad Canyon that was initially noted in the 1970s and subsequently re-recorded by LANL. This trail appeared to be isolated, implying to Steen that it was of local significance, despite the fact that it is “deeply cut” (Steen 1982:7). The fact that LA 30639 was subsequently recorded nearby, however, makes it possible that the two formed part of a larger network, perhaps a major east-west trail ultimately linking up with the North Mesa trail (see below).

LA 21585. LA 21585 is the Otowi Mesa trail network. It is a series of 11 trail segments that consists of the Bayo staircase, which climbs out of Bayo Canyon north of Otowi (LA 169), a segment descending the north side of the mesa into Barrancas Canyon, and associated trail features to the east and west along the mesa top. LA 21585 was originally assigned to a set of hand and toe holds climbing up the south face of the mesa west of the Bayo staircase recorded by PARP; subsequent LANL fieldwork applied the number to other trail features on the mesa (Hoagland et al. 2000:7–81), while the segment entering Barrancas Canyon was added by PTP in 1999.

LA 21602. LA 21602 is the Kwage Mesa trail network. PARP recorded three segments of this trail ascending the toe of Kwage Mesa west of Otowi. These segments were re-recorded by PTP in 1999 with several additional segments recorded on the south-facing cliff of the mesa, where a possible rock-art shrine is present (Snead and Munson 2001). The total number of segments is

11. Since Kwage Mesa is not continuous to the west, these trails appear to be of local significance.

LA 21624. This trail is a short, deeply worn trail segment recorded by PARP and that crosses a narrow mesa neck south of Tsirege. The topographic location of this trail and the apparent depth of wearing evident suggests that this trail may have been a segment of a major north-south network.

LA 21629. This is a short trail that was recorded by PARP but not re-located by PTP. The original site form suggests that it is a local trail providing access to a mesa top summit north of Sandia Canyon; it is probable that this is actually Segments 5 and 6 of LA 66885 (see below).

LA 21632. See LA 66885.

LA 21634. See LA 66885.

LA 21635. See LA 66885.

LA 30639. This is a short trail segment recorded by LANL on Sigma Mesa north of Mortandad Canyon. There is a circular feature of unknown association at the toe of the mesa above the trail, suggesting that the trail may have provided local access to this feature; the proximity of LA 16803, however, suggests the possibility that the two trail segments may have been part of a trail network supporting east-west movement along the mesa tops.

LA 50976. See LA 70989.

LA 65661. See LA 70989.

LA 65683. Part of the suggested North Mesa trail network; see LA 65738.

LA 65687. Part of the suggested North Mesa trail network; see LA 65838.

LA 65714. See LA 70989.

LA 65716. See LA 70989.

LA 65738. LA 65738 is the North Mesa trail network. This series of a minimum of eight segments recorded under five LA numbers (65683, 65687, 65738, 75740, and 65741) represents access to the summit of Tsankawi North Mesa and travel along it to the east and west. These segments were visited in 2001 but not formally re-recorded, so that their definition as a trail network is incomplete.

LA 65740. Part of the suggested North Mesa trail network; see LA 65738.

LA 65741. Part of the suggested North Mesa trail network; see LA 65738.

LA 65743. This is a related set of minor trails associated with a group of cavates on a lower level near the west end of North Mesa. The articulation of these trails with the North Mesa Trail Network is unclear.

LA 65752. See LA 70989.

LA 65753. See LA 70989.

LA 64754. See LA 70989.

LA 65755. See LA 70989.

LA 65756. See LA 70989.

LA 65757. See LA 70989.

LA 66885. LA 66885 is the Sandia Canyon trail network. This series of nine trail segments recorded under five LA numbers (21632, 21634, 21635, poss. 21629, and 66885) represent a major route onto the mesa between Sandia and Los Alamos canyons and along it to the west. The recording of these segments has a complex history; see Larson (1987:11) and Snead (2001b) for further details. It is likely that these segments were originally a part of the North Mesa trail (see below), and also articulate closely with the Tsankawi Mesa trail network.

LA 70956. See LA 70989.

LA 70989. LA 70989 is the Tsankawi Mesa Trail Network. As defined in 2001, this network consists of 74 distinct trail segments associated with LA 214 (Tsankawi Pueblo), and was originally recorded under 12 LA numbers (50976, 65661, 65714, 65716, 65752-57, 70956, and 70989). The network includes features on the top and flanks of the mesas as well as stairways connecting the mesa top with the surrounding valleys. This is the most intricate trail network on the Pajarito, with a total measured length of 7.62 km (4.73 mi). The Tsankawi Mesa trail network connects both to the Sandia Canyon trail network to the west and the proposed North Mesa trail network to the north.

LA 70993. This is a minor trail running along the north flank of North Mesa, apparently below the upper cliff. No other associations noted in the site report.

LA 125383. This is a minor trail providing access to the top of “fence mesa” or “south mesa” immediately south of Tsankawi Mesa. Trail is notable for the flanking walls that restrict access to the mesa summit and between which the trail passes.

LA 127693. LA 127693 is the Otowi East trail network. As defined in 2001, this network consists of a minimum of four trail segments associated with the small mesa east of Otowi (LA 169), all of which serve to provide access to the mesa summit. Rough terrain inhibits movement further east.

Sacred Area Trails

In the summer of 1991, I spent two weeks undertaking reconnaissance survey of portions of the San Ildefonso Sacred Area, located on the Central Pajarito Plateau. This area is critical for an understanding of Ancestral Pueblo settlement in the region, since it includes much of the terrain between Pajarito and Sandia canyons and, in particular, the Classic period community house of Navawi (LA 214). Restricted access to this property means that knowledge of sites in this area is several decades old; my examination of these early records, however, suggested that trails were an important part of the archaeological record in the Navawi area. I accordingly applied to the Office of the Governor at San Ildefonso Pueblo for a permit to make a preliminary assessment of trails and related sites therein, which was granted with the proviso that respect be shown to any locations of a probable sacred nature. The informal nature of the project also meant that no reports were filed with the New Mexico Historic Preservation Division, nor were LA numbers assigned to the sites encountered.

The brevity of the project, the large area covered and the fact that I conducted the work by myself on all but a few days meant that the data were recorded in haste. This was also several years before I devoted much thought to developing a recording protocol for trail features. The result is a body of information that is incomplete and not directly comparable to records collected by the BAS or, later, by PTP. It is, however, suggestive of the full extent of the trail system on the central Pajarito, and fills an important spatial gap between the major communities. Further research in the vicinity, particularly with the advent of geographic positioning system recording of archaeological sites, is a high priority.

Of the 34 sites noted in the course of the Sacred Area survey, 17 were trail features, for a total estimated length of 1.61 km (1 mi). Several of these included multiple segments, as presently defined. All of the characteristics of trail fabric and structure noted elsewhere on the Plateau were present, with some segments worn or constructed to nearly 0.66 meters in depth. Cairns and berms were also noted. Minor trails linking mesa tops to canyon bottoms were distinguished in four cases; seven others can be collectively considered to form a Navawi Mesa trail network, linking the Navawi community house with the surrounding countryside. Among these can be included a series of four braided trails with associated stairs/steps at the mesa neck northwest of Navawi that is also the location of the famous “game trap” mentioned by Steen (1977:29). This seems to be the major “gateway” to Navawi itself. Several of the associated trails are highly formal. Another element of the Navawi Mesa trail network is a parallel set of stairs descending into the canyon due east of the community house, illustrating the redundant character of stairs known from other Pajarito examples.

One of the most significant aspects of the Sacred Area survey was the recording of five trail segments that represent long-distance travel across the central plateau. In particular, these link both the larger Coalition period settlements in the area and the three large community houses (Tsankawi, Navawi, and Tsirege) that dominate the settlement pattern in the subsequent Classic period. One major route is visible for a considerable distance traveling along the mesa top northwest of Navawi, passing directly through a substantial Coalition settlement before descending into Sandia Canyon close to New Mexico Highway 4. At this point, travel onwards towards Tsankawi, visible to the north, would pass through valley bottoms, but a route towards the Coalition site of Sandia Pueblo (LA 12609) to the northwest is equally plausible (and, since the mesa top trends in that direction, may be preserved archaeologically).

Between Navawi and Tsirege the route runs across the lay of the land and is largely visible where it crosses saddles on the low mesitas. To the southwest one of these segments ascends from the Cañada del Buey, only a short distance beyond Tsirege, while to the northeast the trail enters Mortandad Canyon directly west of the gametrap/trail complex on Navawi Mesa. These trail segments are uniformly short and widely separated but often deeply worn, showing signs both of construction and of long-term use. In this they are analogous to LA 21624, which may represent a similar major trail headed south from Tsirege. Perhaps the most dramatic trail recorded in the Sacred Area survey is on North Mesa at Tsankawi on the San Ildefonso side of the fence east of the monument boundary. Here a worn trail, sometimes divided into two clearly parallel routes, heads down the mesa in the direction of the Rio Grande, with recognizable segments extending to over one km in length. Associated stairways, including one formal feature that descends north into Los Alamos Canyon, indicate the importance of this route, which is clearly a continuation of the North Mesa trail network. In each of these cases the presence of worn trail segments far from the larger centers of habitation indicates frequent use over long periods of time (see below).

Southern Pajarito

Sites and trail network names recorded in the Southern Pajarito are listed in Table 81.3. This area has seen the most recent and intensive survey, and there is a correspondingly greater number of trail features recorded. The BAS recorded 49 trail features in the main section of the monument, of which several are otherwise clearly "historic." Table 81.4 includes lists of these latter sites as well as historic trails that have been recorded elsewhere on the plateau. In addition, some of the BAS trails could not be re-located in 1999 and should be considered questionable (see Table 81.5). An additional 27 sites were recorded as trails by BAS but were not re-recorded. The current list of recently documented trails thus includes 47 trail segments grouped into 15 sites with LA numbers, representing five local and 10 major trails. Further information on most of these trails can be found in Snead (2000).

Table 81.3. Ancestral Pueblo trails on the southern Pajarito Plateau, listing alternative numbers and suggested names.

LA #	BAS IO	PTP	Name	Segments	Type
60442			Portrero del Rito Trail		M
60494			Old Pajarito Trail	4	M
60495			Old Pajarito Trail	3	M
60496			Portrero del Rito Trail		M
60522				6	L
65581			Portrero de las Vacas Trail/ Capulin Staircase	4	M
65846			Portrero de las Vacas Trail?	5	M?
77779			Portrero del Alamo Trail	5	M

LA #	BAS IO	PTP	Name	Segments	Type
84137			Old Pajarito Trail?	3	M
84138				1	L
90799			Portrero del Rito Trail?	?	L
134110	325	2		1	L
134111	245	1	Old Pajarito Trail/Frijoles Staircase	5	M
134901		7	Portrero del Rito Trail 4		M

Segs = number of recorded trail segments; L = local (minor) trail; M = part of major (regional) trail; N = network of related trails

Table 81.4. An incomplete list of recently recorded Historic period trails on the Pajarito Plateau.

LA #	Location	Status
50950	Capulin Canyon	Site stake and other features found in 1999, but trail/groove segments originally recorded do not appear to be trail features
60521	Capulin Canyon	Site stake and other features found in 1999, but trail was not located
65611	Capulin Canyon	Apparent location of the site was investigated in 1999, but the site stake and the trail were not located.
65855	Capulin Canyon	The site was found in 1999; the trail feature was considerably more ephemeral than previously indicated, and is thus of questionable association

Table 81.5. Reputed Ancestral Pueblo trails on the Pajarito Plateau that could not be re-identified by PTP.

Identifier/LA #	Description
BAS IO 44	Minor trail near Corral Hill on the Portrero del Rito
BAS IO 430	Trail of uncertain associations north of San Miguel
LA 50933	Trail of uncertain associations on the Portrero del Alamo
LA 50909	Minor trail on the Portrero del Alamo. Not rerecorded
LA 50911	Trail of uncertain associations on the Portrero del Alamo
LA 50964	Minor trail associated with a small pueblo in Capulin Canyon
LA 50986	Trail of uncertain associations along a branch of Hondo Canyon
LA 53141	Trail of uncertain associations on the Portrero del Rito
LA 53167	Trail of uncertain associations on the Portrero del Rito
LA 60177	Trail of uncertain associations in Sanchez Canyon
LA 60446	Trail of uncertain associations on the Portrero del Rito
LA 60507	Trail of uncertain associations along west side of Capulin Canyon
LA 60508	Trail of uncertain associations along west side of Capulin Canyon
LA 60544	Trails of uncertain associations along west side of Capulin Canyon near its mouth
LA 65601	Trail of uncertain associations along west side of Capulin Canyon

Identifier/LA #	Description
LA 65670	Trail of uncertain associations above west rim of Capulin Canyon
LA 65689	Minor trail associated with a small structure in Capulin Canyon
LA 65701	Trail of uncertain associations in Medio Canyon
LA 65777	Trail of uncertain associations along Capulin Canyon rim
LA 65792	Minor trail associated with a small pueblo in Capulin Canyon
LA 70851	Trail of uncertain associations west of Capulin Canyon
LA 71008	Trail of uncertain associations along Hondo Canyon
LA 71013	Trail of uncertain associations along Hondo Canyon
LA 71036	Trail of uncertain associations along branch of Hondo Canyon
LA 71044	Major trail running down mesa south of Yapashi
LA 77707	Trail of uncertain associations on the upper Portrero del Alamo
LA 77762	Trail of uncertain associations on the Portrero del Alamo

LA 60442. LA 60442 is a major trail and is part of the Portrero del Rito trail (see below), which runs along the Portrero del Rito south of Frijoles Canyon. The site is associated with LA 60496 and LA 134901.

LA 60494. This is a major trail that is part of the Old Pajarito trail (see below). It consists of four recorded segments that climb the south side of Frijoles Canyon across the creek from the modern horse corral. It is associated with LA 60495. Some worn areas are evident, although the slope itself consists largely of loose talus.

LA 60495. LA 60495 is a major trail that is part of the Old Pajarito trail (see below). It runs parallel to LA 60494 but is less formal in its attributes. Three segments of the trail were recorded. Cairns associated with both of these trails are of uncertain association, particularly since modern travel is apparent on the trail.

LA 60496. This site is a major trail that is part of the Portrero del Rito trail (see below). It is associated with LA 60442 and LA 134901. Both LA 60496 and LA 60442 were quite ephemeral when originally recorded. Neither of the trails could be re-located in 1999, despite the identification of other features associated with these "sites," suggesting that the ongoing watershed restoration in the vicinity had impacted their visibility.

LA 60522. This is a minor trail that consists of six recorded segments climbing the east side of Capulin Canyon.

LA 65581. LA 65581 is a major trail that is part of the Portrero de las Vacas trail (see below). This site consists of five recorded segments that climb the east side of Capulin Canyon. This trail provides access from points to the south and west to the mesa top and ultimately, Yapashi (LA 250); it has been designated the "Capulin Staircase" because of deeply worn/constructed segments, braiding, and sets of stairs.

LA 65610. This is a minor trail that consists of six short recorded segments that are largely sets of steps. The area is notable for a petroglyph trail marker at the point where the trail meets the mesa rim.

LA 65846. This is a possible major trail of five segments that leads south from Yapashi (LA 250). This trail may be the initial stretch of the Portrero de las Vacas trail (see below) and link up with the Capulin Staircase (LA 65581), but it is also possible that it only went as far as a small mesa top summit that may have been the location of a shrine. This is the only recorded trail directly associated with Yapashi, which suggests that further survey in the vicinity would be valuable.

LA 70821. This is probably an historic trail northwest of Yapashi.

LA 77721. LA 77721 is an historic trail in Frijoles Canyon that is a possible former interpretation loop.

LA 77731. This is an historic trail in Frijoles Canyon that is a possible former interpretation loop.

LA 84901. This is probably an historic trail in Frijoles Canyon that is of uncertain association.

LA 110141. This is the Mattie Brook Trail located in DP and Los Alamos canyons (Hoagland et al. 2000:7-2).

LA 127624. LA 127624 is the Los Alamos Bench Trail that runs along the north rim of Los Alamos Canyon (Hoagland et al. 2000:7-3).

LA 127699. This site is the Camp Hamilton Trail, which is on the mesa south of Pueblo Canyon (Hoagland et al. 2000:7-149).

LA 138092. This is an historic trail that climbs the west side of Hondo Canyon. This route possibly intersects with that used by LA 65581, which was also used historically (Gauthier, personal communication, 2003).

LA 77779. LA 77779 is a major trail that is part of the Portrero del Alamo Trail (see below). It consists of five segments running from the mesa top down the west slope of a tributary drainage, ultimately leading toward the Rio Grande. LA 77779 is highly formal, with several step/stair segments and cairns of various dates. Large parts of the route are in view of the LA 12579 community house, which is across the river.

LA 84137. This site consists of a major trail of three segments linking the Portrero del Rito with the bottom of Lummis Canyon. Berms and cairns are present and the site is closely associated with LA 84138. This may be one of the primary routes associated with the Old Pajarito trail (see below), but further definition is required.

LA 84138. This is a minor trail of a single segment that provides access to a mesa top shrine overlooking the confluence of Lummis Canyon and the Rio Grande. LA 84137 is only a few meters distant.

LA 90799. LA 90799 is a major trail located on the east side of the Rio Grande across from the mouth of the Rito de los Frijoles. The site is associated both with LA 174, the Caja del Rio North community house, and LA 134901, which represents the easternmost extension of the Portrero del Rito trail (see below).

LA 134910. This is a minor trail that consists of a single recorded segment that descends into White Rock Canyon from the Portrero del Rito several hundred meters south of LA 134901. This trail is comparatively ephemeral and does not link to any previously documented routes.

LA 134111. This site consists of a major trail and is part of the Old Pajarito Trail (see below). It contains five recorded segments that climb up the east side of Frijoles Canyon. This highly formal feature, with stairs, braiding, and deeply worn sections, is also called the "Frijoles Staircase."

LA 134091. LA 134091 is a major trail that is part of the Portrero del Rito Trail (see below). It contains four recorded segments that descend into White Rock Canyon from the southeastern end of the portrero. Flanking walls are present where this trail crosses the canyon rim, and it is evident that this is the major route into the Frijoles area referred to by Hewett (1909:437) and Bandelier (1982:146–147).

LA 138059. This is a major trail that climbs the mesa in lower Hondo Canyon. The site was recorded by NPS in 2002.

DISCUSSION

There are several interesting points of comparison between the recorded trails from the Central and Southern Pajarito. Figure 81.18 depicts the general distribution of sites recorded since the early 1990s, either by the PTP, LANL, or post-BAS research within Bandelier (for clarity, sites recorded earlier have been omitted). Most evident is the impact of different survey regimes in different jurisdictions on the plateau, with the absence of recent work on the northern plateau creating an obvious and artificial gap in the record.

There is, however, an obvious pattern in the distribution of trails in the different defined categories. Although minor trails are distributed relatively evenly, trail networks are confined entirely to the central plateau. In contrast, segments of major trails dominate in the south but appear to be less common further north. Once again, this pattern appears to be less a product of human action and more attributable to geology and the parameters of modern land ownership. All of the trail networks on the central plateau are found on the relatively low, flat mesas of the area, where wide exposures of tuff are common. Such conditions favor the preservation of even relatively ephemeral trails. With the exception of Otowi, all of the Classic period community houses on the central plateau are located on such mesa tops, meaning that the dense patterns of activity associated with such sites have remained visible.

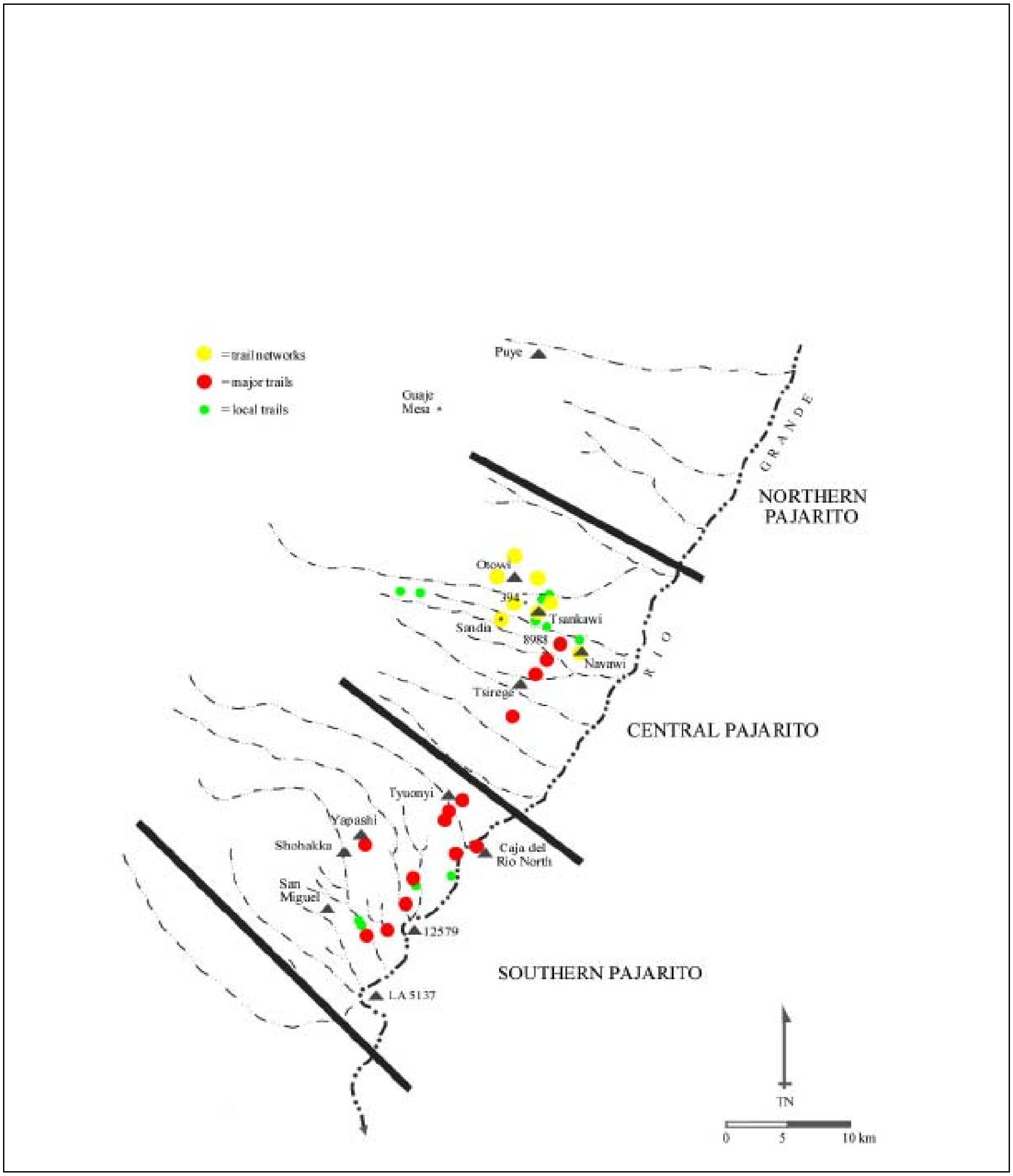


Figure 81.18. Ancestral Pueblo trails of the Pajarito recorded by PTP or other recent projects, along with other sites mentioned in the text.

In contrast, the community houses of the southern plateau are located either on tops of broad portreros (e.g., Caja del Rio North, Yapashi, and San Miguel) or in the canyon bottoms (e.g., Tyuonyi, Shohakka, LA 12579, and LA 56137), both locations where topsoil is relatively well-preserved. Such circumstances are not conducive to the preservation of trail networks as exist further north. Indeed, trails appear most clearly along the canyon rims, in some cases far from the community houses themselves. The cluster of major trails along the Rio Grande does reflect important patterns of movement, which will be taken up below, but the analogous terrain on the central plateau is presently unavailable for survey. Lastly, several of the trail networks of the central plateau are not directly associated with the community houses but instead represent major trails with associated alternate routes and feeder trails, rendered different in appearance to those further south by the vagaries of preservation but conceptually analogous.

In essence, we have yet to reach a point in the recording of Pajarito Plateau trails where the sort of broad spatial trends implied by Figure 81.18 can actually be relied upon. There remain, however, several areas of useful discussion.

Trail Names

The complexities of trail data that are hinted by Tables 80.2 and 80.3, in which minor trails, major trails, trail networks, and their constituent segments mesh uneasily with different site-numbering systems, are quickly becoming an impediment to understanding the data itself. My suggestion is that the nomenclature used here be expanded to incorporate the most spatially extensive scale of the trail system, thereby providing frames of reference more in keeping with the actual structure of the landscape and less entrapped by archaeological convention. This system is essentially hierarchical. The minimal units are aspects of trail fabric and features associated with particular trail segments. If necessary, closely related groups of segments can still be considered “sites,” designated as either local trails or major trails by applying the criteria outlined above. More widespread use of the trail network concept, and consolidating them under one LA number, will result in a smaller number of sites being designated and thus streamline the process, but this will not be relevant in all cases.

At the maximal level, groups of related sites (or networks) should be linked together into “named trails” that reflect movement across the landscape at a large scale. Those names should be derived from traditional toponyms to reflect the relationship between trails and the surrounding terrain. Naming dozens of local trails would be as confusing as referring to them by LA number, but the data suggest that the numbers of major trails are relatively few. I suggest the following named trails, from south to north:

Portrero de las Vacas Trail. This would refer to all trails heading towards Yapashi from lower Capulin and, possibly, Hondo canyons, presently represented by LA 65581, the Capulin Staircase.

Portrero del Alamo Trail. This would refer to all trails leading north/northwest up the portrero between Alamo and Lummis canyons, presently represented by LA 77779.

Portrero del Rito Trail. This would refer to all trails heading north/northwest up the portrero south of Frijoles Canyon, presently represented by LA 60442, LA 60496, LA 134901, and, possibly, LA 90799, which although it is on the east side of the Rio Grande clearly articulates with LA 134901.

North Mesa Trail. This would refer to all trails headed east-west on the series of mesitas immediately north of Tsankawi, in particular the North Mesa trail network and the Sandia Canyon trail network. Note that not all of the potentially relevant major trails/trail networks listed in Tables 81.2 and 81.3 are covered by these names, since some spatial associations and relationships are less clear than others. All of those named here, however, represent long-distance, roughly east-west routes linking the Rio Grande with points close to the Jemez or San Miguel Mountains.

A final, and perhaps more controversial, trail designation is what I am calling the *Old Pajarito Trail*, which represents a north-south route that spanned the entire Pajarito Plateau. Identifying such a feature is challenging, since moving across the southeast/northwest-trending portreros might leave less evidence than following the terrain. It would seem to be just such a route that the early explorers followed, however, and physical evidence that such a major thoroughfare once existed is also accumulating. At present I would include LA 60494, LA 60495, LA 134111 (the Frijoles Staircase), LA 21624, several deeply worn trail segments on San Ildefonso land between Tsirege and Mortandad Canyon, LA 21585 (the Bayo Staircase), and the Garcia Staircase, with the trail ultimately coming to an end first at Shufinne (LA 795), and in subsequent centuries further east at Puyé. LA 81437, which descends from the Portrero del Alamo into Lummis Canyon near its confluence with the Rio Grande, may represent the point where the Old Pajarito Trail finally descends and begins to follow the river bottom towards Cochiti.

There is some logic to the terrain that such a route would have followed. From the top of the Bayo Staircase, for instance, the viewer looks through a gap in the north side of Barrancas Canyon, making for relatively unobstructed travel as far as Guaje Canyon. On a reconnaissance along that section of the Guaje Canyon rim in 2001, I located an old cairn that marked a likely spot for just such a trail to have descended. This is obviously ephemeral data, but my expectations are that when fieldwork is extended to parts of the plateau that are currently under-documented, such as the zone between Frijoles and Pajarito canyons and that between Guaje and Garcia canyons, more evidence for the Old Pajarito Trail will be forthcoming.

Dates and Routes

Dating the Pajarito trail system is largely a process of defining the association between the trails and other, more chronologically sensitive, features, so it is only with reference to the extensive databases established by the various Pajarito projects that any progress can be made on this issue. As empirical evidence for the extent of the trail system increases, the subtleties of these associations become clearer. There do appear to be morphological aspects of trail structure that pertain to different time periods, and some associated features, such as petroglyphs, contribute relevant information.

It can be assumed that the local trails were the products of patterns of movement through the landscape that may have been quite brief. LA 65610, for instance, is closely associated with a fieldhouse on the portrero east of Capulin Canyon, and it is logical to associate the relatively ephemeral trail with the use of that structure over only a few generations. A single Agua Fria

Glaze-on-red sherd found at the fieldhouse would thus suggest an Early Classic date for the entire complex. The associated trail marker, a single petroglyph of the outline of a human head adorned by a feather (see Snead 2002a:763), enforces the image of a pattern of use that was restricted in time and pertained to a particular circumstance.

A relative chronology can also be established for several of the major trails. In cases where a comparison between the trail system and the Coalition/Classic settlement pattern can be made, the Coalition sites appear to represent a better "fit." This is particularly clear on the central plateau, where the trail from Navawi to Tsankawi intersects a clustered Coalition settlement (LA 8988), and the North Mesa trail appears to pass through LA 394 before merging with the Sandia Canyon trail network. The associated trail segments, including one continuing southwest towards Sandia Pueblo, are all heavily worn. In contrast, a branch of the trail that heads back east toward Tsankawi, is relatively ephemeral.

It is also interesting to note that the major trail represented by the Frijoles Staircase (LA 134111) and LA 60494/LA 60495, passes through Frijoles Canyon 800 meters south of the center of Classic period population in the canyon (e.g., Tyuonyi and Long House). This is despite the fact that, as demonstrated by the modern Frey trail, it is possible to descend the canyon's north cliff much closer to Tyuonyi.

It thus appears that the major axes of movement on the Pajarito Plateau date to the Coalition period, suggesting that they were established during the early period of settlement on the plateau. When the settlement pattern shifted during the Classic period, short "feeder routes" developed that linked the new community houses more closely to the regional trail system. When these communities were abandoned, however, the traditional network appears to have resumed its original importance, with evidence suggesting use well into the Historic period.

Guard Pueblos

The concept of guard pueblos, which are small residential facilities established as outliers of community houses to provide warning or defense in case of attack, is widespread in southwestern ethnography (cf. Connelly 1979:540), and has recently been inferred to explain the distribution of sites in Frijoles Canyon (Snead et al. 2004). It is also closely correlated with trail systems, since it is the regional trail system that would bring outsiders into a community.

Identifying some of the smaller residential structures on the Pajarito as guard pueblos would be an important step in understanding the settlement pattern, and the relationship between these sites and the trail network would be important evidence of such a function. This close correlation exists in three cases; Duchess Castle (LA 42), Navawi Long House (LA 214), and Rainbow House (LA 217). Each of these sites can be considered a "satellite" of a nearby larger community house (Tsankawi, Navawi, and Tyuonyi, respectively), and each is directly associated with a major trail that passes near, but not directly through, the community house itself. Travelers from particular directions would only have access to the community core after passing the guard pueblo. The fact that Caja del Rio North commands a clear view of Tyuonyi several kilometers to the northwest and also sits on the trail leading to it suggests that it may have had a similar function.

Guard pueblos appear to have been a relatively late development, coming only with the 14th century AD. It isn't clear whether this is due largely to the reorganization of settlement associated with the rise of the community houses, or whether some added constraint, such as increasing conflict, played a role. It does seem likely, however, that they are a reflection of an increased need to keep watch on the trails, a need taken to the greatest extreme in Frijoles Canyon, where Frijolito (LA 78) and the House of the Water People (LA 10942) in addition to Rainbow House may have created a formidable perimeter.

Labor Investment

The final point of discussion here is the issue of relative investment in trails. It was clear from the outset that not all trails were constructed in the same fashion, and the original designations "local" and "major" reflected more than function. Although both trail fabric and associated features provide evidence for levels of investment, fabric is more reliable since it is in that area that Ancestral Pueblo "style" is most distinctive.

It is typically argued that investment of labor in trails relates to increasing efficiency. It could thus be expected that more elaborate trails would be present in places where traffic was high and terrain difficult. This is to a certain extent true in the Pajarito case, since several of the more elaborate trails are found at topographic "choke points" or places where obstacles must be crossed. Pajarito archaeologists have frequently noted, however, that explaining the more labor-intensive trails in terms of "efficiency" is not always adequate. In many cases steps are pecked out to an extent that far exceeds functional requirements, and indeed makes climbing more difficult. Some sets of steps are also located on relatively gentle slopes where it is almost easier to walk beside them than in them.

It is increasingly clear that the Pajarito trails include some symbolic content that is expressed not only in the form of petroglyph trail markers but in the structure of the trails themselves. The most visible manifestation of such "meaning" are the remarkably elaborate staircases. The most prominent cases recorded to date, the Bayo, Capulin, Frijoles, and Tsankawi North staircases (Figures 81.14 through 81.17), are remarkable examples of the investment of labor in trails. Each of these cases includes sections of formal stairs, sometimes extending for more than 10 meters, with additional features such as hand holds also present. Braiding is also a recurrent feature of Pajarito staircases; all of those recorded are characterized by multiple routes, sometimes tightly interwoven, sometimes forming distinct parallel stairs up the sides of the canyon.

It is difficult to construct a functional explanation for the high level of formality in staircases. At the Frijoles Staircase, for instance, it is possible to walk up the slope alongside the most formal stair segment almost as easily as it would be to use the stair itself. There also seems to be only one such highly formalized staircase in association with particular sites; although there are numerous stairs in association with the Tsankawi Mesa trail network, the Tsankawi North Staircase is qualitatively distinct. The same holds true for Otowi, where despite the presence of trails and steps associated with travel east and west (the Kwage Mesa trail network, and the Otowi east trail network), neither approaches the high formality of the Bayo staircase. The nature of braiding at these sites is also distinct. Since the stairs are actually constructed, it is difficult to account for the existence of parallel routes as a simple factor of shifts in traffic over time. Parallel sets of stairs were intentionally constructed, and while it can be argued in some cases that such efforts would be necessary when some steps became too worn to be used efficiently, this is clearly not the case in all examples.

I have argued that these elaborate staircases represented formally designed entrances to the major communities, a feature I call "gateway trails" (Snead 2002c:763). As such, they are intended to symbolically inform the traveler that they were entering a new space, one directly associated with a community house and its residents. They would thus be a different iteration of a trail marker, in which the investment of labor in the trail itself would signify ownership, identity, or some related concept. In their original form, together with the cairns, berms, and other associated features that are now largely absent, such approaches would have been visually impressive symbols of community.

The issue of braiding/parallel routes may pertain to a related but distinct process. Within Pueblo society, repetition is a key component of ritual; such actions can involve the process of construction as well, such as the repetitive plastering of the inner walls of kivas and other ceremonial spaces. Watson Smith tabulated numerous archaeological sites where kivas had been plastered on multiple occasions, up to as many as 63 at Hawikuh; one of the kivas in his survey that featured 20 replasterings was in Frijoles Canyon (cf. W. Smith 1952:17). The construction and dismantling of altars for ritual practices in many of the pueblos also seems to reflect a similar process (see Parsons 1996 [1933]. In the case of gateway trails, the repetitive re-construction of trails may represent a formal renewal of the relationship between the community and the route, possibly conducted at particular intervals or at points of social/political transition. Under such circumstances, the establishment of parallel routes may not have reflected a need to speed up traffic or bypass an obstacle, but instead a desire to reestablish a ritual relationship between the community or some of its members and the trail itself.

Another intriguing possibility regarding trail symbolism concerns duality. In several cases, stairways are structured as two parallel and distinct routes in close proximity. The best example is the Bayo Staircase, where two stairways climb much of the distance to the mesa top 10 to 20 meters apart. This is echoed in a pair of stairs at Navawi, segments 7 to 8 of the Sandia Mesa trail network (and possibly segment 4; Snead 2001a:map 2), and perhaps in the Tsankawi North Staircase as well (segments 71 and 69), where two different stair segments can be distinguished on the exposed tuff. Such patterning may also be present in other trails on the central plateau; two braided routes are evident in the North Mesa trail east of the NPS boundary, and two clear, parallel routes are evident in segments 3 (Figure 81.3) and 6 (Figure 81.8) of the Sandia Mesa trail network. This pattern is not evident on the southern plateau, although further study may prove otherwise.

The consistent appearance of twinned routes on major trails and stairways of the central plateau present several intriguing possibilities. One is simply that the trails were established at different times, and, following the logic described for gateway trails, reflect different episodes of symbolic labor investment. If rebuilding one stairway was an important act, it is conceivable that building a new, parallel stair was an extension of the same practice. It is also possible that the different stairs reflect the presence of different users. If the Ancestral Pueblo occupants of Tsankawi, Navawi, and surrounding communities were organized into moieties like their Tewa descendants, their use of separate but aligned pathways is conceivable. The fact that only some of the stairs and trails show evidence of such a pattern suggests that such formality was not part of everyday life in the community houses, but instead linked to specific ritual practices. Just as repetitive construction of stairways may have been a symbolic act, so the use of those stairs at particular times may have been linked to specific ceremonial practices, and thus reflective of the internal structures of the community itself

Archaeological evidence from elsewhere in the Southwest suggests that some of the patterns documented for the Pajarito trails are not unique. Some twinned or parallel stairways are evident at Chaco Canyon; W. H. Jackson's photo of the famous Jackson staircase depicts an example of this (see Powers 1984:53). The anomalous presence of stairways in "relatively flat terrain," implying that they had other than functional significance, has also been documented (Pattison 1985:71). Mike Marshall describes a widespread pattern of parallel roads and paths in the Chaco region, for which he finds ample ethnographic documentation, including for the Tewa, where "double roads" leading south from the place of emergence are described over which the Tewan moieties diverged and rejoined in the ancestral journey to Ojo Caliente" (1997:69; see also Vivian 1997a, b).

Regarding the idea that twinned trails may be symbolically associated with ancestral migration and pilgrimage, it is interesting to note that many of the twinned segments documented here are associated with the North Mesa trail. This route, which appears to have run from the Rio Grande all the way to the Jemez, passes right through the center of Ancestral Pueblo settlement on the central Pajarito. Although it surely had extensive functional uses, it is intriguing to think that it served as a ceremonial route as well. It is, of course, difficult to determine whether these different patterns of movement would have been associated with the trail from the beginning, or whether they evolved over time. To return to Marshall, "[p]ilgrimage down these divergent corridors into parallel paths may have the reactualized and validated the origin myths and opened cosmological channels over which spiritual energy was conducted" (1997:69). It may be that the trail accrued symbolic importance over time, and that it could have been until the Historic period when this role became dominant. The likelihood that the twinned stairs were constructed when the community houses were occupied suggests that such a pattern had deep historical routes, but its longevity remains to be investigated.

CONCLUSIONS

Work on the Pajarito trails since the 1990s has been enormously productive. The insights of earlier generations of scholars, who saw great potential in studying the trails, were correct, and we are thus gaining a greater appreciation both for the complexity of the cultural landscape of the Pajarito and for the Ancestral Pueblo people for whom the trail network was an intrinsic part of their everyday lives.

Several contributions can be identified. The first is that the diverse morphology of the Pajarito trails is increasingly well-understood. Trail fabric and associated features are now thoroughly documented, providing scope for further analysis. The general parameters of the overall network are also coming into focus. The chronological approaches that will ultimately allow us to link changes in the settlements to shifting patterns of movement across the plateau are getting better. We also have a greatly improved sense of the role that the trail system played in politics, economics, and ritual in the Ancestral Pueblo world.

The preliminary nature of this research must nonetheless be emphasized. Less than half of the Pajarito trails for which some documentation exists have been re-recorded. Adequate documentation of the elaborate trail networks is time-consuming. Re-examination of areas that have been the subject of recent systematic survey has turned up new trail sites, suggesting that trails are elusive even when up-to-date field methods are applied. Large portions of the Pajarito have yet to be surveyed at all, including zones that lie between the major nodes of Ancestral Pueblo settlement. Administrative barriers remain, and the continuing physical remoteness of some parts of the Pajarito present considerable logistical difficulties.

The first priority for further research is completion of the re-documentation process. Revisiting known trails is an efficient and cost-effective means of expanding the body of available information, and ensures that all trails are recorded to a similar standard. New survey is, of course, also highly desirable. Given that the administration of large parts of the plateau are currently being reorganized, efforts to survey lands that will no longer be in the public domain (strictly speaking) are particularly vital. Recent work in TA-71 (Hoagland et al. 2000; Snead 2001a) is an example of what such targeted efforts can accomplish. Similar approaches need to be employed elsewhere, particularly on the northern plateau, where the baseline survey information is less accurate and the resources of the administrative agent less plentiful.

Priorities for further survey should also include detailed analyses of trail networks associated with the remaining community houses of the central plateau for which these have not yet been conducted. Tsirege is the most prominent example, since our knowledge of the trails associated with that site has not appreciably expanded for a hundred years. Another priority is Sandia Pueblo, particularly since a close examination of the site and associated lands along Mortandad Canyon will assist in determining the age of the trail network in that area. Finally, a targeted plan of research in the region south of Tsirege should be developed, since is in that area that evidence for an Old Pajarito Trail linking Frijoles Canyon with points farther north should be available.

In addition to providing a window on the Pajarito trails, the study of roads and trails present a unique opportunity for the archaeological study of trails in general. By breaking down the roads/trails dichotomy, we make further progress in understanding the relationship between movement and landscape in human societies. It is no longer possible to see trails as functional reflections of economic processes without either symbolic or political significance. Taking a serious look at trails has proved to be a major step forward in expanding archaeological perspectives on the past; the value of taking this study and related studies to new levels requires no further argument.

CHAPTER 82
ROCK ART OF LOS ALAMOS NATIONAL LABORATORY

Marit Munson

INTRODUCTION

This chapter discusses the rock art of Los Alamos National Laboratory (LANL), set within the broader context of relevant information from the Pajarito Plateau and the northern Rio Grande region. The chapter begins with a discussion of previous rock art research on the Pajarito, from the curiosity of late 19th century explorers to regional syntheses and systematic recording for management purposes. It then continues with a discussion of rock art styles generally applicable to northern New Mexico; these widely used style designations provide a broad regional chronology, yet they overlook significant variation within the Rio Grande Valley. Recent research has resulted in a more realistic stylistic chronology for Coalition and Classic period rock art of the Pajarito Plateau. The next section describes the dating methods in brief, then discusses the stylistic traits characteristic of each period.

The focus then shifts to spatial variation on two different scales. First, dramatic differences in the immediate context of Coalition and Classic rock art are discussed, as the images shifted from private functions to more public significance. The following section expands the geographic scale to consider variation across the Pajarito Plateau, specifically addressing the issue of boundaries between Keres and Tewa ancestors. The data collected in Munson's dissertation work (2002) indicate that the boundary is not visible in the rock art; instead, rock art imagery varies relative to specific communities, including an Otowi-Tsankawi community and a Tsirege community. Small-scale variations in more detail, highlighting issues specific to the rock art of LANL are then discussed. Finally, the chapter concludes with brief recommendations for rock art recording procedures and management issues.

PAST RESEARCH

Early Interest (1890s–1930s)

The prehistory of the Pajarito Plateau was not well known to the Anglo world until the late 19th century, when the area's proximity to Santa Fe encouraged the attention of explorers and the general public (Snead 2001b). Adolph Bandelier, a Swiss-born businessman and self-taught scholar, began a survey of the Southwest in 1880, under the auspices of the Archaeological Institute of America. Led by guides from the Keres pueblo of Cochiti, Bandelier traveled throughout the Pajarito Plateau, documenting sites and writing about the Pueblo inhabitants of the northern Rio Grande (Lange and Riley 1966). Although Bandelier occasionally noted rock art sites, his interest in the imagery was minor. Other than a brief note that "there are pictographs" in Frijoles Canyon (1892:143), he mentions just a single site on the entire Pajarito Plateau. Describing Painted Cave, located in Bandelier National Monument, he lists images at the site as including "clouds, sheet lightning, the sun, dancing-shields, and male and female dancers" (1892:156), then adds some information from his Cochiti guide:

> I was informed that in former times, whenever a pueblo was abandoned, it was customary to paint a series of such symbols in some secluded spot near the site of the village. Whether this is true or not, I do not know (Bandelier 1892:157, note 1).

In a later discussion of rock art in the Abo area, Bandelier again mentioned the information about Painted Cave, saying that "such records of the Cachina were usually executed whenever a pueblo was to be forever abandoned" (1892:278).

In 1896, Edgar Lee Hewett began an archaeological survey of the Pajarito Plateau and adjoining areas in the northern Rio Grande. Although Hewett worked throughout the Jemez Plateau (Hewett 1906), he was particularly enamored of the Pajarito; seeking to preserve it as his own personal fiefdom, he simultaneously limited other researchers' access and lobbied for the creation of a national park (Rothman 1992). Throughout the first decade of the 20th century, Hewett excavated at major pueblos across the southern and central Pajarito Plateau, including Yapashi, San Miguel, and Otowi. He ran several School of American Archaeology field schools in Frijoles Canyon, aided by a Tewa crew from San Ildefonso pueblo.

Hewett's perspective on Pajarito prehistory, and especially the relationship between modern pueblos and the prehistoric sites, was often contradictory (Snead 2001b:130–131). Initially, his interest in rock art on the Pajarito Plateau was rooted in his hope that "while some of these [images] represent nothing more than idle picture-making, perhaps most of them are of serious totemic, legendary, and religious significance" (1906:11). Thirty years later, however, Hewett simply illustrated a few examples of the more interesting rock art, writing that rock art from Puye was "far inferior to... the pottery designs" (1938:115). Comparing the imagery to kiva murals, "does not," he added, "give the impression that the Puye rock pictures were intended to be ceremonial or mythological records....They are a much less serious form of art, merely suggestive of the play of fancy that characterized the Indian mind throughout the Southwest, which reflected, to some extent, their attitude toward nature and life" (Hewett 1938:115). His disappointment that the rock art "had little function in recording facts" (Hewett 1938:115) is evident. Hewett had come to believe that there was a significant disconnect between prehistoric imagery in all media and early 20th century Pueblo designs, a break "so radical that it can only be accounted for on the ground of strong new elements intruding from an outside source" (Hewett 1938:104).

During Hewett's tenure on the Pajarito Plateau, a network of scholars, artists, and public figures developed that ultimately not only influenced research on the Pajarito, but shaped the course of Pueblo arts in the early 20th century as well. Intrigued by the "graphic art of the cave dwellers" (K. Chapman 1916), artists from Santa Fe often joined Hewett in the field. Kenneth Chapman, in particular, spent two field seasons recording images inside cavate rooms, concerned that the "picture writing" was "in danger of being obliterated both by the elements and by mutilation at the hands of vandal tourists whose activity was everywhere manifest" (K. Chapman 1917:1). Chapman's overviews of the rock art, published as part of Hewett's reports (K. Chapman 1916, 1917, 1938), were the first to speculate on the dates of the images, noting the potential temporal significance of soot blackening and plastering over the rock art (1938:142).

Chapman also mentioned that Hewett's Pueblo workers, who used some cavates as living quarters while in the field, produced designs of their own on the cavate walls, noting that "many of these might have been confused with the work of the ancient Pajaritans were it not for the freshness of their appearance" (K. Chapman 1917). The workers' exposure to prehistoric arts during the Pajarito fieldwork is often cited as a significant influence on the work of early 20th century Pueblo artists, including Crescencio Martinez (Brody 1997:22–24). Gustave Baumann, a well-known German-American artist, also drew inspiration from Hewett's fieldwork, eventually producing a series of woodcuts representing the images inside Pajarito cavates (Baumann 1939).

Defining Styles (1960s–1990s)

Research on the rock art of the Pajarito Plateau did not begin in earnest until the 1960s, when Charlie Steen and Polly Schaafsma both worked on defining temporally significant styles. Steen's work with Los Alamos rock art in the 1970s resulted in the definition of two distinct rock art styles (1977, 1979): the Frijoles Style and the Mortandad Style. He defined the Mortandad Style, using the Mortandad Cave Kiva (at LA 12609) as the type "site," as large, rough anthropomorphic figures pecked[1] into the walls and ceilings of densely sooted cavates (Steen 1979). Steen seldom mentioned exterior rock art, focusing instead on interior imagery that he felt was "of a religious nature" (1977:17). He believed that cavates with interior imagery served as kivas or, in the case of the smallest isolated and heavily soot-blackened rooms, "quiet retreats for individuals--small caves for prayer" (Steen 1977:17). Thus defined, the Mortandad Style appears to be confined to a handful of cavates in Mortandad, Ancho, and Sandia canyons. Although subsequent researchers sometimes refer to the Mortandad Style (H. Toll 1995:196–197), its limited geographic distribution makes its utility questionable and it has not been widely adopted.

Steen's Frijoles Style, defined in contrast to the Mortandad Style, is similarly problematic. The Frijoles Style consists of images incised into the plaster walls of cavates, including geometric patterns, realistic figures, and "life forms" (Steen 1979), or, the figures illustrated by Chapman (1938) (Figure 82.1). These interior scratched figures are often divided into prehistoric and historic categories, based entirely on subject matter. Images of hunters, dancers, kachinas, and various animals, for example, are often accepted as prehistoric (e.g., H. Toll 1995:196; Wellman 1979:93–96), while associated images of people on horseback or wearing broad-brimmed hats are classified as historic (Chapman 1938:141; Wellman 1979:96; see Liebmann 2002:136–138 for a more extreme example). However, the suite of scratched interior images appears stylistically consistent; given the depiction of horses and other historic subject matter, it is likely that this distinct scratched style is entirely historic, an idea given support by Chapman's (1938:141) accounts of Pueblo workmen producing images in the cavates during Hewett's excavations at Frijoles. As with the Mortandad Style, this Frijoles Style is geographically

[1] Steen uses the term incised, but inspections of the Cave Kiva and of his illustrations indicate that the images were almost certainly pecked.

limited; it is most common within Frijoles Canyon, with scattered examples from the north-central Pajarito.

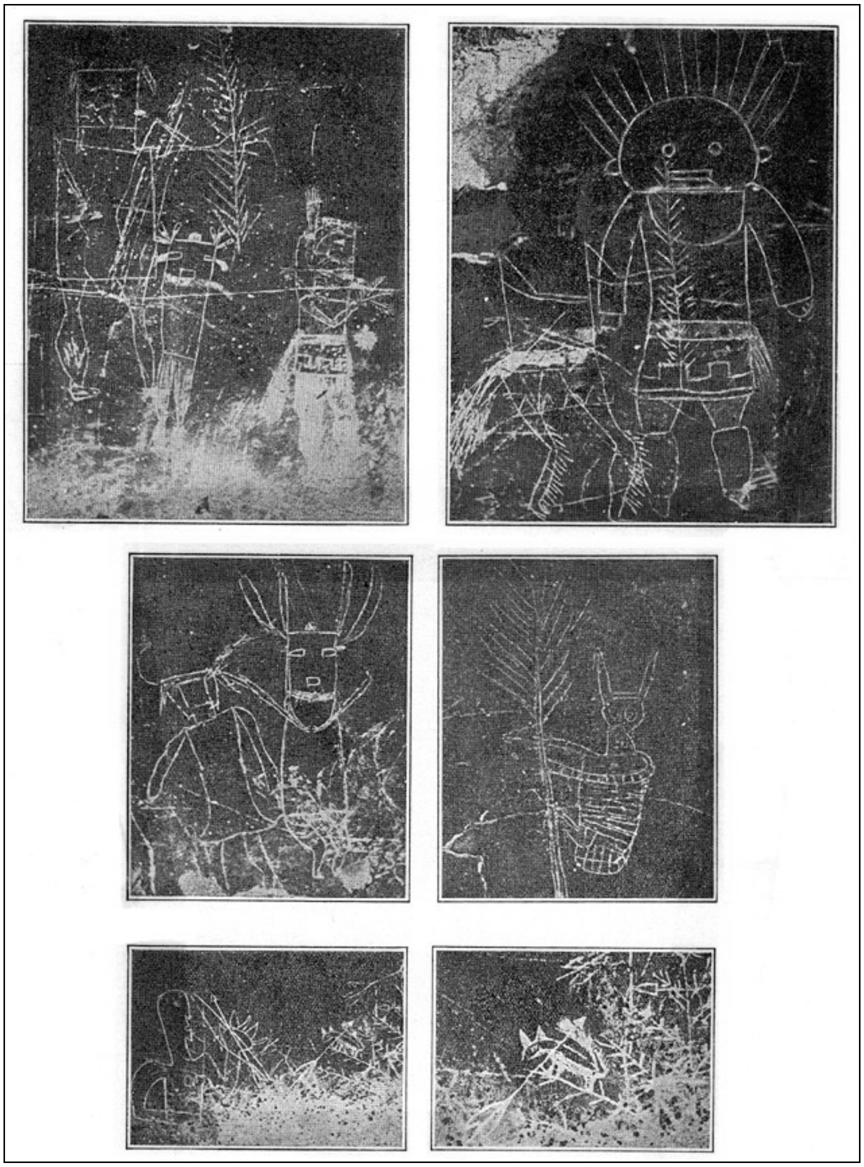


Figure 82.1. Historic incised or scratched rock art, as illustrated by Chapman (1938).

Schaafsma's broader classification of Rio Grande Valley rock art is much more widely accepted. Beginning with a 1966 rock art survey associated with the Cochiti Dam project, P. Schaafsma (1975) began to sketch in the rough outlines of a chronological sequence for Rio Grande rock art. By 1972, Schaafsma had defined the Rio Grande Style, which encompassed post-AD 1325 rock art within the Rio Grande Valley. Although she believed that all of this rock art "can be considered a single entity" stylistically (P. Schaafsma 1980:275), she also acknowledged distinct geographic differences, dividing the Rio Grande Style into five distinct provinces corresponding to the distribution of historic linguistic groups (P. Schaafsma 1972, 1992:87–113). The Rio

Grande Style is discussed in greater detail below, with specific attention to the Keres and Tewa provinces, which include the Pajarito Plateau.

Schaafsma's general outline of the prehistory of northern Rio Grande rock art, in which the distribution of motifs parallels the ethnic and linguistic boundaries visible in ceramics and ethnohistoric accounts, is widely accepted for the Pajarito Plateau. She proposes that the distinctions between the various provinces of the Rio Grande style are related to "variations in mythology, religious emphases, and values" (1992:113) throughout the Rio Grande Valley. For example, she suggests that the emphasis on themes of war and conflict in the Galisteo Basin reflects the presence of warrior societies to the east of the Pajarito, prompted by conflict with Plains tribes, while the lesser frequency of war iconography in other Rio Grande rock art may reflect competition among the pueblos. She also suggests that the steady decrease in the number and complexity of rock art masks from south to north along the Rio Grande reflects the "marginal nature" of the kachina religion in the northern Tewa pueblos (P. Schaafsma 1992:115).

Numerous other researchers have adopted Schaafsma's general chronological outline wholeheartedly, using it as support for studies of ethnic boundaries on the Pajarito Plateau. In their work on northern Rio Grande ceramics, for example, Graves and Eckert (1998) use Schaafsma's distinction of rock art provinces in support of their argument that differences in the color and iconography of decorated wares reflect the presence of different ideological systems. Nevertheless, it should be noted that Schaafsma herself recognized a certain continuity in style and content between the Keres and the Tewa provinces on the Pajarito Plateau (1992:111).

Site-Specific Research (1980s–1990s)

In 1989, Arthur Rohn published a general-interest book on the rock art of Bandelier National Monument. In it, he illustrates numerous rock art sites that are accessible to the public, setting them within the context of a brief prehistory of the Pajarito Plateau. He believes that the rock art is uniformly religious imagery, created during dances and ceremonies as a means of declaring clan or lineage membership (Rohn 1989). Although the book contains little analysis or support for these statements, its conclusions are widely cited.

Rohn's students at Wichita State University have since conducted a series of studies focused on the rock art of individual sites in the central Pajarito. Loy Neff (1990), for example, documented the rock art of Tsirege Pueblo in exhaustive detail, analyzing the layout of the images relative to clusters of rooms within the cavate pueblo. Cynthia Orr (1996) carried out a similar study at Tsankawi, although her recording was more limited and perhaps less accurate than Neff's work at Tsirege. In Neff's thesis, he concluded that Tsirege rock art is mostly related to marking sacred places and providing symbolic protection; imagery within the cavate pueblo, for example, marks different clan groups, while other images are placed in locations where they serve as protection for stairs and trails, as in the Awanyu at the main stairway. He proposes that more isolated rock art images provide protection to the village in general; such images include a series of large shields pecked on boulders that rest on the valley floor in front of the cavate pueblo. Neff briefly notes a variety of differences in the frequency, placement, and presumed function of motifs at

Tsirege compared to Frijoles Canyon, suggesting that the differences indicate belief systems that have diverged from a common antecedent, perhaps related to the Keres/Tewa boundary.

Broad Research Agendas (1990s–Present)

The most intensive research on Pajarito rock art has been focused on Bandelier National Monument. In Toll's (1995) study of variability in cavate architecture, he briefly discusses rock art within the cavates, partly refuting the notion that the presence of rock art indicates that cavates served as kivas. He attributes differences in the rock art of Frijoles Canyon and Tsankawi to differential preservation of the cliffs themselves (also see Crowder 1995). In addition, crews systematically noted rock art during the Bandelier Archaeological Survey (BAS), and several volunteers addressed the rock art directly (Crowder 1995; N. Olsen 1995, 1997). Olsen, in particular, launched an ambitious study of all of the rock art identified during the BAS. Focusing on patterning in the distribution of rock art motifs relative to a variety of geographic and archaeological features, she sought to demonstrate that rock art was a form of symbolic communication. Although some of the descriptive material may be useful, the multivariate statistical methods that she applied are inappropriate for the data, calling her conclusions into question. Crowder's work (1995), more limited in scope, provides a summary of the motifs present at various sites in Frijoles Canyon and within the Tsankawi unit of Bandelier National Monument.

Information from the northern plateau is less comprehensive; major projects, such as the Pajarito Archaeological Research Project, seldom recorded rock art, and data from LANL and the Santa Fe National Forest have never been incorporated into a broader study. Instead, most of the discussions of geographic variation in Pajarito rock art compare data from the entire bulk of Bandelier south of Frijoles Canyon against a few sites from the Tsankawi Unit, or compare extensive field data with more limited published accounts from elsewhere. Munson's dissertation (2002) sought to address this issue, examining rock art sites from across the Pajarito Plateau; the discussion below summarizes her findings.

Recording and Management (1990s–Present)

In addition to ongoing professional recording for management purposes at LANL, Bandelier, and the Santa Fe National Forest, two major projects have used volunteers to record and monitor the rock art of the Pajarito Plateau.

In Los Alamos County, two volunteers, Betty Lilienthal and Dorothy Hoard, have done extensive recording of the vast concentration of images near springs and other natural features along the Rio Grande; their publication (see Lilienthal and Hoard 1995) also includes some photographs of sites on tuff within Sandia Canyon and adjacent canyons. Their records, on file at the Laboratory of Anthropology, ultimately culminated in a National Register listing for the petroglyphs of White Rock Canyon. Their recording of the rock art is detailed and thorough, although it sometimes neglects archaeological remains associated with the petroglyphs.

In addition, Mike Bremer and other US Forest Service archaeologists have led a Passport in Time work program on the northern Pajarito for many years (e.g., Baldwin and Bremer 1999). This project, which uses volunteers from around the country to record archaeological resources on Forest Service land, has focused on sites in Garcia Canyon. Although the primary aim has been to record cavate pueblos, the crews have been diligent about recording associated rock art.

TEMPORAL VARIATION IN ROCK ART STYLES

Temporal control has always been a difficult issue where rock art is concerned. Although various direct dating methods are currently being developed (e.g., Rowe 2001), they are not yet practical for widespread use. Most rock art research still relies upon the definition of temporally significant styles (Francis 2001), defined through standard methods of relative dating (Keyser 2001; P. Schaafsma 1985:241–244). In the Rio Grande Valley, P. Schaafsma's (1980, 1992) decades of work have resulted in the following general classification of rock art styles through time.

Archaic and Developmental Period Rock Art

Archaic and Developmental rock art are little documented and poorly understood in northern New Mexico. Early rock art in New Mexico is referred to as the Abstract Style, loosely classified through the presence of heavy patination and stylistic similarities to early rock art elsewhere in the arid west. In fact, the style is sometimes known as the Great Basin Abstract Style, after its resemblance to Archaic rock art documented by Steward (1929) and Heizer and Baumhoff (1962). With a few exceptions, such as the array of petroglyphs dated through partial excavation at Glorieta Pass, the Abstract Style in the Southwest has never been properly dated; in the northern Rio Grande region, Abstract Style is believed to encompass petroglyphs from the Archaic through Basketmaker II, and perhaps even into later periods (P. Schaafsma 1980:77).

The Abstract Style (Figure 82.2) is characterized by zigzags that are either single or in parallel sets, straight and curved lines, rows of dots, curvilinear meandering lines, spirals, circles that are bisected, conjoined, concentric, with central dots, or with rays like sunbursts, rectilinear patterns such as "ladders," "nets," rakes, grid patterns, or rectilinear meandering lines, or representational figures, which are less common, but include stick-figure anthropomorphs, simple animals, and tracks.

Abstract Style petroglyphs usually occur on all sides of a boulder or cliff face, sometimes tucked into narrow cracks or formed to fit the shape of the boulder (Figure 82.3). Elements are often repeated in long rows (P. Schaafsma 1992:83).

Figure 82.2. Abstract style petroglyphs (from P. Schaafsma 1992:85).

Although poorly documented in the Rio Grande Valley, the Abstract Style is present at an array of sites in the northern Rio Grande. Black Mesa, near Leiden, includes boulders covered with completely repatinated abstract petroglyphs that probably date to the Archaic or Developmental periods (Boyd and Ferguson 1988). Heavily patinated petroglyphs at Arroyo Hondo are superimposed by Coalition period images (P. Schaafsma 1980:47), while Abstract Style imagery at other sites north of Arroyo Hondo is associated with a Basketmaker II site (P. Schaafsma 1980:47, 47). Pitted boulders occur in Arroyo Hondo, in the Galisteo Basin, and along the Rio Grande north of Cochiti (P. Schaafsma 1992:83); similar completely repatinated boulders in the Great Basin have been suggested to date between 5000 and 3000 BC (Heizer and Baumhoff 1962:234–235). Other Abstract Style petroglyphs are known from West Mesa (Albuquerque) and the Socorro area (P. Schaafsma 1992:83) and along the San Jose River (P. Schaafsma 1980:47).

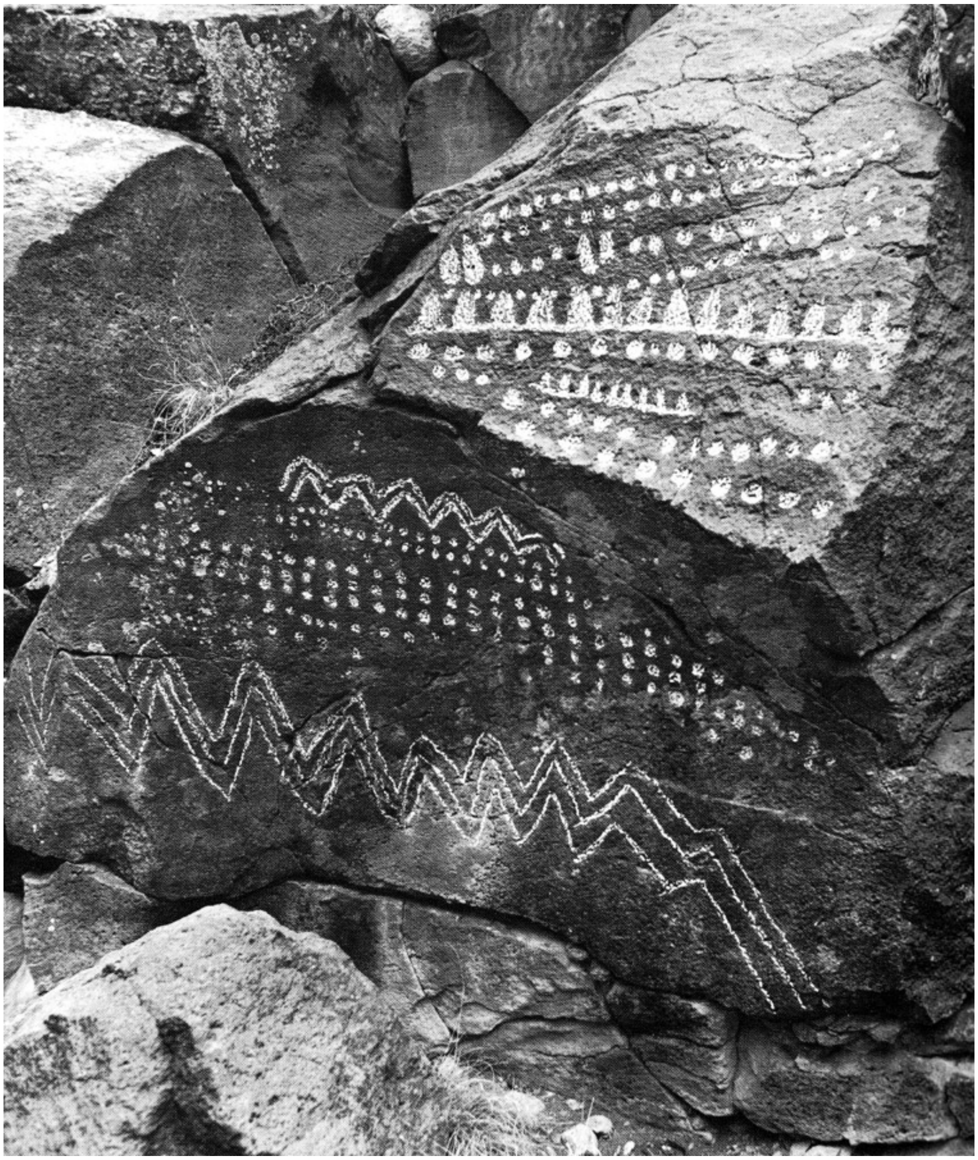


Figure 82.3. Abstract style petroglyphs, showing typical layout of elements (from P. Schaafsma 1992:84).

It should be noted that all of the northern Rio Grande rock art that is believed to predate the Coalition period is in the form of pecked images on basalt boulders; neither Abstract Style paintings nor petroglyphs on tuff have been identified on the Pajarito Plateau. There are several possible explanations. First, Abstract Style rock art is rare throughout northern New Mexico; low population levels on the Pajarito Plateau during the Archaic and Developmental periods make it unlikely that there was much associated rock art from these periods. Second, Archaic or Developmental rock art produced on the soft tuff available on the Pajarito Plateau may have eroded so heavily that it can no longer be recognized. Rock art on basalt has better resistance to erosion, but relatively little survey has been carried out in basalt-rich areas of the Pajarito Plateau. Finally, the Abstract Style is generally completely repatinated and usually lacks representational imagery; its subtlety makes it easy to overlook. Even in extensively recorded areas such as White Rock Canyon (Lilienthal and Hoard 1995), the Abstract Style may be unnoticed or simply neglected in favor of the more recent, visually dynamic work.

Coalition Period Rock Art

Schaafsma believes that most pre-14th century rock art in the Rio Grande Valley dates to the Pueblo III period, coinciding with a major population increase. She describes Pueblo III period rock art as generally similar to that of the Colorado Plateau, although it shows "considerable variability in style, content, and ... relationships to rock art in adjacent regions" (P. Schaafsma 1992:85).

In general, Pueblo III style rock art includes (Figure 82.4) solidly pecked life-forms including birds, deer, lizards, mountain sheep, and tracks; stick figures; flute players; human figures with oversized hands and feet, and scenes involving copulation are common in the northern Rio Grande (P. Schaafsma 1992:86); complicated geometric designs, similar to textile and pottery motifs; spirals and concentric circles; meandering lines, lines of dots, zigzags, and bisected and conjoined circles, elements that are typical of the Abstract Style but were also produced in Pueblo III rock art (P. Schaafsma 1992:87). The specifics of Coalition style rock art on the Pajarito Plateau are discussed in greater detail in the following section.

Classic Period Rock Art

Classic period rock art is usually discussed as part of a widespread fluorescence of visual arts in Puebloan society, beginning in the early 14th century (Brody 1991; P. Schaafsma 1992). The Rio Grande Style of the Classic period (P. Schaafsma 1992:91) is widespread and well known for its visually dynamic qualities and detailed representational imagery. The Classic Rio Grande Style (Figure 82.5) includes highly stylized outlined figures with considerable decorative detail and the human figures are often drawn with boxy bodies, large feet, knobby knees, and well-developed calves; masks and/or faces; mammals, birds, snakes, and horned serpents; shield bearers and shields; and cloud terraces, four-pointed stars, and crosses.

Schaafsma describes regional variation in the Rio Grande Style relative to historic linguistic groups, including the Keres and Tewa pueblos associated with the Pajarito Plateau. The southern Pajarito Plateau, up to Frijoles Canyon, is included in Schaafsma's Keres province. She describes Keres rock art as including simple faces, often consisting of a basic circular or square outline, "very simple headgear" (1992:106), and plain dots for facial features. Square masks are especially common north of Cochiti Pueblo, although some of these may have been made recently. Full anthropomorphs are depicted with stylized boxy bodies, often with an X across the torso. Fluteplayers are common, while shield bearers and shields are less notable. Lines of heads or masks on rectangular blanket-type designs are primarily found in the Keres province (P. Schaafsma 1980:275). Mountain lions are "emphasized" by their large size and prominence (P. Schaafsma 1992:108); portrayals of snakes and horned serpents are common, although they are less "dramatic" than in the northern and southern Tewa provinces (P. Schaafsma 1992:108). Spotted fawns, skunks, and other animals are also represented (P. Schaafsma 1992:105–108).

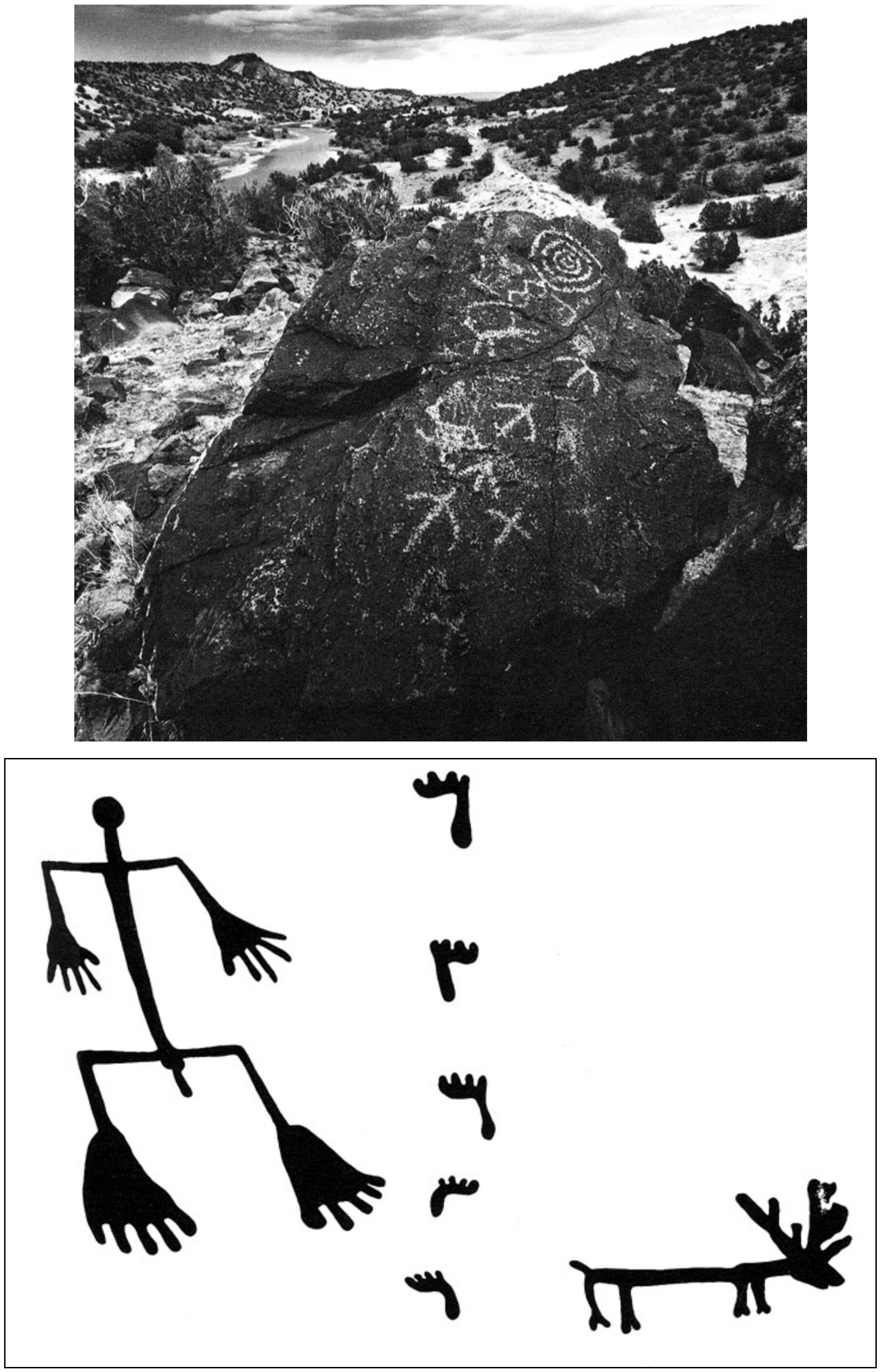


Figure 82.4. Typical Pueblo III rock art. Upper: Rio Grande Valley, north of Santa Fe (from P. Schaafsma 1992:87). Lower: Petrified Forest National Monument, Arizona (from P. Schaafsma 1980:157).

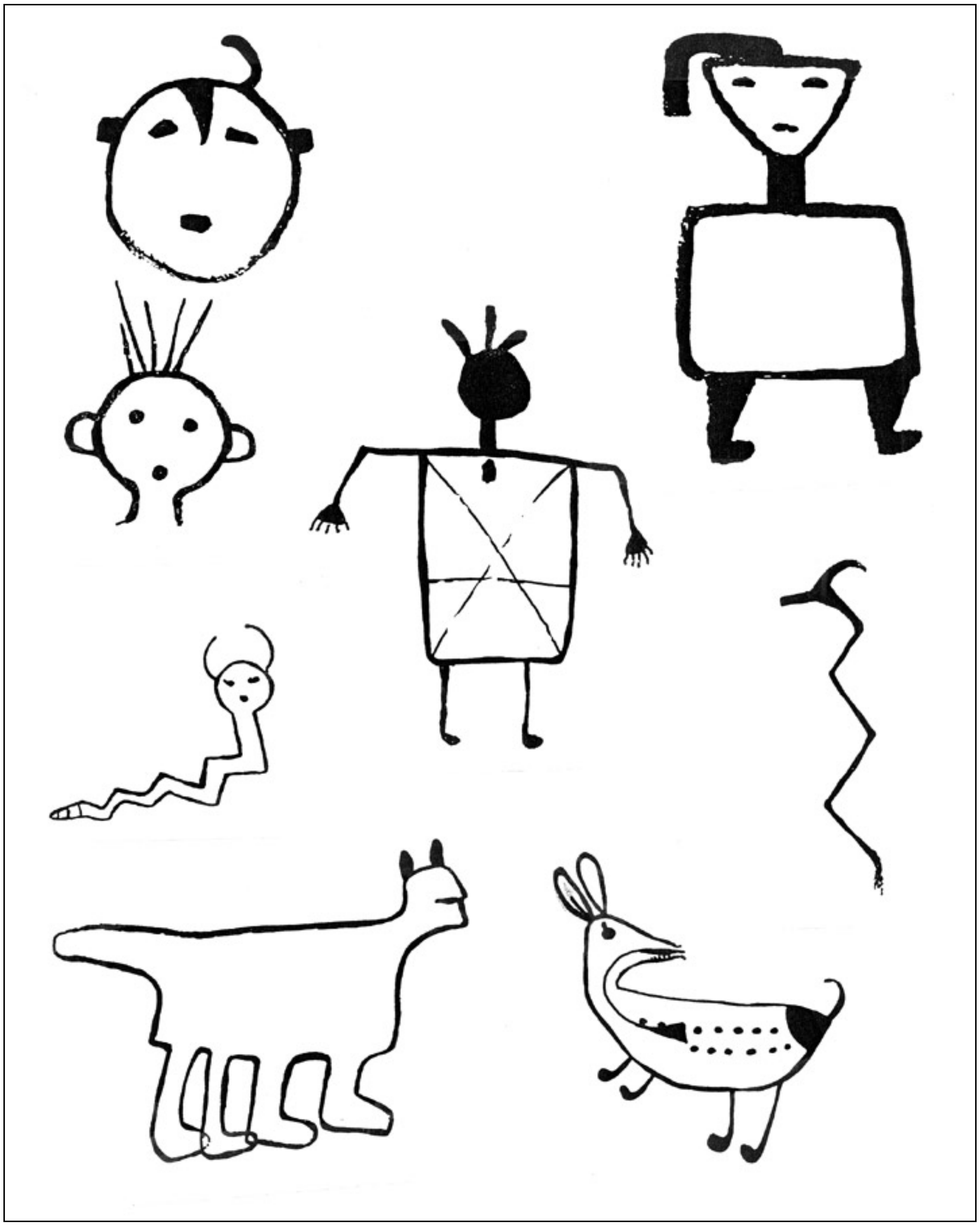


Figure 82.5. Rio Grande style petroglyphs, post-AD 1325 (from P. Schaafsma 1992).

The northern Pajarito Plateau, in contrast, is included in the northern Tewa province. Masks and human figures are less common than in other Rio Grande provinces, decreasing in frequency as one moves north along the Rio Grande (Boyd and Ferguson 1988; P. Schaafsma 1980:286). Instead, the images emphasize flute players, lightning arrows, birds, cloud terraces, and "fertility motifs" (Schaafsma 1980:286, 1992:111). Depictions of shields increase in size and detail (Schaafsma 1992:112). Horned serpents from the Northern Tewa area are depicted with horns pointing backwards; the horned serpent from Tsirege (LA 170) provides a classic example. Spirals and concentric circles are common elements. The specifics of Classic style rock art on the Pajarito Plateau are discussed in the following section.

Dating Pajarito Rock Art: Coalition and Classic Periods

Although Schaafsma's chronology is generally accurate, it has two major problems. First, it focuses almost exclusively on Classic period rock art. As P. Schaafsma puts it, rock art before AD 1300 is "overshadowed by the proliferation of petroglyphs in the [Classic] Rio Grande Style" (1980:160). Second, detailed studies have documented that her broad classification obscures significant geographic and temporal variation on the Pajarito Plateau.

Munson's dissertation (2002), the first project to focus on dating rock art on the Pajarito Plateau, dated the imagery in two distinct stages. First, association, superpositioning, and other relative methods were used to distinguish between rock art elements directly associated with the primary occupation of each site and those that post-date occupation. Then the primary elements were used as the foundation for stylistic seriation of rock art elements through correspondence analysis, an exploratory multivariate statistical method. Analyses indicated that there are few differences in the depictions of animals and in the use of geometrics through time; human figures change dramatically between the Coalition and Classic periods.

Seriation of human figures using correspondence analysis shows the relationship between the style of human figures and the sites at which they are located; a plot of the first two dimensions of the correspondence analysis has the characteristic horseshoe-shaped plot that indicates a linear relationship between the variables (Baxter 1994:119–120). This linearity could potentially be a function of any number of temporal, spatial, or functional patterns. Assessing its temporal significance must be accomplished by cross-referencing the independent dates, based on ceramic chronologies that are available for 22 sites dated by previous research projects (see Munson 2002). When the sites are arranged according to their values along Dimension 1, the independent dates are in chronological order, indicating that Dimension 1 orders the sites temporally. The most recent sites are indicated by negative values on Dimension 1, while the oldest sites have positive values. The array of stylistic traits in the correspondence analysis documents stylistic trends in the representation of humans through time. In general, this analysis indicates that there was a shift from naturalistic depictions during the Coalition period to increasing detail and iconicity during the Classic and into the Historic period.

Coalition Period: Naturalistic Figures

Coalition figures are often solidly pecked and are characterized by simple naturalistic bodies, necks, feet, legs, and arms (Figure 82.6). The majority of the human figures are shown in frontal view, as they are from all periods on the Pajarito Plateau. Only about 10 percent of the figures have facial features, in part because they are difficult to depict on solidly pecked heads. Depictions of male genitalia, common in Coalition figures, almost always take the form of an erect phallus from a figure shown in profile; although most common on Coalition period flute players, other individuals are also shown with penises. Ambiguous "lizard-men" that may be men with long penises or lizards with tails are also a part of this tradition. Female genitalia are usually not depicted; the two occurrences are of complex figures with solid or bisected ovals inside the outline of the body, at the base of the torso.

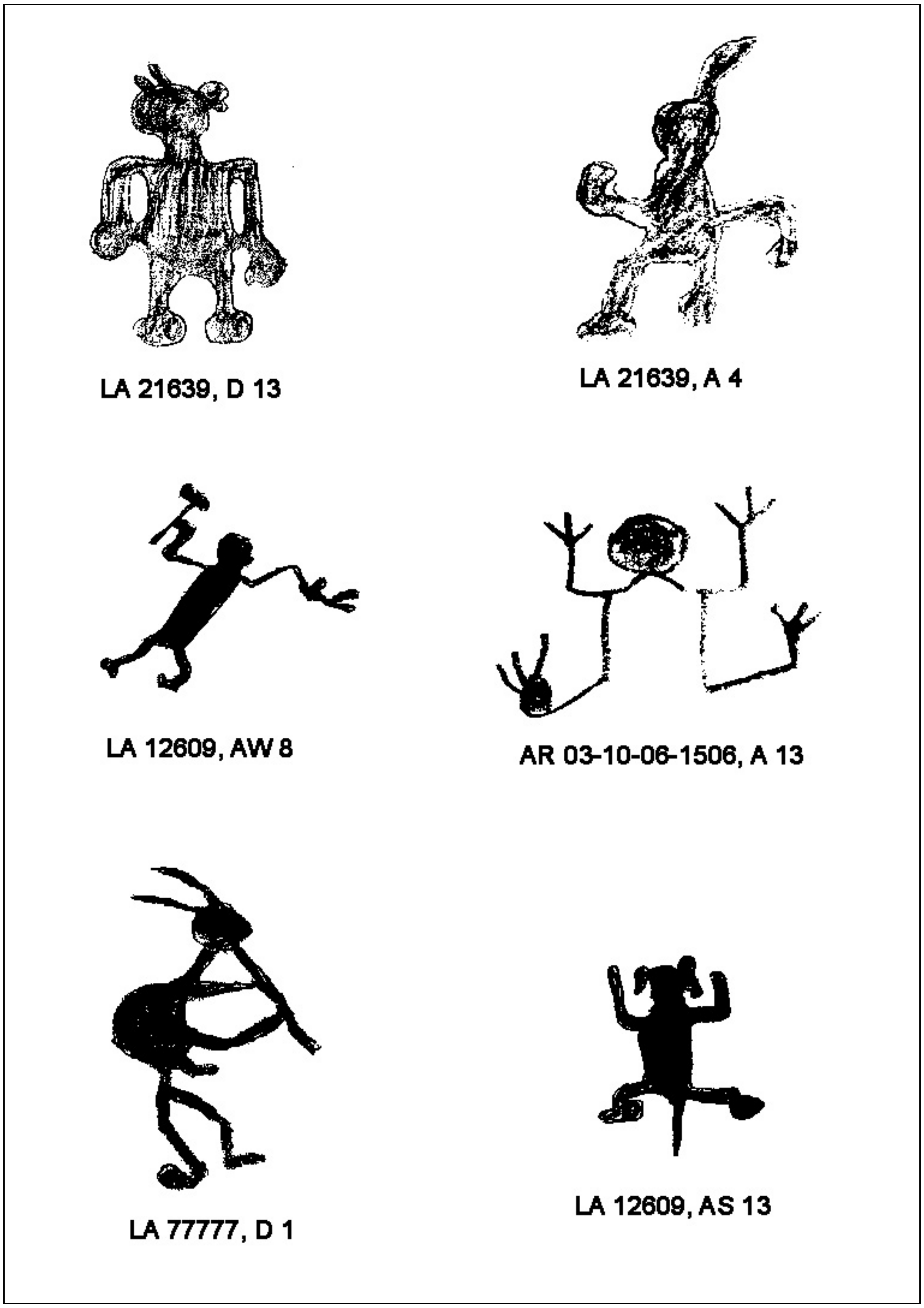


Figure 82.6. Coalition style human figures from the Pajarito Plateau.

In general, Coalition figures lack complex decoration, although some figures do have simple additions to their heads. Feathers are the most common; on individuals shown in profile (especially flute players), they are often just a single thick line, raking back from the head. In frontal view, they are usually shown in pairs, angling slightly outward, almost like antennae. A few individuals have short pairs of lines, often curved, emanating from the upper sides of the head; these are believed to represent horns. Projections from the sides of the head more often take the form of small circles, representing ears, or perhaps hair whorls; more distinct representations of hair whorls take the form of a stemmed "butterfly." Other possible depictions of headdresses are shown on an individual with horns with balls on the tips and a figure with thick straight lines from the top of the head, like rabbit ears.

Solidly pecked flute players, shown in profile, are quite common (Figure 82.7). Most have straight, downward-pointing flutes and humped backs, and are shown with bent legs, as if they are seated. These images are not only characteristic of the Coalition period on the Pajarito (P. Schaafsma 1980:160), but they are also typical of Pueblo II-III rock art on the Colorado Plateau (P. Schaafsma 1992:86).

Figure 82.7. Coalition style flute players from the Pajarito Plateau.

Classic Period: Geometric Figures

During the transition from the Coalition to the Classic, a new, geometric form of human representation was introduced (Figure 82.8). Although some figures that date to the Classic period are similar to the naturalistic Coalition style, the proportion of naturalistic portrayals of humans decreased rapidly; by the Classic period per se, 85 percent of the human figures were depicted with strict geometric shapes. This rectilinear style of representation is most noticeable in the shapes of bodies, heads, and necks. Almost a third of the Classic figures have rigidly rectangular bodies, and another 10 percent have square or triangular bodies. Figures are often depicted with a distinct "hollow" neck consisting of open, parallel lines; when no neck is shown, the base of the head usually opens directly into the body, indicating that the configuration of the shoulders and upper body was produced with the head shape in mind. Just half of the figures have rounded, naturalistic heads; the remainder are strict geometric shapes, such as squares, drawn with precise right angles. Downward pointing triangular heads, flat-topped heads (rounded along the bottom and sides but truncated with a straight flat line across the top), and tapered trapezoidal heads are also predominantly Classic.

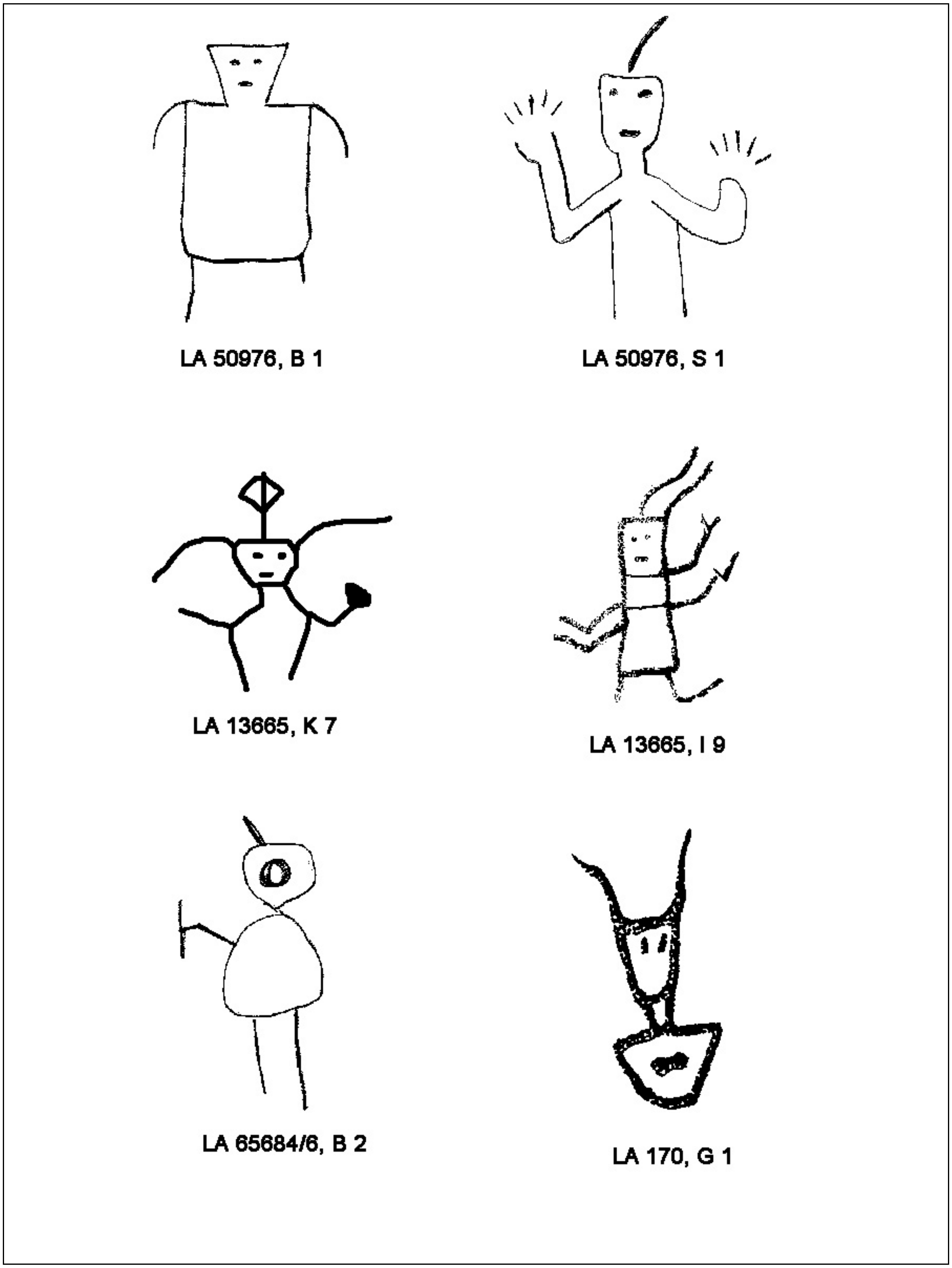


Figure 82.8. Classic style humans from the Pajarito Plateau.

In contrast to the largely geometric bodies and heads, other body parts are represented in an increasingly realistic fashion; almost two-thirds of Classic humans are shown with details such as fingers and facial features. Eyes are usually shown as simple dots or short horizontal lines, and mouths are seldom more than a straight horizontal line. Most forms of decoration are more complex than in Coalition period figures, although ears or hair whorls are rarer and less distinct in the Classic; the small circles on either side of the head are present in low frequencies, but clear depictions of hair whorls are rare. Feathers, although occasionally shown in the Coalition single-line style, are usually depicted as a series of long parallel lines, while more complex headdresses are shown in a wide range of forms. Some individuals have decorated torsos, such as chevrons, Vs, Xs, and diagonal lines, although they are relatively rare.

The proportion of figures that are outlined increases dramatically from the Coalition-Classic transition (slightly more than half) through the Classic (around 90%). Most of the depictions of female genitalia are from the Classic period. They take the form of individuals shown in frontal view, with a loop or two short parallel lines pendant from the base of the body, between the legs. Males are rarely indicated in the Classic period; like the females, they are usually depicted in frontal view. In the Coalition period, many of the male individuals are flute players; in the Classic period, only a single flute player is phallic. In addition, Classic period flute players are rendered in looping lines, completely unlike previous figures (Figure 82.9).

Historic Period: Elaborate Geometric Figures

Historic period rock art shows little change from that of the late Classic, although most of the trends in the Classic are somewhat strengthened (Figure 82.10). Less than 10 percent of human figures are naturalistic; rectilinear figures dominate. Rectangular heads are more typical of this late imagery. Details such as fingers, mouths, and eyes are increasingly common, reaching almost 75 percent. Almost two-thirds of these late figures lack arms and/or legs. The fact that prevalence within an assemblage is the main distinction between Classic and historic styles makes it difficult to distinguish between the two periods without specific historic imagery at the later sites.

However, the latest imagery includes various elaborations rarely seen in earlier imagery, such as legs drawn with bulging calves. Individuals may have Xs across the torso or carefully delineated belts, complete with tassels. Noses are indicated by a short vertical line at the forehead. Other figures are shown with elaborate hairstyles, such as "butterfly" whorls, plaits, and asymmetrical hair, or pointed caps. These decorative traits have strong similarities to ethnohistorically documented Pueblo paraphernalia, such as bandoliers (Strong 1979), hair whorls, and the pointed cap worn by warriors.

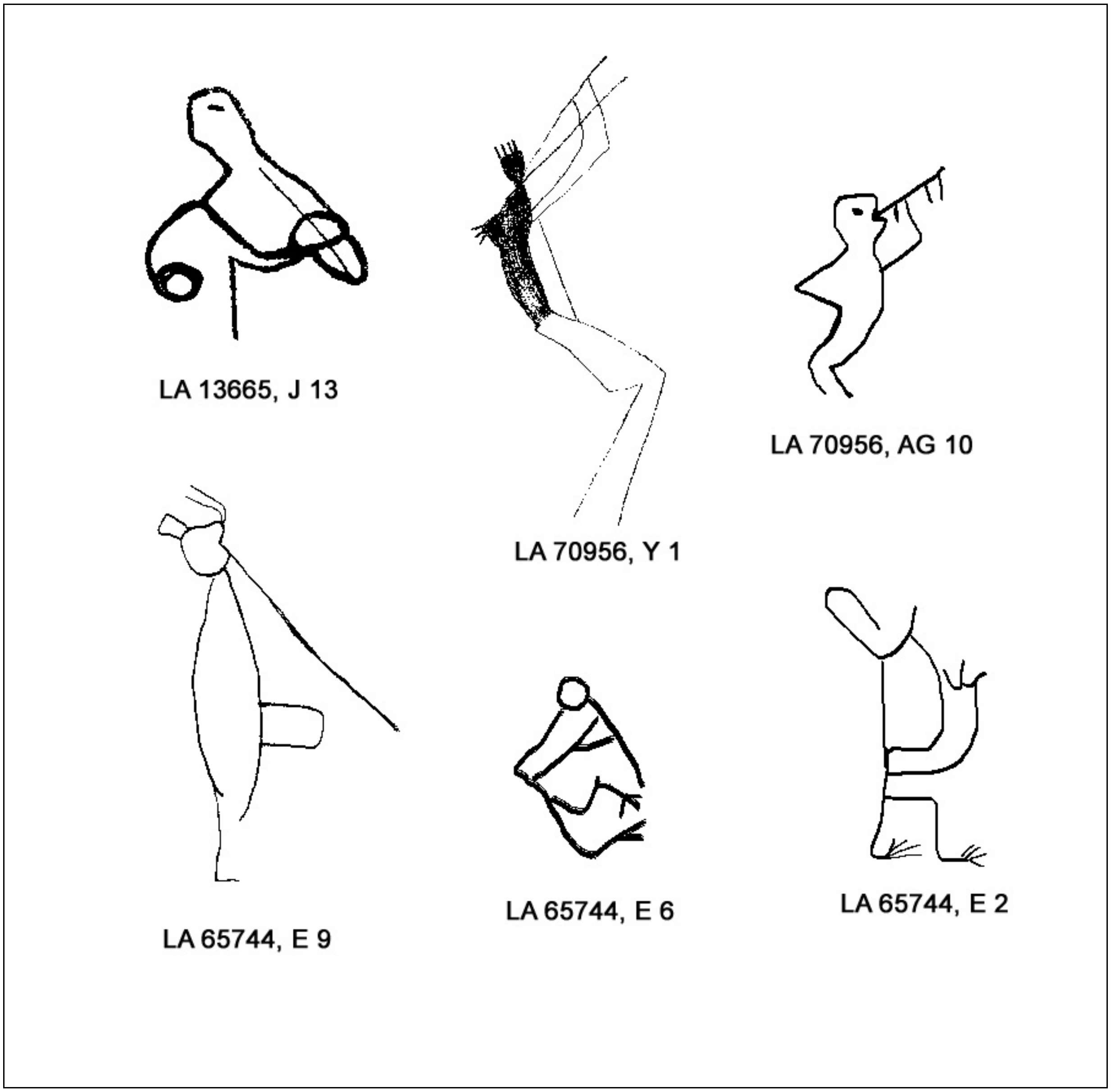


Figure 82.9. Classic style flute players from the Pajarito Plateau.

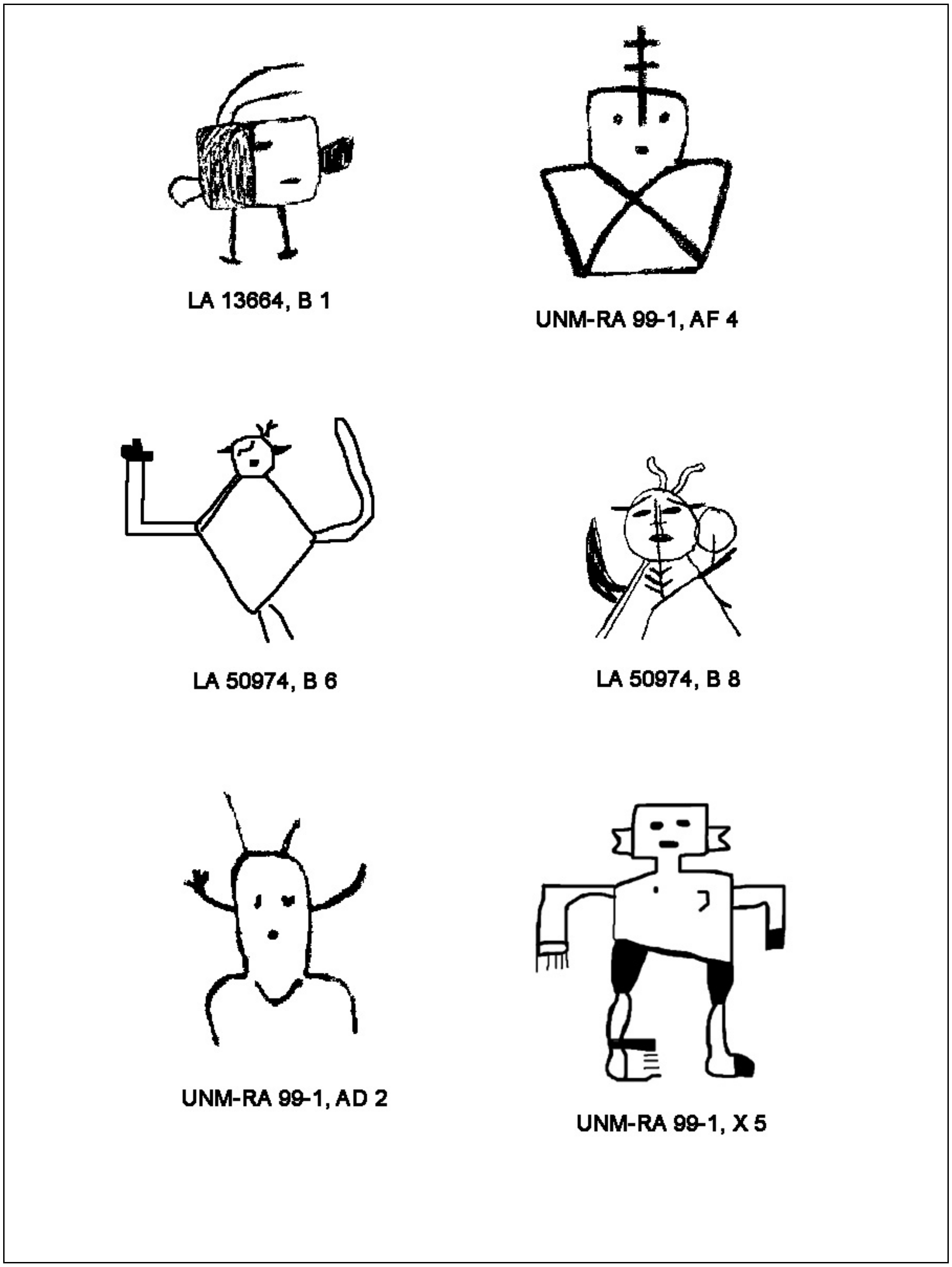


Figure 82.10. Historic style human figures from the Pajarito Plateau.

Depictions of Animals

Attempts to seriate depictions of animals were unsuccessful; correspondence analysis fails to show any linear relationship between the stylistic traits of animals and the sites at which the depictions occur. This result is rather surprising; given the range of variation observed in the field, it was anticipated that Classic period animals would show greater complexity and detail than those at Coalition sites. Classic birds, for example, seemed to be shown with feathered wings and precise fan shaped or feathered tails, while rare depictions of claws on quadrupeds or of rattles on snakes date to the Classic period or later (Figure 82.11).

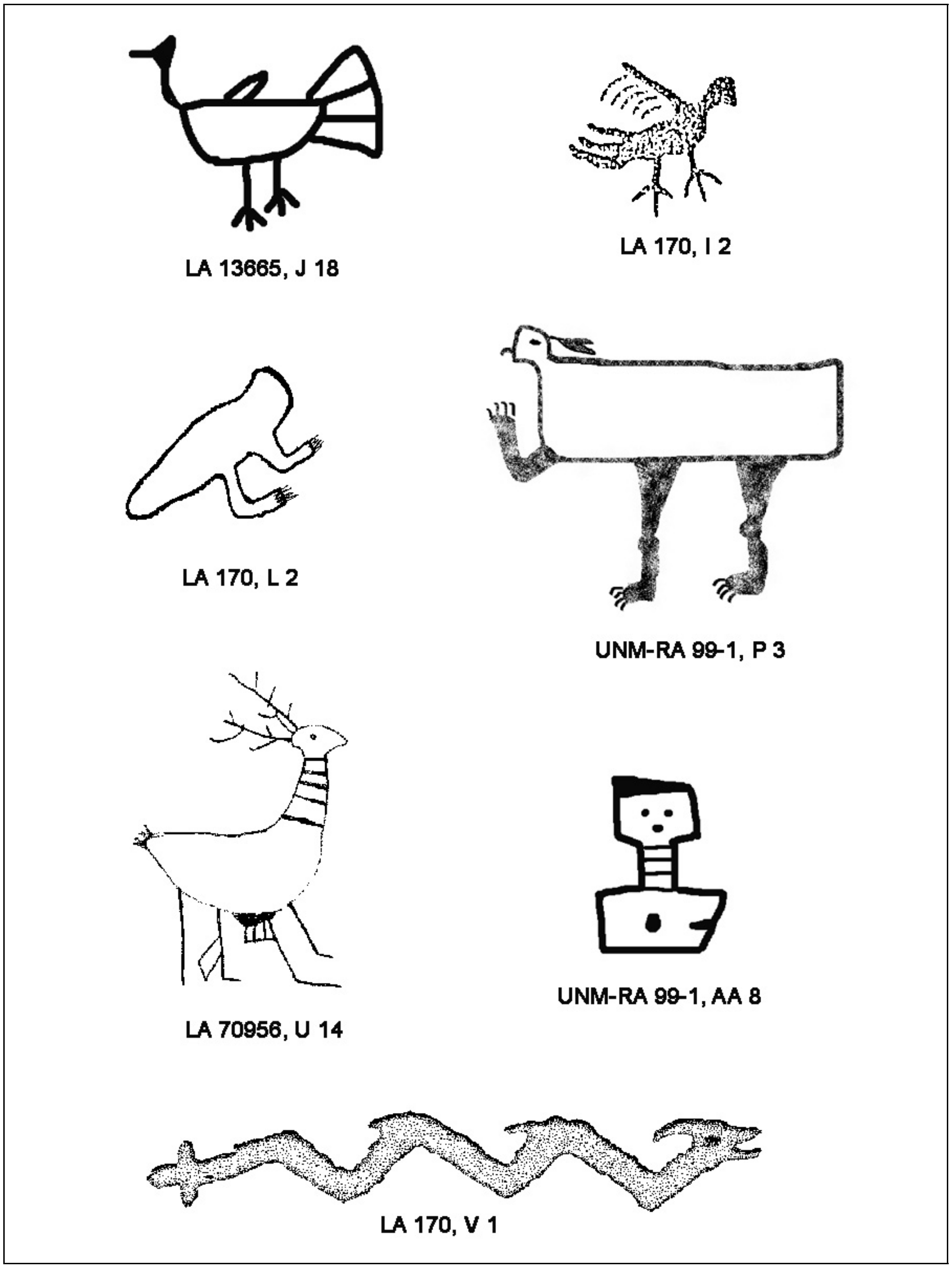


Figure 82.11. Detailed animals from the Pajarito Plateau. Most of the figures date to the Classic period; the mountain lion (UNM-RA 99-1, P 3) is from a historic site. The rectilinear human with striped neck (UNM-RA 99-1, AA 8) is also historic; it is provided as comparison to the deer with striped neck (adjacent).

A closer look at the data provides a partial explanation. For one thing, traits such as body shape may be determined more by the specific animal being depicted than by stylistic concerns. An artist is limited by the need to choose an appropriate combination of traits in order for the depiction to be understood (B. Smith 1998). For example, mountain lions in Puebloan imagery are often shown with long narrow bodies, a long tail stretched straight out, and short limbs and neck. The proportions of the tail, legs, and neck relative to the body are essentially fixed; lengthening the neck or changing the tail leads to ambiguity, such as that visible in the composite animals from LA 127636 (Figure 82.12).

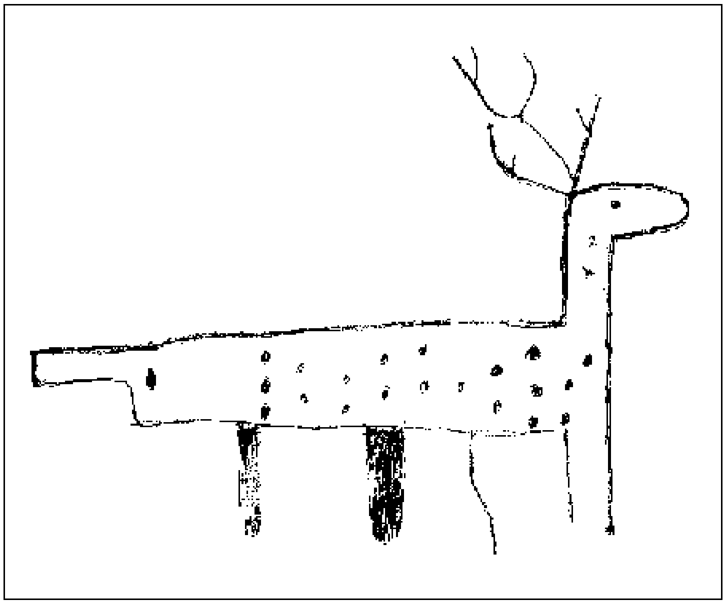


Figure 82.12. A composite animal from LA 127636, combining characteristics of a mountain lion and deer.

CONTEXTUAL DIFFERENCES THROUGH TIME

Context of Coalition Period Rock Art

In addition to dramatic shifts in style, Coalition and Classic period rock art also differ greatly in context. Coalition rock art is overwhelmingly found in private contexts. Of the images dating to the Coalition period, a full 80 percent are inside cavates carved into cliff faces. Some of these rooms are entirely enclosed by the rock, while others have openings in the front that were filled in with stone and mortar; all are small, enclosed spaces. They vary in size and quality of construction, but most are relatively small, with low ceilings. Some of the rooms have features such as niches, vents, and loom anchors, which are typical of cavates on the Pajarito (H. Toll 1995; Vierra et al. 2000).

Although in-depth analysis of cavates and cavate features is not the focus of this report, the cavates recorded during field work (Munson 2002) supported previous observations regarding the variability of features and finishes in cavate rooms (e.g., H. Toll 1995). Cavates with rock art are larger and have more features than those without; cavates with imagery average 5.1 square meters in size, and contain 5.0 features, while plain rooms average 2.7 square meters in size, with 2.2 features each. Rock art also tends to occur in rooms that are more formally prepared; 85 percent occur in cavates with a tan plaster dado on the lower walls and/or a thick coat of soot on the upper walls and ceiling. Most of the rock art is pecked or cut through the soot, exposing the light gray tuff below and creating high-contrast images (Figure 82.13).

Figure 82.13. High-contrast imagery inside a cavate at LA 12609.

Previous researchers have interpreted this interior Coalition period rock art as an indication that the rooms served as kivas (Rohn 1989; Steen 1977, 1979). Indeed, a few cavates are so distinctive in the amount of imagery, the relatively large size of the room, and the density of the features that they are likely ceremonial rooms. The Mortandad Cave Kiva, for example, is dramatically different from most cavates. One of the largest cavates on the Pajarito, the room is well-formed and has numerous features, including multiple niches, a firepit, a double doorway, and vent holes. The densely packed rock art crowded together on the cavate walls includes three times more imagery than any other cavate, and the combined scale, density, and iconography of the images is visually overwhelming (Figure 82.14). There is no coherent overall layout, but several of the images are integrated into small "scenes" of interacting figures. On the west wall, a person swings a club at a humped arrow swallower; on the east, two canids are shown muzzle to muzzle. Between and above the two doors is the dominant image, which is a large shield bearer with a feathered shield. The shield bearer holds a club in one hand and a horned serpent in the other. In addition, an arrangement on the wall opposite the doors pairs spotted mountain lion-type animals with two horned serpents; the serpents' bodies merge into a large arc over all four figures. Their symmetrical arrangement around a niche behind the fire pit is reminiscent of some northern Rio Grande kiva layouts (Smith 1990).

Nevertheless, most cavates with rock art are considerably simpler and are unlikely to have had primarily ceremonial functions. For example, of the 24 other Mortandad cavates with rock art, only five have even a fifth the number of images of the Cave Kiva; most have fewer than three scattered images and low to moderate numbers of features. The images could have been produced and viewed only by people with access to the rooms, whether inhabitants, kin, neighbors, or invited artists. The small size of the rooms effectively limited the audience to less than a dozen people, all sanctioned by the inhabitants of the room. The interior location of the rock art implies direct individual or family control over the imagery and its use. It is unlikely that these cavates were the functional equivalent of standard kivas (see H. Toll 1995:213–215).

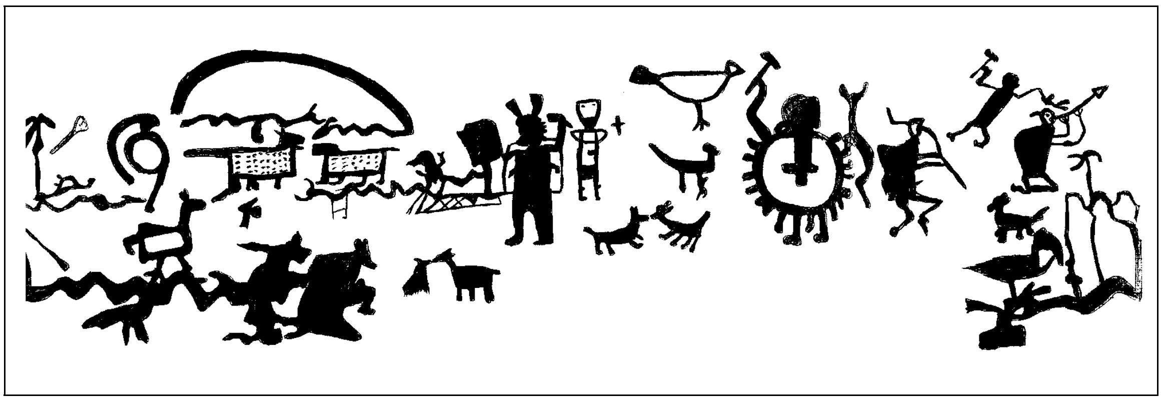


Figure 82.14. Interior petroglyphs from the Mortandad Cave Kiva.

Coalition rock art does occur in exterior contexts, but it is seldom directly associated with cavates. The Mortandad site, for example, has an unusually high proportion of exterior rock art: 18 of the 23 panels are on the cliff face. However, only a single element is actually on the lower level of the cliffs, directly associated with the cavates; the remaining 78 elements are on the caprock at the top of the mesa, linked to the cavate pueblo only by a trail and stairway leading to the masonry pueblo on the mesa above. Similarly, only three elements of the 348 at the Kwage cavates (LA 35003) are on an exterior panel. The only significant exterior rock art in the vicinity is at LA 21602, a single panel of fewer than a dozen images that is located high above the Kwage site, just below the top of the mesa (Snead and Munson 2001).

Informal field observations suggest a general division of Coalition period rock art between intensive imagery inside rooms at cavate pueblos and small quantities of exterior rock art scattered along upper cliffs away from habitation sites. The north side of Bayo Canyon, for example, consists of a long, steep talus slope topped by a series of cliff faces, one of which includes a number of cavates. At the top of the cliff is a sloping section of eroded bedrock and boulders, leading up to a second, shorter outcrop at the top of the mesa; this cliff is scattered with numerous small panels of rock art (Figure 82.15). The pattern of small rock art panels located in the vicinity of small Coalition period cavate pueblos is repeated in Sandia Canyon and along the Mesita del Buey, near Tsirege (Vierra et al. 2000). These panels have not yet been dated stylistically and they lack the close association with habitation sites that would allow them to be dated securely. These scattered panels, often too small to be documented as full-fledged sites, are probably under-reported in the literature; it they do indeed date to the Coalition period, they raise the possibility that Coalition rock art may also be under-reported.

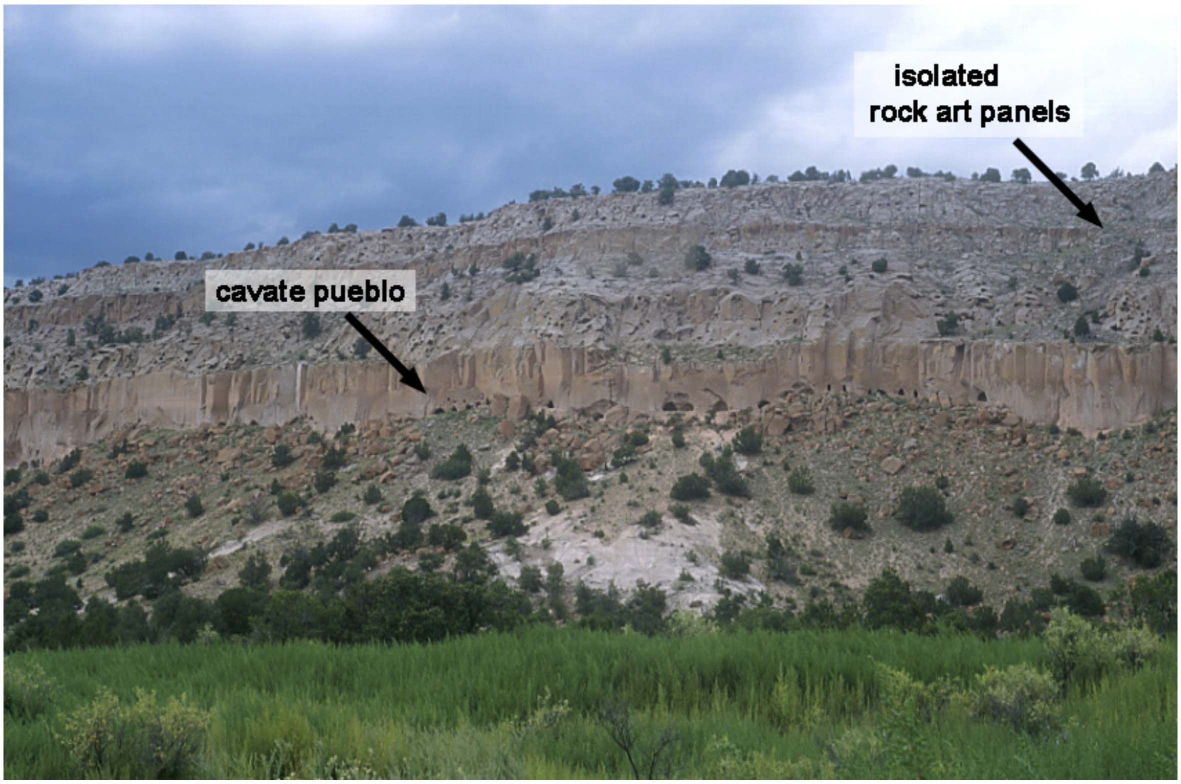


Figure 82.15. Location of isolated rock art panels relative to cavate pueblos in Bayo Canyon. The photograph was taken from Otowi Pueblo.

In the absence of additional information, however, the distribution of these panels relative to Coalition and Classic period sites provisionally suggests that this scattered rock art may be contemporaneous with small Coalition pueblos. If so, the dichotomy between dense interior rock art and scattered, distant exterior rock art indicates that each context had different audiences. The exterior rock art is relatively open, without physical barriers that would restrict its production or viewing, yet much of it is far enough afield that the images are less likely to have been seen frequently. The presence of trails leading from most of the Coalition cavate pueblos to the mesa tops (Snead 2002a) would have facilitated access to the rock art on the upper cliffs, but direct associations between trails and rock art are unusual (Snead and Munson 2001). At the Mortandad site, for example, the central stairs lead individuals within view of the most concentrated rock art, but not directly to it (Figure 82.16). Similarly, a major stairway at the east end of the mesa along Bayo Canyon provides access to the same level as the rock art, but only a single panel with a few elements is actually visible from the trail.

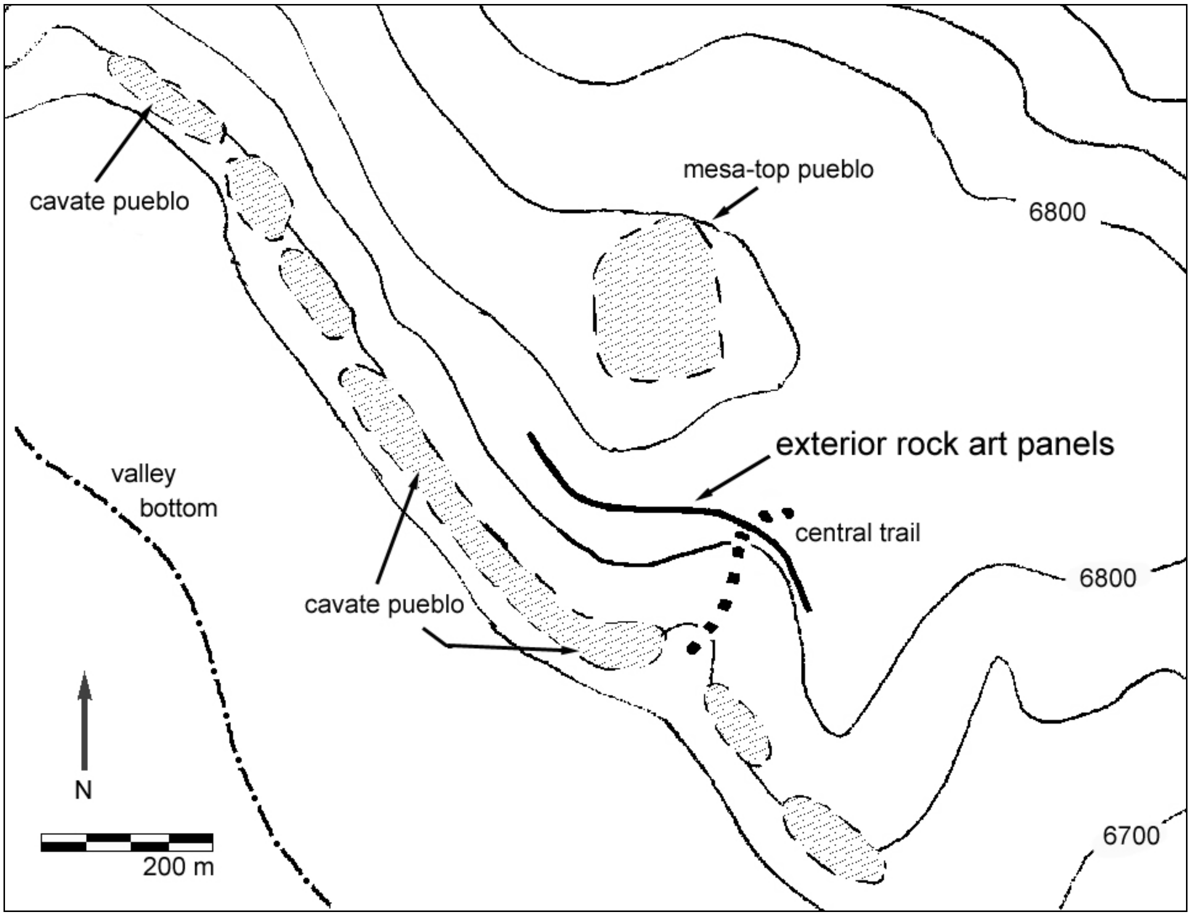


Figure 82.16. A plan map of the Mortandad site, showing the relationship of exterior rock art panels to other features.

Context of Classic Rock Art

While Coalition rock art is almost entirely in private contexts, 85 percent of Classic rock art in this study is located on exterior surfaces. Rock art on cliff faces is, of course, a logical accompaniment for the multi-story cavate pueblos that were common in the Classic period (Van Zandt 1999:387), as the very fabric of the cavate pueblos provided an expanse of cliff and walls suitable for rock art. However, many Coalition period sites, like the Kwage and Mortandad sites or smaller cavate pueblos like LA 21639, have ample cliff faces that were completely ignored by artists. There is no indication that Coalition period rock art was crowded onto insufficient space; more than 80 percent of the panels from both periods have light or moderate use of space, and only a small, uniform proportion of the panels have heavy use that might indicate crowding. In addition, the increase in large cavate pueblos in the Classic period would have provided ample interior space for rock art, space that these artists seldom used. The dramatic jump in exterior rock art, then, indicates a new emphasis in the Classic period on public locations for imagery.

Although the exterior rock art is large enough to be potentially visible from a moderate distance, only a small percentage is in the prominent locations visible to individuals approaching a site.

The primary audience for most of the external rock art was the inhabitants of each cavate pueblo, or at times individuals living within a segment of a pueblo (Figure 82.17). Closer examination of the distribution of Classic rock art highlights the existence of special-purpose locales, involving small platforms surrounded by extensive rock art imagery. These alcoves, visible from villages but somewhat removed from the traffic of daily life, are locations where small groups of individuals gathered periodically for rituals centered on the production of rock art.

Figure 82.17. The horned serpent at Tsirege (vertical panel at center of photo) is located along the main stairs leading to the mesa top pueblo. Although it would have been seen by anyone entering the site using this stairway, it is not readily visible to strangers at a distance.

GEOGRAPHIC VARIATION IN PAJARITO ROCK ART

Purported Differences in Northern and Southern Pajarito

As discussed earlier, much research on Pajarito rock art has relied upon Schaafsma's stylistic distinctions relative to historic Keres and Tewa boundaries. In broad outline, the geographic distribution of elements fits within P. Schaafsma's (1992) delineation of conflict-related Tewa rock art in the north and religious Keres rock art in the south. Rock art from the northern plateau, for example, includes most of the imagery with war-like connotations, such as shield bearers, weapons, arrow swallowers, thunderbirds, and mountain lions. Depictions of possible kachinas, in turn, are most common in or south of Frijoles Canyon.

Nonetheless, close examination of the distribution of rock art elements indicates that the greatest variability is actually among clusters of neighboring sites: those in Garcia Canyon, in the Otowi-Tsankawi area, the Tsirege area, Frijoles Canyon, and the southern Pajarito around San Miguel. For example, although flute players are numerically most common in the north, 90 percent of all flute players in the Pajarito sample are found in the Otowi-Tsankawi area. Similarly, the predominance of shield bearers in the north results from the fact that 88 percent of all shield bearers in the sample are limited to the Otowi-Tsankawi area. Weapons, thunderbirds, and arrow swallowers, limited almost entirely to sites on Tsankawi and north mesas, are even more restricted in distribution. In turn, the Otowi-Tsankawi area largely lacks elements such as individuals with torso Xs, possible kachinas, and the pointed-cap being, all of which are common at Tsirege and in Frijoles Canyon. Tsirege and the Frijoles sites also have numerous shields and concentric circles, but completely lack the shield bearers of the Otowi-Tsankawi area. The Frijoles Canyon sites are distinguished from Tsirege by their numerous faces and plain circles. The sites in Garcia Canyon, with large numbers of spirals and plants, are unusual enough that they were difficult to date stylistically, while the rock art on the far south Pajarito is also quite distinct from other locations. The imagery in the San Miguel area includes many pictographs, the unique star ceiling, and numerous faces pecked around corners. The following section describes the characteristic rock art of each of these geographic areas in greater detail.

The Northern Pajarito

The northern Pajarito rock art in Munson's dissertation consists entirely of Coalition period imagery from sites in Garcia Canyon. Although this sample is not an ideal representation of the northern plateau, it is sufficient to point out certain differences between Garcia Canyon imagery and the remainder of the Pajarito. The assemblage is dominated by spirals and zigzags. Animals and anthropomorphs are uncommon; the latter are often incomplete, as in the case of isolated legs and feet. The unique representations of plants are notable; the rare depictions of plants elsewhere on the Pajarito lack the rounded circles at the tips of the stems that make the northern depictions of plants resemble sunflowers. The sole shield is also unusual, with a lobed interior and a central face.

The North-Central Pajarito

The rock art of the north-central Pajarito Plateau is dominated by transitional Coalition-Classic elements and Classic period imagery. The areas around Otowi and Tsankawi, in particular, are mixed temporally, while the rock art at Tsirege is primarily limited to the Classic period. In addition to their temporal differences, these two areas within the north-central Pajarito have overlapping but different rock art motifs.

Compared to the rest of the Pajarito, the Otowi-Tsankawi area has the vast majority of the images relating to hunting or warfare, including most of the shield bearers and virtually all of the images of weapons. In the Coalition period, representations of weaponry are mostly bows and arrows, often with individuals using them to shoot quadrupeds, although sometimes as individual objects. A few human figures hold possible spears. Transitional Coalition-Classic weapons are entirely held by single individuals, including some shield bearers. In the Classic period, weapons are represented as isolated bows and arrows, a single object that appears to be a projectile point, and a shield bearer holding a possible spear. The Otowi-Tsankawi area also contains most of the arrow swallowers in the sample. These individuals are represented in profile and often look much like flute players. The earliest, from the Coalition period, is inside the Cave Kiva at Mortandad; the latest is a Classic period figure in Frijoles Canyon. The majority of these images, though, are Coalition-Classic transitional and are located at the Tsankawi Trail site.

Birds and unidentified quadrupeds constitute more than two-thirds of the animals in the Otowi-Tsankawi area. Canids are found in all periods, while depictions of deer or possible elk are limited to the Coalition and transitional Coalition-Classic. Mountain lions are common in the Coalition period, while transitional sites include the sole dragonfly and almost all of the thunderbirds in the sample. Horned serpents are common in the Otowi-Tsankawi area in the Coalition rock art, along with numerous zigzags that resemble snakes; although short or excessively meandering zigzags bear little resemblance to local conventions for depicting snakes, the long horizontal zigzags that encircle cavates are similar to the form of more direct depictions of serpents. Such "cavate snakes" are common in Coalition and Classic period cavates on the north-central Pajarito.

At Tsirege, in contrast, simple passive figures and simple faces dominate, each constituting about 30 percent of all human images. Elaborate humans are evenly split between active and passive forms. Two of the anthropomorphs represent a person with a pointed cap being and a beaked masked figure. Animals, as is typical of the Pajarito, are mostly birds and unidentified quadrupeds. Numerous canids are present at Tsirege, as is the only Classic mountain lion in the northern Pajarito sample. Horned serpents are unusually common, comprising more than 10 percent of the animals, while plain snakes are relatively rare; this is hardly surprising, given the presence of the Awanyu and other dramatic horned serpents. Only a single plant is present. Shields are common at Tsirege, including some that bear elaborate designs similar to historic pueblo shields (Wright 1976, 1992) and others that are decorated with concentric circles, lobes, or feathers. Large plain concentric circles, more common at Tsirege than in any other dated rock art site on the Pajarito Plateau, probably also represent shields, although this should not be assumed of all concentrics.

Frijoles Canyon

The most numerous, and most visually prominent, shields in the sample are from Classic and late sites in Frijoles Canyon. Long House, in particular, has 10 shields, and a careful examination of the canyon shows that most of the major cavate pueblos have at least one large shield prominently placed on the cliff face high above. Large concentric circles that may also represent shields are fairly common in Frijoles Canyon.[2] Single circles, which are quite common, could potentially evoke shields, although judging from their small size they might simply be incomplete or heavily weathered faces. As at Tsirege, Frijoles sites lack shield bearers and weapons of any kind.

[2] Cavate Groups A and M, for example, have large shield-like concentrics that are visible from the canyon bottom with binoculars.

Virtually all of the human imagery consists of faces; most are simple, but a few have sufficient detail that they could represent masks. The infrequent full human figures are mostly elaborate and active; they include a being with a pointed cap, a possible representation of Shalako, and the only arrow swallower outside the Otowi-Tsankawi area. Birds are by far the most common animal (35% of animals), followed closely by snakes and horned serpents (16% each). Unidentified animals and quadrupeds constitute only one-fifth of the animals, which represents a sharp break from other Pajarito Plateau rock art. A sole plant is the southernmost such image in the study. Though rare overall, terraces and sets of concentric arcs are more common in Frijoles Canyon than in other parts of the Pajarito.

The Southern Pajarito

The distribution of rock art in the sample makes it difficult to fully address variation across the southern Pajarito Plateau. The vast majority of the rock art in the south is from the vicinity of San Miguel. This southernmost rock art is almost half human figures, which is a full 25 percent more than any other area. About 30 percent of the humans are elaborate, including multiple representations of specific individuals. Nine of the human figures have a pointed cap and claw-like hands, two are Shalako, and three have a combined head and body. The only shield bearer outside the Otowi-Tsankawi area is a late figure in Capulin Canyon, although Painted Cave, which was not recorded, also includes some of the figures (Rohn 1989). The only exceptions in the distribution of weaponry in the Otowi-Tsankawi area are two late individuals on the far southern Pajarito, one with an arrow coming from the top of its head, another holding a possible spear.

The most elaborate depictions of humans are in the late sites of the far southern Pajarito. Some detailed faces are probably representations of masks, while particularly elaborate humans may be kachinas or supernatural beings, such as mudheads, the pointed cap being, Shalako, and ogres. Most of the human figures on the southern Pajarito are passive. Handprints, though infrequent, are almost entirely from the San Miguel area, probably due to the greater proportion of pictographs in the southern Pajarito. Simple faces are usually pecked around corners, a trait typical of Keres rock art (P. Schaafsma 1980:275).

Animals are quite rare, forming only 13 percent of the southern rock art. Horned serpents, zigzags, and snakes are correspondingly rare, although when they do occur it is often in complex forms, such as the serpent at the San Miguel Site that has a body of interlocking diamonds. Most of the clear depictions of mountain lions occur in this southern area, as do most of the weasel-like animals. The far southern plateau also includes the only thunderbird outside the north-central Pajarito. Dots and + signs are quite common, due entirely to the presence of the star ceiling at the San Miguel Site. Only a single terrace was recorded on far southern Pajarito, but anthropomorphized terraces are also present at Painted Cave (see Rohn 1989:112).

Taken in concert, this evidence suggests that the content of the rock art varies on a finer geographic scale than previously recognized. The relative size of this spatial distribution is in keeping with the imagery's apparent audience, the occupants of individual communities. These geographic differences also appear to persist through time. The weaponry depicted in the Otowi-

Tsankawi area, initially present in Coalition hunting scenes, is common at transitional Coalition to Classic sites, as well as in later Classic sites. Shield bearers, likewise, are found at a few Coalition sites in the area, then increase in number, particularly during the transition to the Classic period. Similarly, the Late Coalition images of detailed humans in the far south are predated by related Classic period depictions.

Geographic Factors Related to LANL Rock Art

Two specific issues relating to geographic variation are pertinent to the rock art of Los Alamos. First, the palimpsest effect in the Otowi-Tsankawi area is a potentially serious problem. Most sites were established in the Late Coalition period, with major occupation in the Classic period, and the whole area was intensively used prehistorically. Individual rock art sites or panels may have imagery with a wide range of dates, and differences in patination or style may not be great enough to distinguish Late Coalition period rock art from that of the Classic period. At best, much of the rock art within the Otowi-Tsankawi area may have to be designated as transitional in nature, rather than definitively assigned to a specific time period. This is particularly true of the small clusters of panels common on isolated cliffs not directly associated with habitation sites (discussed above relative to the context of Coalition images).

Second, there are considerable differences between rock art on tuff and that on basalt. Some of these differences are simply due to the nature of the material; it is impossible to create the same kind of fine detail on the soft, coarse tuff as on basalt. In general, petroglyphs on tuff are larger in scale and/or include less detail. Petroglyphs on basalt may have greater detail and are less likely to be solidly pecked, given the amount of labor required to work the surface of the hard basalt. As a result, the stylistic dating outlined above is not always sufficient to date rock art sites exclusively on basalt.

LA 49948, a petroglyph site located in Water Canyon, is a prime example of this problem. The site consists of small petroglyph panels scattered along talus slope boulders and low, broken cliffs of basalt on the north side of Water Canyon. With the exception of two small concentrations on the upper cliff, the panels are isolated spatially and do not seem to have been placed relative to each other or to any discernible feature of the landscape. The petroglyphs themselves include concentric circles, lobed figures and curvilinear meanders, small Xs, a lizard-like figure, and a few simple humans. The rock art at LA 49948 is closely related to that at LA 49944, LA 49945, LA 49946, and LA 49947, which are single panel rock art sites located just upstream on basalt boulders and cliffs. These elements strongly resemble Abstract Style rock art traditions (P. Schaafsma 1992), but the lack of heavy patination at the site argues against a date that old. Some elements have also been modified with historic scratching.

Rock art from White Rock Canyon, as recorded by Lilienthal and Hoard (1995), and from the Cochiti Dam area, as recorded by Schaafsma (1975), includes many similar elements that are cryptic in date, along with large, detailed images that are stylistically similar to historic Pueblo drawings. Petroglyphs on basalt should therefore be dated with great caution, relying heavily on patination and superpositioning (when available).

RECORDING AND MANAGEMENT ISSUES

Recommended Recording Procedures

In addition to standard archaeological recording procedures, there are several recommended procedures for recording rock art sites. A separate rock art sheet is desirable to ensure that the necessary information is collected without adding much time to the overall site recording process.

First priority, for quick recording:

• A photograph, with scale and date, of each panel. They provide a record of the exact condition of rock art at a given point in time, which is useful for monitoring changes in condition.

• A listing of all elements present. The terms used to describe the elements should be standardized in a field manual, with verbal descriptions as well as example illustrations. It is important that these categories are as explicit as possible, as one person's idea of a corn plant may be someone else's dance wand or prayer stick. If the elements categories are organized as a brief check list, the recorders can simply check to indicate which elements are present at a site.

• An estimate of the number of elements present. Again, this could be done with check boxes listing ranges of numbers (<10, 10 to 25, 26 to 50, 51 to 100, >100). This number is useful for determining how extensive the rock art is at a given site, should more detailed recording be desired at a later date.

• An indication of the techniques present at the site (pecking, incising, grinding, painting, combinations).

• An indication of the possible date of the imagery, the basis for the judgment, and/or the potential for dating. This would include check boxes for superpositioning, patination (including sooting or plaster in cavates), subject matter, stylistic variation, and comparison with other media. A comments field would help provide further details.

• A list of potential threats and/or management issues, including check boxes for erosion, plant growth, vandalism, heavy visitation, and other threats.

Second priority, for more detailed recording:

• All elements should also be drawn whenever possible, as field observations often show details that cannot be seen in photographs. Drawings should attempt to represent what can be seen as objectively as possible, without embellishment. If it is desirable to extrapolate from what can readily be seen (as is often useful for making sense of eroded pictographs), the reconstructed image should be clearly labeled as such.

• Each element should be given an identifying number or letter.

• Dating information should be recorded in detail for each image.

Superpositioning relationships should be stated clearly, in a form such as "X lies under (is older than) Y." If the relationship cannot be determined, that should be stated explicitly. Relative patination should be noted using standardized terms (such as complete, heavy, medium, light).

Dating petroglyphs within cavates is particularly important; the rock art within cavates in the central Pajarito Plateau appears to be a mixture of imagery contemporaneous with occupation and images post-dating occupation. When dealing with interior rock art it is important to remember that the rock art may be contemporaneous with the primary occupation of the site, or it may be more recent. Rock art on different panels within a site, or different elements within a single cavate may not be contemporaneous. Previous projects have typically failed to record information necessary to distinguish between the two. This can be addressed by explicitly recording information that may help in dating; specifically, photograph and document in writing:

• any indication of sooting, including an estimate of percent sooted, from 0 to 100 percent blackened,
• any superpositioning of plaster layers over images or parts of images,
• any differences in the color of the tuff itself. Color differences can be very subtle, and may differ depending on lighting. Recording the color of pecked areas and the background color of the tuff with a Munsell color chart may help identify color differences that could distinguish between fresh, modern images and earlier petroglyphs.

Erosion and Other Natural Damage

The volcanic tuff of the Pajarito Plateau, which is the substrate for the majority of the rock art, is generally soft and highly susceptible to weathering and erosion. However, tuff forms a hard weathering rind through time, and it appears that erosion from wind and water is not a major problem for most Pajarito rock art (Vierra et al. 2000). Likewise, growth of lichens and other plants also does not seem to pose a significant threat to most Pajarito rock art. Peeling plaster within cavates is a more serious threat, particularly to fine-line scratched historic images and inscriptions. Forrest's Master's thesis in historic preservation (2001) may provide information useful for assessing the threat of plaster loss. Photographs are a useful means of monitoring changes in the condition of elements through time.

Vandalism

The major threat to Pajarito rock art is from human action. Field observation suggests that vandalism has not been a great problem in recent years. In some cases, this is due to the inaccessibility of sites; there is a sharp decrease in dated graffiti at a former party site on Kwage Mesa (LA 35003) following the construction of the sewage treatment plant directly below it. The cages on significant cavates in Mortandad and Sandia canyons, though visually disruptive, are highly effective in preventing vandalism. Less drastic measures, such as the warning signs posted at the entrance to the trail to the Mortandad site, also appear effective. The greatest potential threat is probably from unintentional damage. Visitors love to view rock art; most will touch the images. This should be discouraged as much as possible, especially for rock art on tuff. Rubbings, castings, moldings, and the addition of chalk or any other substance should never be permitted.

CHAPTER 83
FUEL LOADS AND WILDFIRE EFFECTS ON ARCHAEOLOGICAL SITES AT LOS ALAMOS NATIONAL LABORATORY

Bradley J. Vierra and Randy G. Balice

INTRODUCTION

Los Alamos National Laboratory (LANL) is located on the Pajarito Plateau in north-central New Mexico. Archeological surveys have recorded over 1000 archeological sites at LANL. The majority of these sites are located in the lower elevations and in areas dominated by piñon-juniper vegetation. The question is, what types of archaeological sites are at greatest risk to wildfires? Since most of the heavy forest fuel loads at LANL are at higher elevations, there is an inverse relationship between site density and fuel loads. Wildfires therefore pose the greatest risk to archaeological sites situated at higher elevations (e.g., temporary campsites and fieldhouses). However, several factors can affect wildfire behavior, with the potential of severe damage occurring to any archeological site. This chapter will present our research on the relationship between archaeological site distribution and fuel loads at LANL. A comparison will then be made between these data and the information collected on archaeological sites within the Cerro Grande fire burn area, including the Rendija Tract.

DISTRIBUTION OF ARCHAEOLOGICAL SITES

LANL occupies the central section of the Pajarito Plateau. The plateau covers an area roughly extending from Santa Clara Canyon on the north, to the mesas above Cochiti Pueblo on the south, to the caldera on the west, and to the mesas overlooking the Rio Grande Valley to the east. LANL covers approximately 29,000 acres of land on this high mesa, ranging from about 1829 to 2438 m (6000 to 8000 ft) in elevation and covered with stands of piñon-juniper and ponderosa pine. The mesa has been incised with several deep canyons that drain from the mountain country down to the river valley. Balice (1998) has defined six basic vegetation and land cover types for LANL: unvegetated, grassland, juniper savanna, piñon-juniper, ponderosa pine and mixed conifer. Figure 83.1 illustrates the distribution of these vegetation types across LANL. Most of LANL is covered with piñon-juniper woodlands at the lower elevations and ponderosa pine at the higher elevations.

As of 2001, approximately 15,700 acres, or about 50 percent of LANL, had been intensively surveyed, with a total of 1025 archeological sites recorded. This reflects an average density of 1 site per 15 acres. The archaeological record of the plateau is rich and diverse, representing over 8000 years of human occupation. The recorded sites span a period from Archaic times to the Cold War era. However, the majority of these sites date to the Coalition period, ca. AD 1200–1325, with a large number of undetermined prehistoric sites (e.g., artifact scatters, fieldhouses, cavates, or rock art sites).

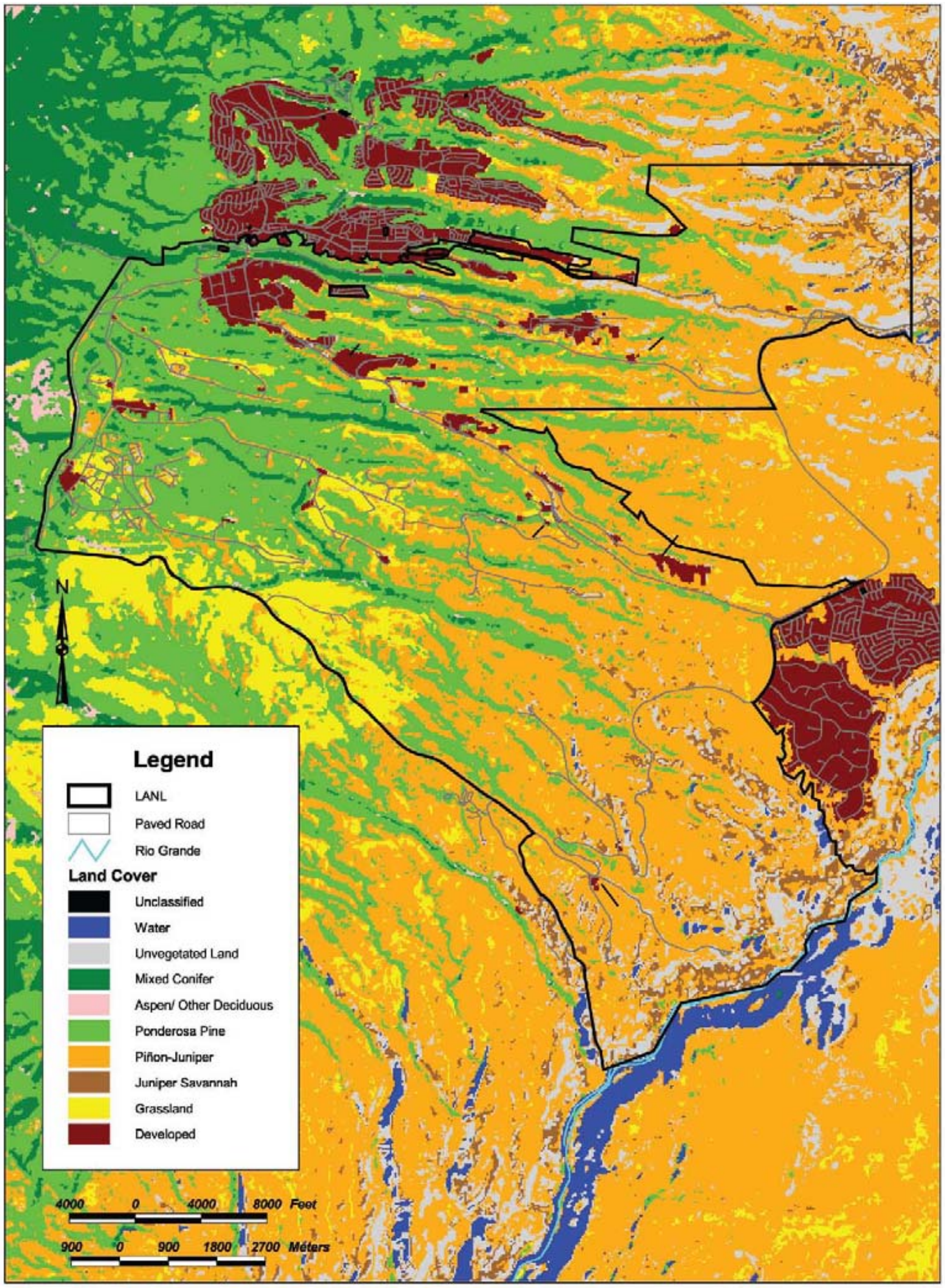


Figure 83.1. Vegetation types at Los Alamos National Laboratory.

Site distribution maps reveal obvious differences in the patterning of sites over time (see Vierra and Schmidt 2006). These differences presumably reflect important changes in past upland land-use strategies. For example, Archaic campsites are distributed across both piñon-juniper and ponderosa pine zones. Undetermined lithic scatter sites exhibit a similar distribution and presumably reflect Archaic campsites lacking diagnostic artifacts. However, these patterns stand in mark contrast to the distribution of Ceramic period habitation sites. Coalition period habitation sites are confined to the piñon-juniper zone, as are Classic period sites. Most of the

Coalition period fieldhouses are also located in the piñon-juniper zone, with a few situated at higher elevations in the ponderosa pine. This contrasts with the Classic period fieldhouses, which show a marked increase in the use of the ponderosa pine zone, most notably the area of Rendija Canyon.

Piñon-juniper and ponderosa pine cover the majority of the area surveyed. Table 83.1 presents the information on site density by vegetation type. Site densities range from a high of one site per 10 acres in the piñon-juniper woodlands, to a low of one site per 585 acres in mixed conifer forest. If we assume a 1000-acre survey was conducted in the piñon-juniper, ponderosa pine, and mixed conifer, we would see an inverse relationship between site density and elevation, with an expected 100 sites recorded in the piñon-juniper, 38 sites in the ponderosa pine, and only two sites in the mixed conifer. The latter may be an underestimation based on the small sample size.

Table 83.1. Density of archaeological sites by vegetation type.

Vegetation Type	Total Sites	Total Acres	Site per Acre
Unvegetated	88	2049	1:23
Grassland	14	1277	1:91
Juniper Savanna	2	442	1:221
Piñon-Juniper	556	6041	1:10
Ponderosa Pine	203	5373	1:26
Mixed Conifer	1	585	1:585

A chi-square analysis of archaeological sites by vegetation type for piñon-juniper and ponderosa pine (Table 83.2) indicates some significant differences (*chi-sq* = 10.9, *df* = 4, *p* = 0.27). Adjusted residuals were therefore calculated to determine which of the cells were contributing to the significant chi-square value. The results confirm the patterns observed in the distribution maps; there is no significant difference in the distribution of Archaic sites, lithic scatters, or Coalition period fieldhouses between the two vegetation types. However, there are significantly more Coalition period habitation sites in the piñon-juniper and Classic period fieldhouses in the ponderosa pine. Classic period habitation sites were excluded from the analysis because only four of these were represented.

Table 83.2. Archaeological site by vegetation type. Top number is the frequency and bottom number is adjusted residual. Adjusted residuals in bold are significant at the 0.05 level.

Site	Piñon-Juniper	Ponderosa Pine	Total
Archaic	36 -0.5	9 0.5	45
Lithic Scatter	7 -1.1	3 1.1	10
Coalition Habitation	102 **2.5**	12 -2.5	114
Coalition Fieldhouse	54 0.1	11 -0.1	65

Site	Piñon-Juniper	Ponderosa Pine	Total
Classic Fieldhouse	25 -2.6	12 **2.6**	37

Chi-square = 10.9, *df* = 4, *p* = 0.027

In summary, there is an inverse relationship between site density and elevation, with most sites being located in the piñon-juniper woodland. Overall, there are relatively more Archaic campsites with some Classic period fieldhouses situated in the ponderosa pine forest, versus more Coalition period habitation sites in the piñon-juniper woodland.

FUEL LOADING AT LOS ALAMOS NATIONAL LABORATORY

Information on fuel inventories conducted in 1997 has been adopted from Balice et al. (1999), as supported by additional data collected in 1998 and 1999 (Balice et al. 2000). The results of these analyses are presented in Table 83.3. The table presents information on fuels inventory summaries and the results of their multivariate analyses. Data are organized by the independent variables: vegetation type (Veg) and by topographic characteristic (Topo). The vegetation types are as follows: PJ = piñon-juniper woodland, Pipo = ponderosa pine forest, and MC = mixed conifer forest. The dependent variables in the top row include 1-hr fuels (0 to ¼"), 10-hr fuels (¼ to 1"), 100-hr fuels (1 to 3"), 1000-hr-sound fuels (>3"), 1000-hr-rotten fuels, duff (decomposed litter), litter (surface pine needles), herbaceous vegetation like shrubs and grasses (Veg), trees per acre that are less than 8" DBH (T/A<8), and trees per acre that are greater than or equal to 8" DBH (T/A≥8). The values for the down woody fuels and ground fuels are in tons per acre. Values in bold type are significantly different from other values in the same column ($p \leq 0.05$). As can be seen, the mixed conifer vegetation type consistently exhibits the highest fuel loads in both canyon and mountain settings. On the other hand, the ponderosa pine also exhibits significantly more 10 hr fuels (i.e., ¼ to 1" size) in both canyon and mesa settings, and a greater number of the larger trees per acre on mesa tops. These smaller fuels can act as ladder fuels to start crown fires in the higher-elevation forests. In contrast, the piñon-juniper woodlands contain significantly more fuel as ground shrubs, grasses, and forbs in both canyon and mesa settings. These fuels are less likely to create severe wildfires.

Table 83.3. Fuels inventory summaries and results of multivariate analyses. Significant values are in bold.

Veg-Topo Class	1 hr	10 hr	100 hr	1K hr S	1K hr R	Duff	Litter	Veg	T/A <8	T/A≥8
PJ-Canyon	0.3	1.2	0.7	0.5	2.9	3.4	0.8	**0.03**	46.4	25.9
PJ-Mesa	0.3	1.6	0.9	1.6	2.9	3.6	1.7	**0.03**	68.7	33.1
Pipo-Canyon	0.2	**1.9**	0.7	0.4	4.4	9.7	0.6	0.01	34.0	42.3
Pipo-Mesa	0.2	**2.3**	0.9	1.3	6.7	8.5	0.9	0.01	52.5	**91.0**
MC-Canyon	**0.9**	**3.1**	**2.5**	1.2	**14.2**	**12.5**	1.4	0.01	**227.9**	**78.7**
MC-Mountain	**0.6**	**2.0**	**3.4**	**3.2**	**28.6**	9.1	0.7	0.01	**222.1**	**121.8**

In summary, there are increasing fuel loads with elevation. We would therefore expect increasing levels of burn severity in these forests. As a consequence of this burn severity, steeper slopes and greater rainfall, we would also expect an increase in the potential for soil erosion at these higher elevations.

THE EFFECTS OF THE CERRO GRANDE FIRE ON ARCHAEOLOGICAL SITES AT LOS ALAMOS NATIONAL LABORATORY

Although the Cerro Grande fire burned a total of approximately 40,000 acres, only about 8000 acres were burned within LANL. This occurred under extreme weather conditions with excessively high winds. As previously discussed by Nisengard et al. (2002), a post-fire assessment was made on all the archaeological sites within the LANL burn area. A total of 384 sites were revisited during the field assessments. Of these, 369 were assessed for burn severity. Burn severity was defined as follows:

1. Low: duff partially consumed, none to little ladder fuels burned, no canopy burned.
2. Moderate: duff consumed, ladder fuel burned, isolated crown burn or torching.
3. High: duff, ladder, and crown completely burned.

Table 83.4 presents the information on burn severity by vegetation type for field-assessed archaeological sites. Overall, about 60 percent of the burned area at LANL is comprised of ponderosa pine. However, about 88 percent of the LANL area that burned did so with low severity, 11 percent with moderate severity, and about 1 percent with high severity. An additional 455 acres were burned in Rendija Canyon on Department of Energy lands. This area is situated within a ponderosa pine setting, with 355 acres of low-burn severity and 110 acres of high-burn severity. Archaeological data from this area are also included in our analysis.

Table 83.4. Burn severity by vegetation type for field-assessed archaeological sites within the Cerro Grande fire burn area at LANL.

Vegetation Type	Total Acres	*Total Archaeological Sites by Burn Severity*		
		Low	**Moderate**	**High**
Unvegetated	293	2	0	1
Grassland	814	80	18	2
Juniper Savanna	15	0	0	0
Piñon-Juniper	1394	85	8	11
Ponderosa Pine	4941	61	54	38
Mixed Conifer	624	3	2	2
Total	8081	231	82	54

Based on our previous discussion, we would expect significantly more severely burned sites in the ponderosa pine forest, and that relatively more temporary campsites and fieldhouses would be more severely burned.

So, are there significantly more severely burned sites located in the ponderosa pine forest versus the piñon-juniper woodland? The answer to this question is yes. An analysis of a contingency table of burn severity by vegetation type for field assessed archaeological sites indicates a significant difference in the distribution of sites across piñon-juniper and ponderosa pine zones (Table 83.5) (*chi-sq* = 4.25, *df* = 2, *p*≤001). A review of the adjusted residuals indicates that there are significantly more low severity sites in the piñon-juniper woodlands, and relatively more moderate- and high-severity burned sites in the ponderosa pine forest.

Table 83.5. Burn severity by vegetation type for field-assessed archaeological sites within the Cerro Grande fire burn area at LANL. Top number is the frequency and bottom number is the adjusted residual. Adjusted residuals in bold are significant at the 0.05 level.

Vegetation Type	***Total Archaeological Sites by Burn Severity***		
	Low	**Moderate**	**High**
Piñon-Juniper	85 **6.6**	8 -5.1	11 -2.9
Ponderosa Pine	61 -6.6	54 **5.1**	38 **2.9**
Total	146	62	49

Chi-square = 4.25, df = 2, p≤001

Second, are there significantly more severely burned temporary campsites and fieldhouses in the ponderosa pine versus the piñon-juniper? Table 83.6 presents the information on archaeological site type by burn severity. However, the sample sizes are too small to run a chi-square analysis. Nonetheless, 11 of the 15 (73%) severely burned sites are located in the ponderosa pine, with only four situated in the piñon-juniper. The sites in the ponderosa pine consist of temporary campsites and fieldhouses. Most of the moderately burned sites are also located in the ponderosa pine. That is, 13 of the 19 (68%) sites are situated in the ponderosa pine, with two in the piñon-juniper and four in grassland settings. Given the weather conditions associated with the Cerro Grande fire, patches of moderate- and high-severity burn areas are also present within the piñon-juniper woodlands.

Table 83.6. Archaeological site by field-assessed burn severity.

Site	***Burn Severity***		
	Low	**Moderate**	**High**
Archaic	14	4	3
Lithic Scatter	7	3	0
Coalition Habitation	43	7	1
Coalition Fieldhouse	21	3	2
Classic Fieldhouse	25	1	9

CONCLUSIONS

At the beginning of this chapter, we asked the question "what types of archaeological sites are at greatest risk to wildfires" at LANL. Our archaeological site distribution and fuel inventory studies indicate that those sites situated at higher elevations were potentially at greater risk for burn severity (Table 83.7). This mostly includes Archaic campsites and Ceramic period fieldhouses in the ponderosa pine forest. The evidence from the Cerro Grande Fire provides empirical support for these propositions.

Table 83.7. Burn severity by topographic setting for field-assessed archaeological sites within the Cerro Grande burn area at LANL. Top number is the frequency and bottom number is the adjusted residual. Adjusted residuals in bold are significant at the 0.05 level.

Topographic Setting	***Total Archaeological Sites by Burn Severity***		
	Low	**Moderate**	**High**
Canyon	43 -1.9	15 -0.7	21 **3.5**
Mesa	195 1.9	67 0.7	33 -3.5
Total	238	82	54

Chi-square = 11.95, $df = 2$, $p = 0.003$

CHAPTER 84
THE LAND CONVEYANCE AND TRANSFER PROJECT ARCHAEOLOGICAL SITE RESTORATION PROGRAM

Samuel Loftin

INTRODUCTION

Several archaeological sites were excavated in association with the Land Conveyance and Transfer (C&T) Project. The process of excavating a site removes much of the vegetation and disturbs the soils. Although the sites are relatively small, there is a risk of accelerated soil erosion, site degradation, and impacts to surface water quality. Once the excavation activities have been completed, we have a responsibility to stabilize and restore the integrity of these sites. Because the budget and staff available for site restoration were limited, we decided to use relatively low-tech treatments that could be implemented quickly and easily. Information gained from successful treatments can be used to design future restoration projects.

Following excavation activities, the sites were back filled and graded. Sites were then broadcast seeded by hand with a native grass seed mixture developed for the C&T Project. The seed mix included native grass species such as blue grama (*Bouteloua gracilis*), little bluestem (*Schizachyrium scoparium*), and dropseed (*Sporobolus cryptandrus*). Broadcast seeding alone can result in very low rates of seedling establishment due to inadequate conditions for germination, coupled with high seed predation by birds and insects. This is particularly true for arid and semiarid areas. Northern New Mexico has been experiencing drought conditions for the past eight to ten years. Annual precipitation has been alternating between average to above average one year to below average the next. These conditions can severely reduce the success of seed germination and establishment but are not uncommon for this region. For these reasons, it is beneficial to combine the seeding with some form of mulching treatment. The White Rock and Airport sites were seeded and mulched with straw. The Rendija Canyon sites were seeded and partially covered with piñon and juniper slash mulch to protect the seedbed and to improve establishment.

WHITE ROCK TRACT

The White Rock Tract is partially situated at the eastern tip of Mesita del Buey and within the Cañada del Buey floodplain (Figure 84.1). The area is covered by a piñon-juniper woodland at an elevation ranging from 2133 to 2186 m (6400 to 6560 ft).

LA 12587

The White Rock Tract rehab activities at this site were conducted in the winter of 2003. Seed and straw mulch was surface broadcast by hand. No slash mulch was used at this site. At the time the original photographs were taken, most of the straw mulch had blown off the site (Figure 84.2). By August 2007, the site was dominated by early successional species, primarily purple aster (*Machaeranthera bigelovii*), with scattered individuals of pale trumpet (*Ipomopsis longiflora*), snakeweed (*Gutierrezia sarothrae*), and Russian thistle (*Salsola kali*). Some seeded grasses are present but at low abundance. Although vegetation cover is relatively low (around 15%), there is no visible evidence of soil erosion.

Figure 84.1. Overview of the White Rock Tract showing important landmarks.

Figure 84.2. LA 12587 with extensive bare soils (top) with much of the straw mulch blown off the site. Bottom photo shows establishment of early successional weedy plant species two years later.

AIRPORT TRACT

The Airport Tract is located near the eastern end of the mesa, which is situated between Pueblo and DP canyons (Figure 84.3). It ranges in elevation from 2153 to 2196 m (7060 to 7200 ft) and is primarily covered by a piñon-juniper woodland with areas of ponderosa pine.

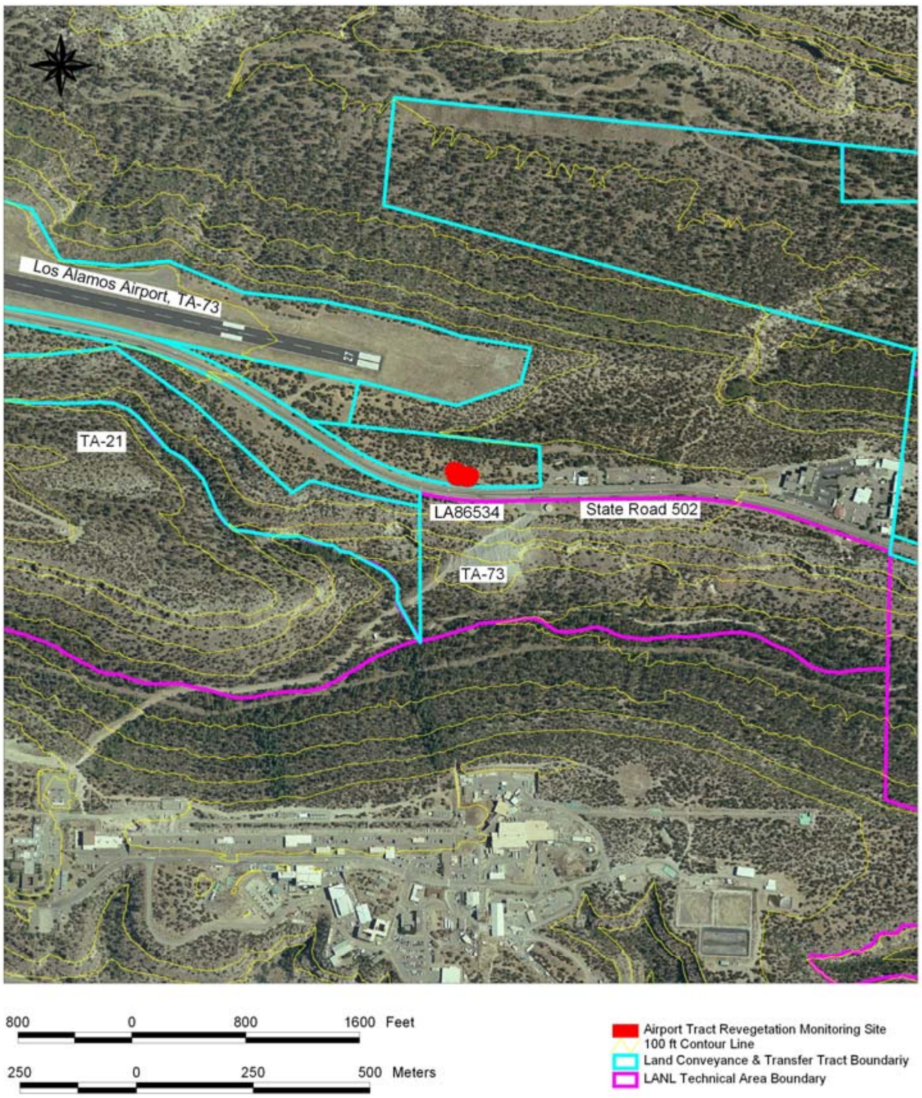


Figure 84.3. Overview of the Airport Tract showing important landmarks.

LA 86534

Archaeological activities at LA 86534 were completed in October 2002. The site was broadcast seeded by hand and then straw mulch was applied. No slash mulch was used at this site. The early photograph show that most of the straw mulch has blown off the site (Figures 84.4 and 84.5). The photos also show a nice stand of early successional plants, mostly lambsquarters (*Chenopodium album*). By August 2007 there had been a distinct change in vegetation. The site is dominated by grasses, mostly native perennials bottlebrush squirreltail (*Elymus elymoides*) and needle and thread grass (*Stipa comata*). There is also substantial cheatgrass (*Bromus techtorum*) cover, a non-native annual grass species. Other incidental plant species include blue aster and snakeweed. Average cover at the site is around 50 percent and there is no visible sign of soil erosion.

Figure 84.4. LA 86534 in the first growing season following seeding treatment; most of the understory plants are early successional weedy plant species.

Figure 84.5. LA 86534 in August of 2007 shows fewer weedy plants and more grasses. Note that the mature piñons have died and been removed from the site. A small piñon tree can be seen in foreground of both photos.

RENDIJA TRACT

The Rendija Tract contains portions of Rendija and Cabra canyons and ranges in elevation from 2293 to 4226 m (6880 to 7280 ft) (Figure 84.6). The lower canyon area is covered by a ponderosa pine forest, whereas, the mesa top areas are covered by a piñon-juniper woodland. The following sites were all located in these mesa top settings.

LA 85408

Rehab treatments on this site were conducted in summer 2005. The treatment included broadcast seeding by hand and then lightly covering with slash mulch that was scavenged from the trees that had been cut to clear the site. Figure 84.7 shows bare, loose, rocky soils with a light slash mulch, and how the same locale looked in August 2007 when grass cover averages around 50 percent. The vegetation is dominated by blue grama with some little bluestem. Another locale at the site (Figure 84.8) shows less vegetation cover (15% to 20%) but more surface rock to protect the soil from erosion. Neither locale at the site shows any visible evidence of soil erosion.

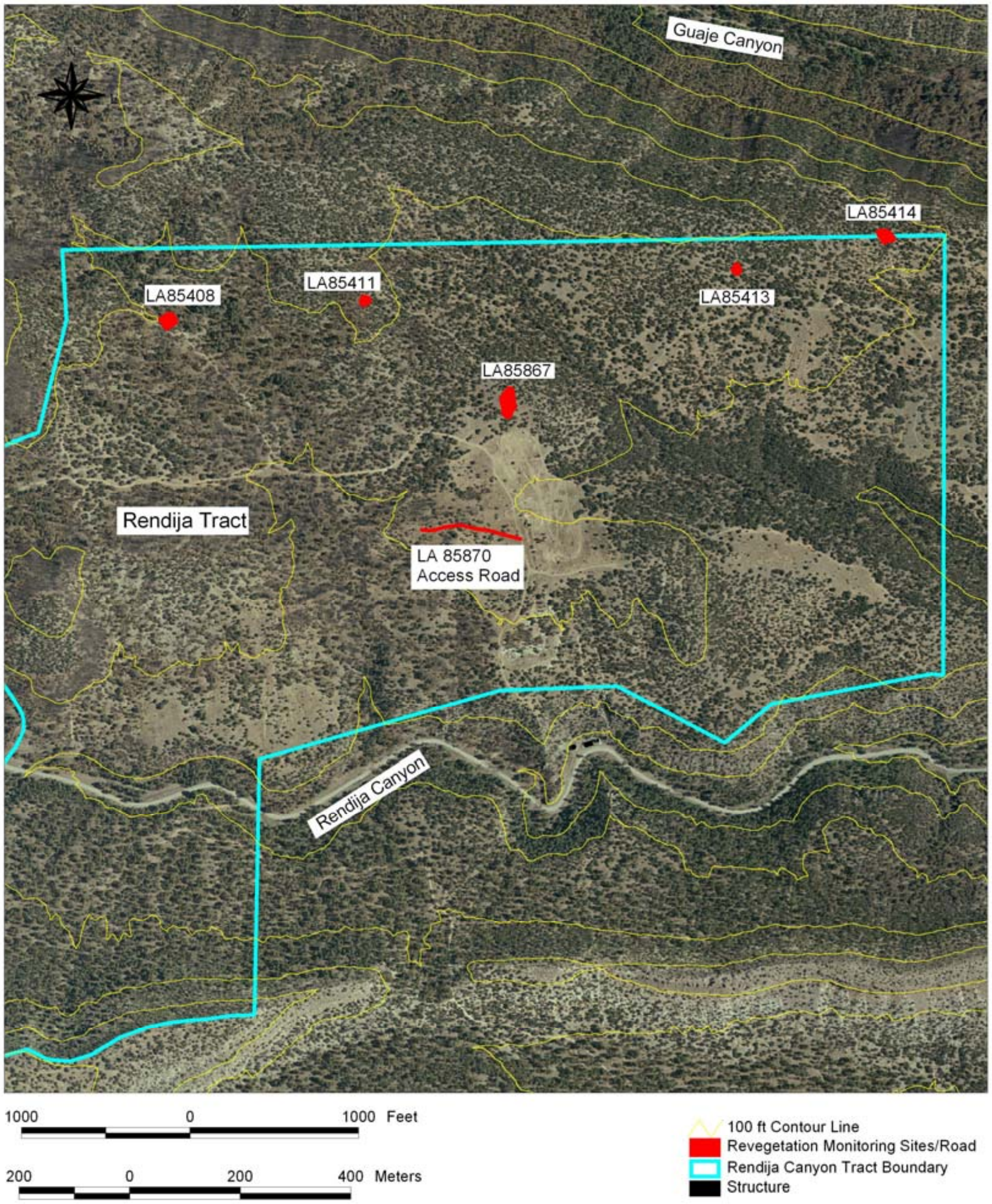


Figure 84.6. Overview of the Rendija Tract showing important landmarks.

Figure 84.7. Top photo shows one locale at LA 85408 shortly after seed and mulch were applied in the summer of 2005. The bottom photo shows the response after two years when the site is dominated by blue grama and soils are well stabilized.

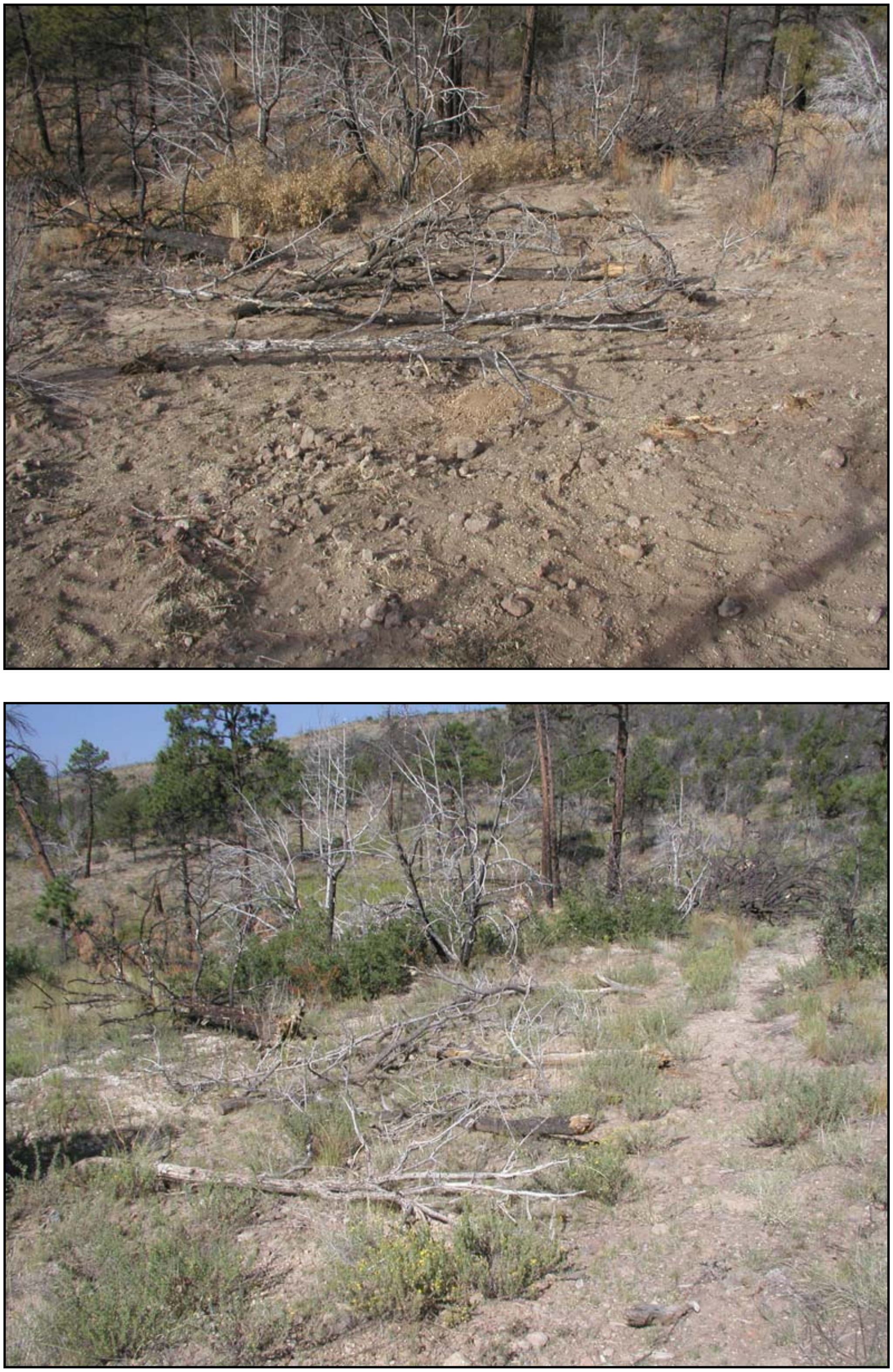


Figure 84.8. Adjacent to the locale shown in Figure 84.7, this locale has less establishment by seeded grass and better establishment from resident plants. Top is shown in summer of 2005 and bottom is summer of 2007.

LA 85411

Rehab treatments on this site were conducted in summer 2005. The treatment included broadcast seeding by hand and then lightly covering with slash mulch that was scavenged from the trees that had been cut to clear the site. The original photograph (top) shows loose bare soils with slash mulch (Figure 84.9). The later photo (bottom) shows substantial vegetation cover. There is good establishment of blue grama, particularly around the perimeter of the site. There appears to be some gopher activity in the center of the site, which is dominated by blue aster and other weedy species. There is a lot of dead plant litter on the site from past growing seasons and there are several resprouting oaks. There is no visible evidence of erosion on the site.

LA 85413

Rehab treatments on this site were conducted in summer 2005. The treatment included broadcast seeding by hand and then lightly covering with slash mulch that was scavenged from the trees that had been cut to clear the site. The original photograph shows loose bare soils with slash mulch. By August of 2007 there is a thick stand of blue grama on the site (see Figure 84.10), with few other plant species present. The blue grama cover averages 70 percent to 80 percent and is adequate to control soil erosion at the site.

LA 85867

Rehab treatments on this site were conducted in summer 2005. The treatment included broadcast seeding by hand and then lightly covering with slash mulch that was scavenged from the trees that had been cut to clear the site. The original photos show loose bare soils with slash mulch and some tracks left by the heavy equipment used to prep the site. The August 2007 photograph shows good vegetation cover on the site. Again, the blue grama has successfully established throughout the site, particularly under or around the slash (see Figure 84.11). The site appears stable with no visible evidence of erosion.

LA 85414

Rehab treatments on this site were conducted in summer 2005. The treatment included broadcast seeding by hand and then lightly covering with slash mulch that was scavenged from the trees that had been cut to clear the site. The original photograph shows loose bare soils with slash mulch (Figure 84.12). The August 2007 photo shows an excellent stand of blue grama (70 to 75% cover), substantially better than in surrounding undisturbed areas. Few other plant species are present on the site. Even with a slope of around 20 percent, there is no visible evidence of soil erosion at this site.

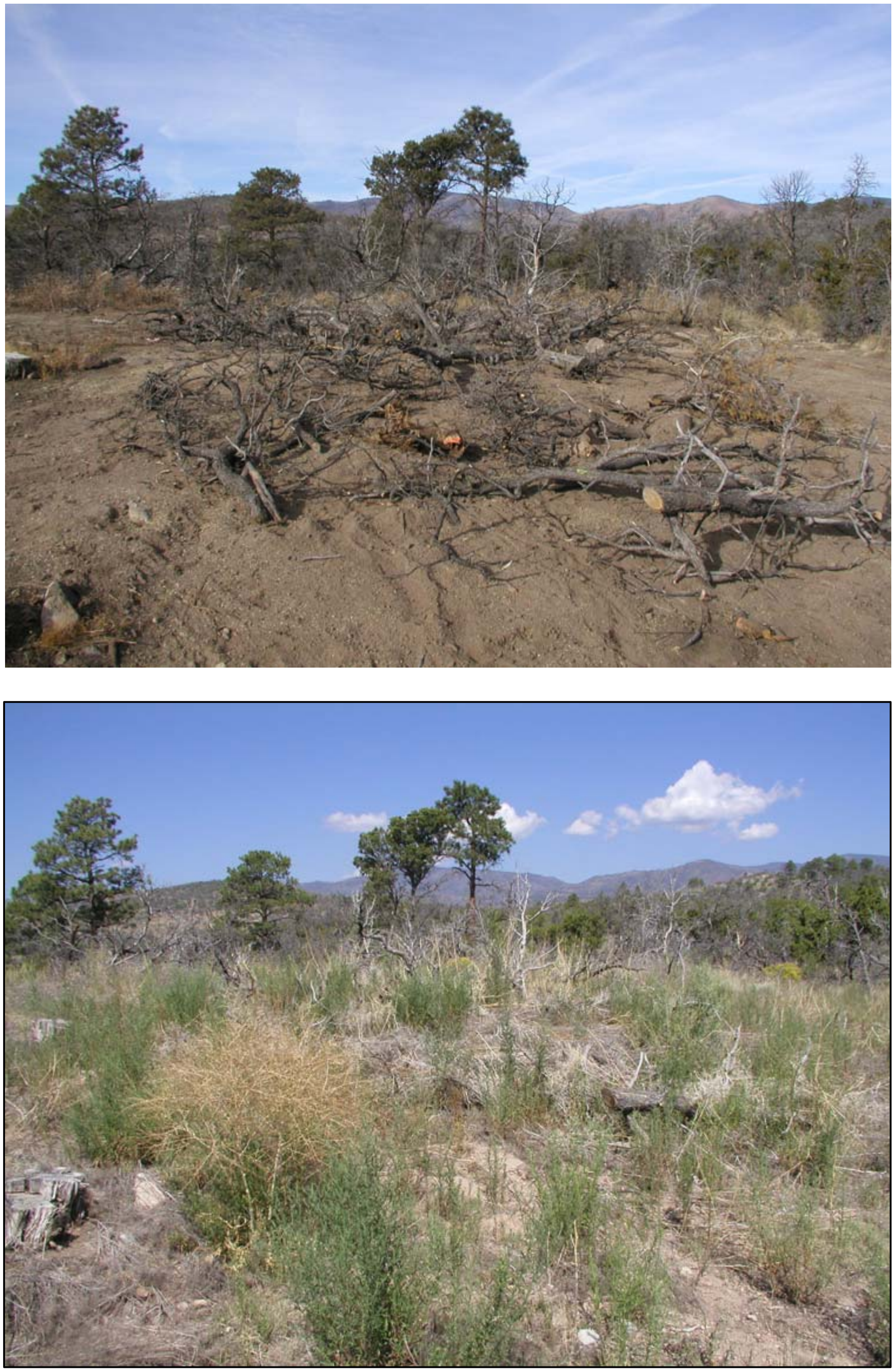


Figure 84.9. Top photo shows LA 85411 shortly after seed and mulch were applied in summer 2005. Bottom photo shows vegetation response after two years. This site still has a substantial weedy plant component along with some seeded blue grama. Judging by the amount of dead plant material on the site, there has been a substantial crop of weedy plants on the site over the past two years.

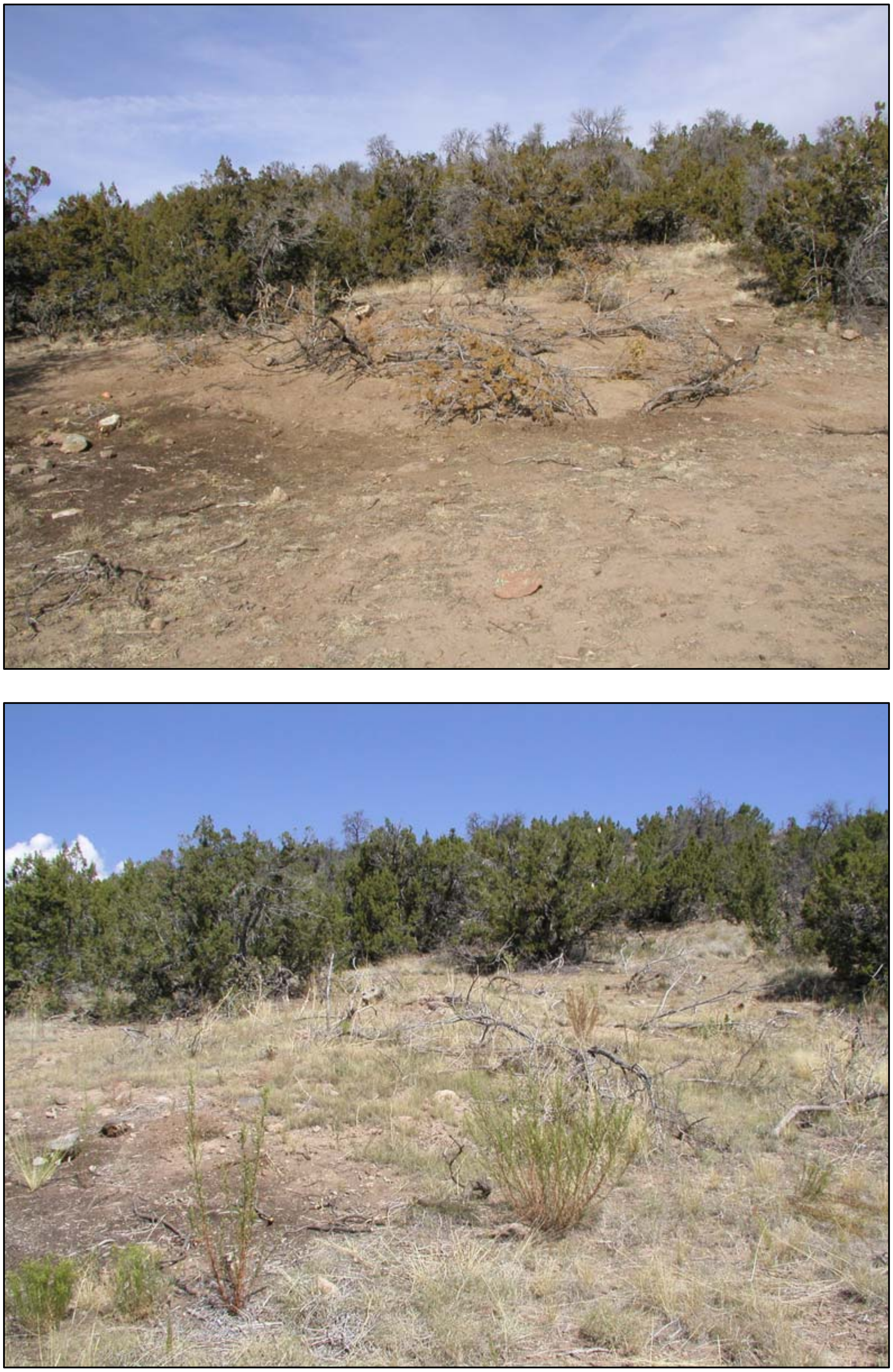


Figure 84.10. Top photo shows LA 85413 shortly after seed and mulch were applied in summer 2005. Bottom photo shows vegetation response after two years. Vegetation on this site is almost exclusively blue grama.

Figure 84.11. Top photo shows LA 85867 shortly after seed and mulch were applied in summer 2005. Bottom photo shows vegetation response after two years. Vegetation on this site is almost exclusively blue grama.

Figure 84.12. Top photo shows LA 85414 shortly after seed and mulch were applied in summer 2005. Bottom photo shows vegetation response after two years. Again, vegetation on this site is almost exclusively blue grama.

Road to LA 85417

This site is a road section that was constructed for access to LA 85417. Rehabilitation treatments were conducted in summer 2005. The treatment included broadcast seeding by hand with no mulch application. After two years, some vegetation (mostly blue grama) was re-established on site mostly in the tracks where water collects (Figure 84.13). The site has little slope and does not appear to be overly impacted by vehicular traffic. There is no visible evidence of erosion.

Figure 84.13. Top photo shows LA 85414 shortly after seed was applied in summer 2005. Bottom photo shows vegetation response after two years. Resident species have resprouted in the road median and there is some vegetation growing in the tracks.

CONCLUSIONS

Despite less than desirable precipitation during the project period, all the sites are stable with no evidence of soil erosion. The Airport and White Rock sites (LA 12587 and LA 86534) are dominated by weedy plants but this is a typical response for disturbed areas and native perennial plants should establish in time. The best seeded vegetation establishment was observed at the Rendija Canyon sites where we used a slash mulch to protect the seedbed (Figure 84.14). Interestingly, blue grama was the only grass from seed mix to successfully establish at these sites. For comparison, we photographed one of the Jicarilla tipi ring sites that received no rehabilitation treatments. The site is still bare with little vegetation cover (Figure 84.15).

Figure 84.14. Photo of juniper slash with blue grama established under and around the protective cover of the dead limbs. Slash improves microsite conditions for seed germination and establishment and provides some physical protection.

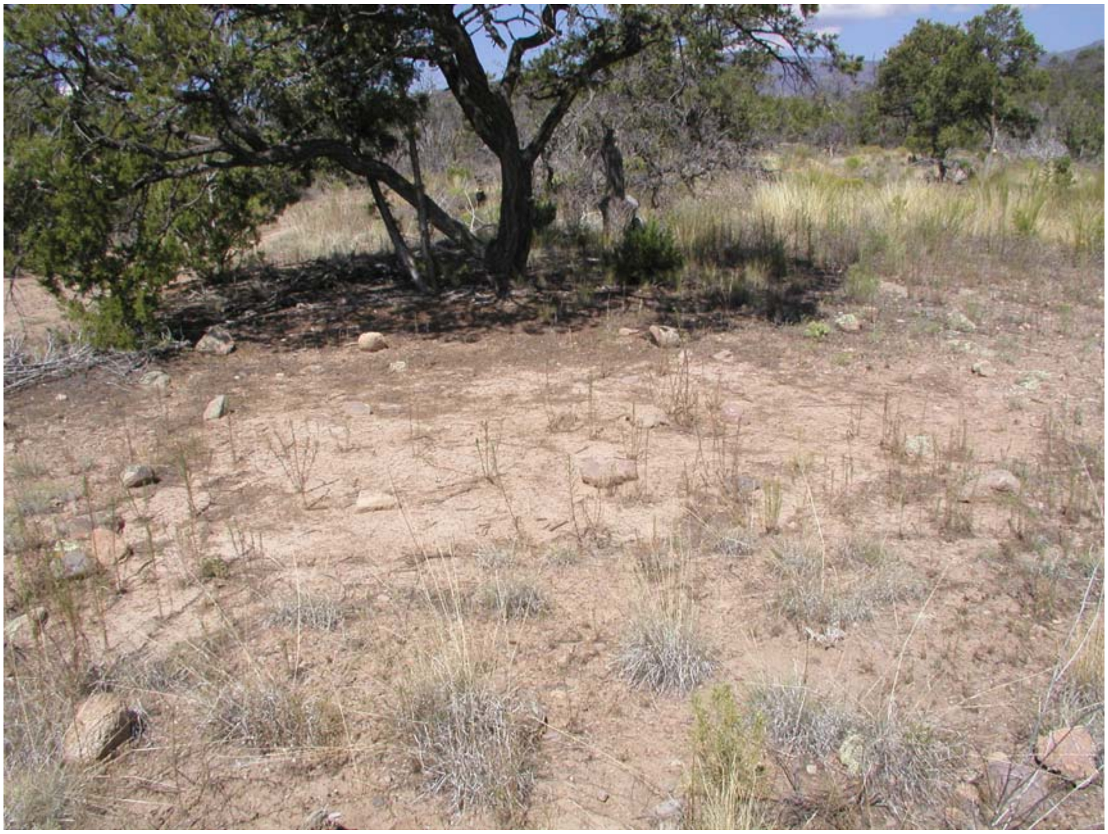


Figure 84.15. Photo of site with no rehab treatments. Although this site is relatively small, after two years the soils remain mostly bare with little vegetation reestablishment.

The results of this project suggest the importance of protective microsites for seed germination and seedling establishment. Broadcast seeding with a slash mulch performed better than other treatments. A surface straw mulch can be helpful, but if there is nothing holding it down it will often blow off the site. I would still recommend using a seed mix with several species. It may have been the case that the climatic factors following these treatments were optimal for blue grama grass. Other years may favor other grass species so it is best to hedge our bets when we can.

CHAPTER 85
PERSONAL PERSPECTIVES ON THE NATIVE AMERICAN GRAVES PROTECTION AND REPATRIATION ACT TRIBAL MONITOR PROGRAM OF THE PUEBLOS OF SAN ILDEFONSO AND SANTA CLARA

Timothy Martinez, Jeremy Yepa, Aaron Gonzales

Los Alamos National Laboratory (LANL) is situated on lands considered to be affiliated with San Ildefonso and Santa Clara Pueblos. A Tribal Monitor Program was set up for the Conveyance and Transfer (C&T) Project archaeological excavations as part of the initial 2002 Intentional Excavation Agreement in compliance with NAGPRA—the Native American Graves Protection and Repatriation Act (see Chapter 72, Volume 3).

San Ildefonso and Santa Clara Pueblos provided tribal monitors who were responsible for observing the excavations, identifying any sacred objects, and supervising the treatment of human remains. During the first two field seasons, Aaron Gonzales and Timothy Martinez served as monitors for the Pueblo of San Ildefonso. Beginning in 2004, they were joined by a monitor from the Pueblo of Santa Clara for all work conducted in Rendija Canyon. Michael Chavarria, Sr., served as the Pueblo of Santa Clara monitor in Rendija Canyon for the 2004 field season. He was replaced in 2005 first by Paul Baca and then by Jeremy Yepa. This chapter presents the views of Martinez, Yepa, and Gonzales (Figure 85.1).

Figure 85.1. Tribal Monitors Aaron Gonzales, Jeremy Yepa, and Timothy Martinez.

STATEMENT OF TIMOTHY MARTINEZ – PUEBLO OF SAN ILDEFONSO

***Powhoge Oweenge* "Where the water cuts through"**

The Pajarito Plateau is the traditional setting of the Pueblo of San Ildefonso. These lands continue to be acknowledged in the songs and prayers of our Tewa people.

I was hired by Los Alamos National Laboratory as the Pueblo of San Ildefonso Tribal Monitor from 2002 through 2006 for the Intentional Archeological Excavation, pursuant to lands managed by the Los Alamos National Laboratory in the Northern New Mexico for the U.S. Department of Energy, in order to create a framework for effective compliance with the Conveyance and Transfer of Lands from Federal Ownership under P.L. 105.119, as well as the Native American Graves Protection and Repatriation Act (NAGPRA), enacted in 1990.

The Excavation and Repatriation Process

As a tribal monitor, I observed the conduct of the excavations as well as treatment of any human remains, funerary objects, unassociated funerary objects, sacred objects, and objects of cultural patrimony that were encountered during the excavations (Figure 85.2).

Figure 85.2. Tim Martinez observing artifact collecting at LA 86534.

Training

Training for the job of monitor included taking the annual CPR, First Aid, Defensive Driving, Substance Abuse Awareness, Computer Security, Annual Security Refresher, and Ordinance Training courses, as well as reading the Environmental Management Awareness System (EMS), Archaeology Excavation, and Lab Safety training manuals.

Excavation

Project work included excavations from four major periods: (1) Archaic, 6000 BC to AD 500; (2) Coalition, AD 1100 to 1325; (3) Classic, AD 1325 to 1600; and (4) Homestead, 1890 to 1943. Excavated site types included lithic scatters, artifact scatters, fieldhouses, roomblocks, garden plots, water control features, tipi/wickiup rings, a homestead, a corral, and a wagon road. Over 40 sites were excavated in three separate C&T parcels: the Airport Tract, the White Rock Tract, and the Rendija Tract.

Laboratory and Field Work

Laboratory and field work activities consisted of flotation, mapping, monitoring access gates, counting, cleaning, washing and re-bagging artifacts, organizing the lab, printing labels, labeling boxes, organizing equipment, and conducting inventory (Figures 85.3 and 85.4).

Figure 85.3. Timothy Martinez screening at one of the sites in the White Rock tract.

Figure 85.4. Bettina Kuru'es and Tim Martinez processing flotation samples.

Meetings

A wide variety of meetings touched upon the C&T archaeological excavations. These included monthly group meetings, weekly team meetings, Resource Council meetings, Tribal Consultation, LANL NAGPRA meetings, and the Trails Working Group meetings.

Repatriation

In December of 2005, I oversaw repatriation and interment of 34 remains from the Maxwell Museum in Albuquerque, one ceremonial object from the Laboratory of Anthropology, three remains from the White Rock site, and one inadvertent discovery from TA-72.

Recommendations

Consultation is the key requirement of any Intentional Archeological Excavation. Museum and Federal agencies must consult with Indian Tribes prior to making decisions. Consultation is a process involving open discussion and joint deliberation with respect to potential issues, changes, or actions. Consultations regarding activities that affect tribal trust resources or property must be carried out on a government-to-government basis.

Unclaimed Native American human remains and objects shall be disposed of in accordance with regulations. Native American groups and representatives of museums should be consulted. Initiate consultation on the inadvertent discovery if human remains must be excavated or removed. Enter into agreement with the consent of culturally affiliated tribe or organization as to the disposition of, or control of, specific items.

Consultation must seek to identify traditional religious leaders who would also be consulted to identify where applicable lineal descendents and Indian Tribes (Pueblo) affiliated with the human remains, funerary objects, sacred objects, or objects of cultural patrimony.

Conclusion

Archaeology is not only about digging up the past, it's about history and education. It's about learning how our ancestors lived, what plants they grew, what they ate, how they built their home. It's also about working with a group of people of various backgrounds, and personalities, and working as a team. The excavations of all the sites were done with the utmost respect by the field crew through communication, protocol, enforcement, and compliance (Figure 85.5).

Figure 85.5. Completion of excavations at LA 127635.

STATEMENT OF JEREMY YEPA – PUEBLO OF SANTA CLARA

My name is Jeremy Yepa. I worked as the tribal monitor for the Pueblo of Santa Clara from 2005 to the end of the C&T Project. Since coming to work with the Cultural Resources Team, I observed and participated in many of the excavations of sites in Cabra and Rendija canyons located north of Barranca Mesa. I monitored the excavations for human remains and burial and sacred artifacts to ensure that the NAGPRA guidelines were followed and proper repatriation to the respective pueblo would be assured. This experience was very educational as both a student and a tribal member. The C&T Project set up a framework for communication between DOE, LANL, and the four accord Pueblos and was a model for any relations between tribes and the government (Figure 85.6).

Figure 85.6. Tim Martinez and Jeremy Yepa discussing issues in Rendija Canyon.

I began working as a Santa Clara tribal monitor in the latter part of August 2005. I hired on as a full time undergraduate student. Employed through the UGS program, I came on board on June 5. At the start of my employment, Paul Baca was the Santa Clara Pueblo Monitor. Due to personal issues he was unable to continue his work with the Cultural Resources Team. With the agreement of Vicki Loucks, Brad Vierra, Bruce Masse, and Santa Clara Pueblo officials, I became the interim monitor until a replacement for Mr. Baca was found. At the end of August and not having found a suitable replacement, Santa Clara Pueblo and LANL selected me to continue as the Santa Clara tribal monitor for the duration of the C&T Project.

Through the course of my employment at LANL, I observed and excavated many sites throughout Cabra and Rendija canyons. These sites included prehistoric fieldhouses, artifact scatters, agricultural plots, water diversion formations, tipi/wikiup rings, traditional cultural properties (observed but not excavated), and the historic Serna Homestead (Figure 85.7). As an undergraduate student, I excavated at each site. It was a new and gratifying experience. I learned so much about archaeology through my employment at LANL. I learned about stratigraphic distinctions, recording excavation unit elevations, measurements, and artifacts, and sweeping the site for clues to its history and its inhabitants such as pollen samples, dendrochronology, charcoal/macrobotanical samples, flotation samples, and the condition of artifacts as they come out of the site. I definitely learned that there is more to archaeology than just digging. It taught me a lot more about my culture, my ancestors, and where we came from. Because one of my majors is computer science, I was given the opportunity to work with the GPS unit. For a project for Santa Clara Pueblo, Brian Harmon, a full time archaeological contractor with LANL, mentored me in plotting out a Traditional Cultural Property (TCP) and then I aided him in superimposing the GPS points onto a topographical map. The invaluable experience and knowledge that I have developed through my time working here will greatly help me to achieve my goals and to better help my people.

Figure 85.7. Jeremy Yepa excavating a fieldhouse in Rendija Canyon.

In addition to my duties as an undergraduate student employee, I was also the tribal monitor for Santa Clara Pueblo. I was trained on NAGPRA guidelines and other issues that are currently a concern for DOE, LANL, and Santa Clara and San Ildefonso Pueblos. I also obtained on the job training on excavating, recording data in the field, screening artifacts (Figure 85.8), and site profiling. As monitor, my duties were screening buckets excavated from the site and identifying NAGPRA defined funerary and sacred artifacts, as well as, non-NAGPRA related artifacts.

Figure 85.8. Jeremy Yepa screening excavation fill at a site in Rendija Canyon.

As a LANL liaison to Santa Clara and DOE, I coordinated negotiations between DOE, LANL, the Santa Clara Tribal Council, and the Santa Clara Environmental Department that resulted with the Santa Clara Pueblo being able to claim two sites located in Rendija Canyon as Traditional Cultural Properties (TCPs). By claiming a site a TCP, the site will be protected from development and Pueblo members will be able to access the site once the Los Alamos County takes over. I also advised the tribe to register the site for the New Mexico Historic Preservation Department's Cultural Properties Review. By being on the list, the tribe can receive assistance for protecting, restoring, and cleanup of the site. The negotiations happened over several meetings that occurred in Santa Clara Pueblo and at LANL with myself, Brad Vierra, Bruce Masse, Vicki Loucks, members of the Santa Clara Tribal Council, and the Santa Clara Environmental Department. In addition to the consultation meetings we had with the tribe, we also provided several tours for Tribal Council members, elders, and department administrators of the sites in the Rendija Canyon. I feel, in addition to the training I received with LANL, that I also have had beneficial experience dealing with my pueblo's Environmental Department, Office of Land Claims and the Tribal Council. It will set up a basis for future employment or consultation opportunities. This experience will directly help me achieve my goals of assisting my tribe to better ourselves.

Overall, the project, in my opinion, was successful. I think that it is a model for future relations between tribes and the government. This project sets precedence for future attempts at a working relationship between these two entities. The bond that was once nonexistent now extends strong from the accord pueblos to the lab, strengthening as we move forward. However, I think that involving the youth, in addition to the elders and tribal representatives of the tribes, may be even more beneficial to the tribes and their futures. Decisions cannot be made without knowing the past. It is imperative that the youth, our future leaders, learn where we come from and who we are so that they are better prepared to lead us in the right direction. It would also be more beneficial to the tribe to involve the whole community by offering presentations at centralized community centers of what is being done. In the end, it was a rewarding experience. I learned the various aspects of archaeology, more history of my people, and helped my pueblo.

STATEMENT OF AARON GONZALES – PUEBLO OF SAN ILDEFONSO

My name is Aaron Gonzales; I am one of two Tribal Monitors from San Ildefonso Pueblo for the Los Alamos National Laboratory's (LANL) Land Conveyance and Transfer Project (Figure 85.9). I am the San Ildefonso Tribal Sheriff's assistant and a member of the Tribal council as well. I was born and raised at the Pueblo. I have been working for LANL, monitoring the archaeological excavations that are part of the C&T Project since May 2002. It has been a great honor to participate in the consultation process with LANL. In addition to being a great learning experience, I feel that having tribal monitors work with archaeologists on their projects is something that is long overdue. Only recently has San Ildefonso been invited to participate actively with the DOE and LANL. We hope that the C&T Project will be a stepping stone to a better working relationship with the Pueblo of San Ildefonso as well as a model for future projects.

Traditionally, the people of San Ildefonso have not condoned excavations of any ancestral sites situated on tribal lands. However, we are excited to have an opportunity to share our perspectives about culturally significant sites situated on LANL lands with archaeologists and other LANL and DOE officials after all this time. Many sites, situated on LANL property, have been excavated since the inception of both entities. To my knowledge, some of these excavations have not been properly documented, thus presenting the Pueblo of San Ildefonso with many unanswered questions regarding where some cultural, ceremonial, and human remains originated.

I feel that this project has been a huge step for LANL in the sense that it is finally seeking the advice from the Native People who once called the Pajarito Plateau home. We no longer reside on the plateau, but our spiritual ties will be with us forever. I hope that this project is only a stepping-stone to a good working relationship with our tribe for the future. There are a lot of other archaeological sites on Laboratory property. As Tribal Monitors, I hope we will be asked to help or give guidance to LANL when the need arises. As long as there are sites being disturbed on LANL land, there will most likely be NAGPRA issues. I hope that DOE and LANL will work with San Ildefonso Pueblo to create a "NAGPRA Excavation/Testing Agreement" where monitors from the San Ildefonso Pueblo will observe and give advice during any future archeological excavations. As a monitor and tribal official, I feel that the tribe has much to learn from DOE/LANL, and vice versa, if only we are all given the opportunity.

Figure 85.9. Aaron Gonzales and Tim Martinez, San Ildefonso Tribal Monitors.

As a Tribal monitor for San Ildefonso Pueblo, I have come to realize that while we do not condone the excavations of any ancestral site, the C&T excavations had to occur in accordance with federal law. I feel that the project has opened a lot of doors for the Pueblo of San Ildefonso and is the first to be referred to the Pueblo. The Pueblo had a impact on "WHAT" was excavated, and most importantly "HOW" sites were excavated. Although LANL is one of our closest neighbors, the dialogue between our communities has been difficult and sometimes questionable. I feel that C&T marked the beginning of a great and positive relationship between our two entities.

I have expressed several concerns, questions, and comments regarding the Draft Comprehensive Agreement. Since then, we had several meetings about Tim Martinez's and my concerns to correct or adjust the 2002 Draft Comprehensive Agreement. I feel that this document should remain a draft so that it can be open to modification if the need arises. During the 2003 field season, we did not encounter any NAGPRA related items, so it was not necessary to consult the agreement or follow the protocol established in the 2002 document. Several Jicarilla Apache tribal elders visited the tipi ring sites. The tribal elders were able to see their ancestral site and provide us with some information about the kinds of things we might expect to find. We also had several site visits by members of San Ildefonso and Santa Clara Pueblos.

A monitor's job description is detailed in the Comprehensive Agreement between DOE/LANL and San Ildefonso Pueblo (see Chapter 72, Volume 3), and was a great learning experience. Not only was I a monitor, but I was also given the opportunity to be an active member of the field and laboratory crews and I am grateful for that (Figure 85.10). I helped with screening for artifacts, washed artifacts and processed flotation samples, and in early 2004 I began illustrating artifacts we found during the C&T Project. Examples of my illustrations are included in Volumes 2 and 3. These illustrations took a considerable amount of time and I took great pride in doing them.

Figure 85.10. Aaron Gonzales, processing flotation samples.

I have learned a lot about what is out there on our ancestral lands and from now on, I will look at things differently. I now know about rock alignments, one- to three-room structures/fieldhouses, grid gardens, artifact scatters, and other features and artifacts. Throughout this project, I have seen things and been a part of things I never would have known about otherwise. I wish that more of the people from San Ildefonso could be given the same opportunities as I have had.

There are three highlights from my time here at LANL with the Cultural Resources Team. One of the highlights was the trip the Trails Assessment Working group took to Mortandad Cave Kiva. I have lived in northern New Mexico all my life and have sat on the San Ildefonso side of the fence facing Mortandad Cave Kiva many times, but I had never been across the fence because of all the 'No Trespassing' signs. To some of the people who came to hike the Mortandad trail it was just a little trip we took, but to me it was something more and I will always remember it.

The second highlight was when I visited Nake'muu. Just to be there at the site and to know that it is still right there, smack in the middle of LANL is just amazing. There must be some strong spirits there. A lot of times when I see places like that, I contemplate things like, what is in store for the rest of us? What is our mission in life? Why did this place last for so long? My life is only a passing wind to a place like that. It was there before my time and it will be there long after I am gone. If only I can make such a lasting impression on this world.

The third highlight of my time here at LANL was the repatriation of the remains and sacred objects that had been removed from their original resting places. I am very proud to have been a part of the repatriation.

Finally, I am proud of the artifact illustrations and other designs I have done during the C&T Project. I feel that I have made a small, but lasting contribution to the project. I come from a long line of artists and I have them to thank for my talent.

I hope that the C&T project will just be the beginning of a long relationship between LANL/DOE and San Ildefonso. I also hope that if any other projects arise, then LANL would first consult with San Ildefonso and other affiliated Pueblos. I feel that too many years and too many decisions have been made without consulting with the Pueblo people who were on these lands first.

CHAPTER 86
RESEARCH QUESTIONS AND CONCLUSIONS

Bradley J. Vierra

INTRODUCTION

Approximately 10,000 years of human occupation are represented on the Pajarito Plateau. This includes the initial use of the area by Clovis hunter-gatherers and, more recently, the nuclear research conducted by the Manhattan Project. During this long history, the plateau has witnessed various periods of sporadic and intense occupation. Most notable of these are the Coalition and Classic periods (ca. AD 1200–1600), during which many of the archaeological sites on the plateau were constructed, occupied, and later abandoned. Nonetheless, the region was also visited on a seasonal basis by Archaic foragers, and groups of Navajos and Apaches. But it was not until the turn of the 20th century that the plateau would again witness a return to more permanent residences with Homestead cabins and the founding of Los Alamos National Laboratory (LANL).

Although the plateau has witnessed almost 100 years of archaeological research, very little of this work has been published in synthetic reports. Most notable of these is the work of Hewett and Wilson at the large Classic period sites of Otowi and Tsirege (Hewett 1906, 1938; Wilson 1916a, 1916b, 1918a, 1918b). Not until the 1950s to 1970s would there be a resurgence in the excavation of sites on the plateau by Worman, Steen, and the Los Alamos Archaeological Society; however, little of this work has been fully published (Fretwell 1954, 1959; Maxon 1969; Poore 1981; Steen 1974, 1977, 1982; Worman 1967; Worman and Steen 1978; Young 1954). More recently, three major survey projects have been conducted on the plateau. The Pajarito Archaeological Research Project (PARP) (Hill and Trierweiler 1986; Hill et al. 1996), the Bandelier Archaeological Survey (BAS) (Powers and Orcutt 1999a, 1999b), and the Land Conveyance and Transfer (C&T) Project (Hoagland et al. 2000). In the latter two cases, detailed reports presenting the results of these surveys were completed. Reports were also done for small-scale excavations conducted by Washington State University in conjunction with the BAS Project (Kohler 1989, 1990; Kohler and Linse 1993; Kohler and Root 1992b). However, only a series of theses and dissertations and a single summary article were ever written for the PARP. All of this underscores the general lack of data currently available on the archaeology of the Pajarito Plateau.

A total of 39 archaeological sites were excavated as part of the Data Recovery Program for the C&T Project. A series of research contexts have already been proposed in the Cultural Resource Management Plan for Los Alamos National Laboratory and provided in the project data recovery plan (Vierra et al. 2002; Vierra and Schmidt 2006). These contexts consist of chronometrics, geoarchaeology, paleoenvironment, land-use, community and site organization, subsistence and seasonality, and technology, production, and exchange. These research domains provide the framework for identifying specific research questions that can be used to help determine the potential eligibility of sites for inclusion to the National Register of Historic Places. Here, they provide a research design to guide the excavation and analysis of data obtained from the sites located within the C&T Project area. This chapter addresses the results of the project excavations in respect to a series of detailed research questions that were provided in the original data recovery plan (Vierra et al. 2002).

CHRONOMETRIC DATING RESEARCH QUESTIONS

1. **What period do the sites date to, and is there evidence of multiple occupational episodes?**

Harmon and Vierra (Chapter 69, Volume 3) reviewed the chronometric information on the excavated sites and presented a coherent sequence for these. Four sites were assigned to the Archaic period: LA 85859, LA 99396, LA 99397, and Area 8 at LA 12587. Three charcoal dates were submitted from the lower levels of LA 85859 providing a calibrated intercept range from 5300 to 4860 BC. This site presumably dates to the Early Archaic period. LA 99396 and LA 99397 can be tentatively assigned to the Middle to Late Archaic period. The Archaic component consists of a surface lithic scatter with possible Middle to Late Archaic points. Obsidian hydration dates indicate a possible Middle to Late Archaic period occupation. Lastly, LA 99397 is a surface scatter with subsurface deposits. Two charcoal dates from the upper levels provided calibrated intercepts of 380 and 160 BC, with obsidian hydration dates ranging from Middle- to-Late Archaic. A single possible Late Archaic site was identified in the White Rock Tract. LA 12587 (Area 8) contains Late Archaic projectile points. Late Archaic points were also recovered at several multi-component surface scatters: LA 86533, LA 86637, and LA 139418.

Table 86.1 summarizes the Ancestral Pueblo temporal sequence for the sites. It has been separated into nine categories: Indeterminate Pueblo, Indeterminate Coalition, Coalition 1, Coalition 2, Coalition2/Classic 1, Indeterminate Classic, and Classic 1, Classic 2, and Classic 3 based on the chronometric and ceramic dates. LA 4618 and LA 4619 were not excavated during the C&T Project, but are included since they are located near the White Rock Tract on Mesita del Buey (Hoagland 2007; Schmidt 2006). The Coalition period sequence includes both roomblocks and fieldhouses, whereas the Classic period sequence solely includes fieldhouses. The temporal sequence for the Coalition roomblock sites consists of LA 86534, LA 135290, LA 4618, LA 12587, and LA 4619.

Architectural remodeling was solely identified at the Coalition period roomblock site of LA 135290. At least three occupation episodes were identified, including multiple floors and features. One hearth was remodeled at LA 86534 and consisted of two use-events. However, three separate components were found at LA 12587. The first component consists of a Late Coalition roomblock, the second component is an unfinished linear roomblock that also dates to the Late Coalition period, and the third component is a Classic period fieldhouse with multiple agricultural features. In addition, at least one fieldhouse in Rendija Canyon may have been reused. The hearth at LA 127635 was radiocarbon dated to the 13th century, however, the ceramic assemblage appears to represent a later 14th century occupation.

Table 86.1. Ancestral Pueblo site temporal sequence from the C&T Project.

Ind. Pueblo	Ind. Coalition	Coalition 1	Coalition 2	Coalition/ Classic	Ind. Classic	Classic 1	Classic 2	Classic 3
86531	85404+?	85417	4618	4619	85861	85404	70025	15116
127633?	86606	86533-	12587		127625	85411	85411?	85403
	86607	86534	85861+		128803	85413	86637	85408
		99396			139418	85414		86605
		127635+			141505	85867		86606?
		135290				127631		87430
						127635		110126
						135291		110130
								127627?
								127634
								128804
								128805
								135292

In addition to the prehistoric sites, three historic sites were also excavated. LA 85864 and LA 85869 are turn-of-the-20th-century Jicarilla Apache tipi ring sites. Five radiocarbon samples were submitted from the latter site; however, only one returned a date that is clearly associated with the occupation. The 260±40 BP date has several calibrated two-sigma ranges, starting at AD 1520 and ending at AD 1950. A single micaceous sherd did yield a luminescence date of AD 1859±13. The historic bead, metal, and ceramic artifacts also indicate a late 19th or early 20th century occupation at the site.

LA 85407 is the Serna Homestead site in Rendija Canyon. Eight wood construction elements from the cabin and corral were submitted to the Dendrochronology Laboratory at the University of Arizona for tree-ring dating. All the samples were ponderosa pine, with five of the eight yielding dates. However, none provided cutting dates due to the poor preservation of the outside rings, leading to a couple of interpretations. The simplest is that the entire structure was built sometime after 1900, based on the 1900+vv date from Room 2. The historic metal and glass artifacts indicate a late 19th to early 20th century occupation and the ceramics a post-1913 date. This corresponds with oral interviews that indicate the homestead was occupied in the early 1900s.

2. **Do the recovered projectile points resemble types described for the Oshara Tradition? If so, do the associated chronometric dates place them within the time range as defined by Irwin-Williams?**

Very few Archaic projectile points were recovered during the C&T Project excavations. Most of these were found in surface contexts, with no clearly associated chronometric dates. They include Middle and Late Archaic points, with one San Jose point recovered from a Classic period fieldhouse (LA 85411). Figures 86.1 through 86.3 provide examples of Early, Middle and Late Archaic point types from the area.

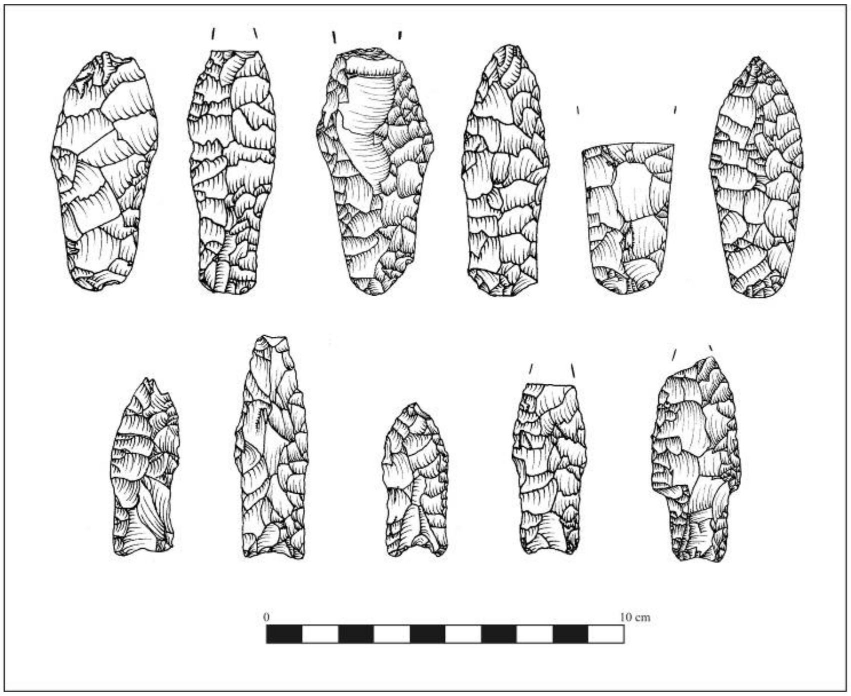


Figure 86.1. Early Archaic points (Jay: upper; Bajada: lower).

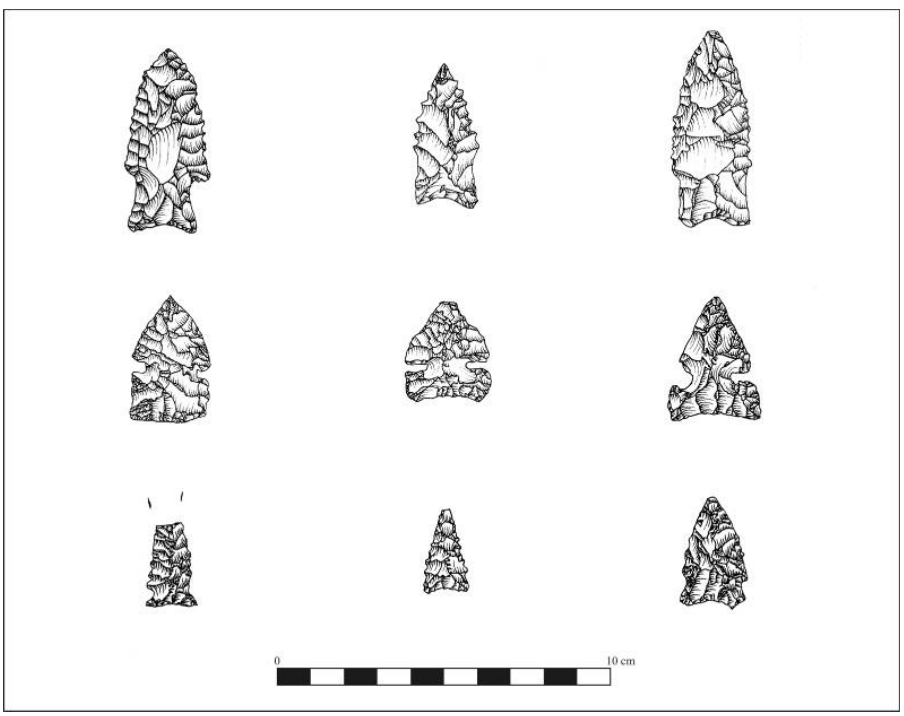


Figure 86.2. Middle and Late Archaic points (San Jose: upper; Large side-notched: middle; Armijo: lower).

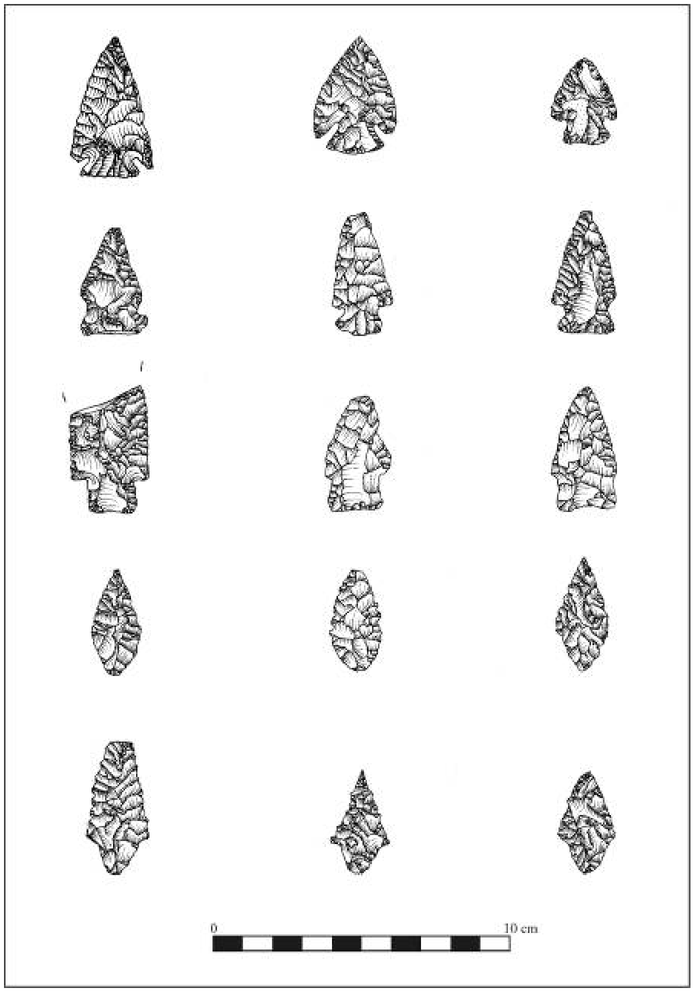


Figure 86.3. Late Archaic points (top to bottom: corner-notched, side-notched, stemmed, leaf-shaped, and contracting stem).

3. **How do the projectile points compare in morphology and temporal range to the sequence defined by Turnbow (1997)?**

There is no temporal information to clarify the relative ages of the projectile point sequence. However, the point types illustrated in Figures 86.1 through 86.3 do fit the variability described by Turnbow (1997). This includes Jay, Bajada, San Jose, large side-notched points (Sudden, Northern or San Rafael types), Armijo, and five other Late Archaic point types. The latter consists of corner-notched, side-notched, stemmed, leaf-shaped, and contracting stem points.

4. **Given the problems with the obsidian hydration dating of Early and Middle Archaic obsidian artifacts, do projectile points from LA 85859 and LA 99396 also follow the pattern of dating to the Late Archaic? Or, were some of these point types actually used (reused) during later times?**

Harmon et al. (Chapter 71, Volume 3) discussed the problems with obsidian hydration dating for this project. Most of the artifacts recovered from both Archaic and Ancestral Pueblo contexts actually dated to the Archaic period. It therefore seems likely that Archaic surface scatters were used as a source of raw materials by the later occupants of the plateau. There were no Early Archaic points recovered from LA 85859, and several possible Middle to Late Archaic point bases were found at LA 99396. Obsidian artifacts from LA 85859 provided a date range of circa 6000 to 2000 BC, with a later surface component dating to the AD period, whereas, LA 99396 provides an unbroken sequence of obsidian dates from about 6000 BC to the first few centuries AD. This indicates that the sites may represent multiple occupation episodes.

Given that obsidian debitage appears to have been scavenged and reused by the later Pueblo site occupants, the question is, did they also scavenge Archaic projectile points. Certainly, Archaic-style dart points were recovered from Ancestral Pueblo contexts. As previously noted, this included a San Jose point from a Classic period fieldhouse and other possible Late Archaic points from Coalition period contexts. However, it is unclear as to whether these latter points actually date to the Archaic or represent Pueblo lance or dart points. A pilot study was conducted on four arrow points and four lance/dart points recovered from a Late Coalition roomblock site (LA 4618) (Figure 86.4). The points were submitted for obsidian hydration dating and the results are presented in Table 86.2. One arrow point could not be dated (Field Specimen [FS] 348), but the remaining six points exhibit hydration rims ranging from 2 to 4 microns, with one outlier of about 7 microns. The larger points do exhibit slightly thicker rims (3.59 to 4.36) and the smaller points have thinner rims (1.94 to 2.13), however, the dates do overlap. Presumably these arrow and lance/dart points are roughly contemporaneous, versus the single dart point, which appears to be Archaic in age. This dart point also exhibits more resharpening than the other points. It therefore seems likely that at least some large points continued to be manufactured and used during the later Ceramic period.

Table 86.2. Obsidian hydration data for the projectile points from LA 4618.

FS #	Type	Rim (*um*)	Age	*sd*
8	Lance/dart	3.59	AD 1650	17
31	Lance/dart	4.36	AD 1431	24
179	Lance/dart	3.71	AD 1619	18
282	Arrow	2.07	AD 1447	50
443	Arrow	1.94	AD 1547	43
466	Arrow	2.13	AD 1828	12
781	Lance/Dart	6.91	3258 BC	152

5. **Can obsidian hydration analysis distinguish between Archaic and later Ceramic period occupations (i.e., Coalition and Classic periods)?**

As previously noted, most of the obsidian artifacts recovered from Ceramic period occupations dated to the Archaic. Therefore, it is presumed that most of these were in fact scavenged from these older sites. Obsidian hydration dating did not clearly distinguish between Coalition and Classic period occupations.

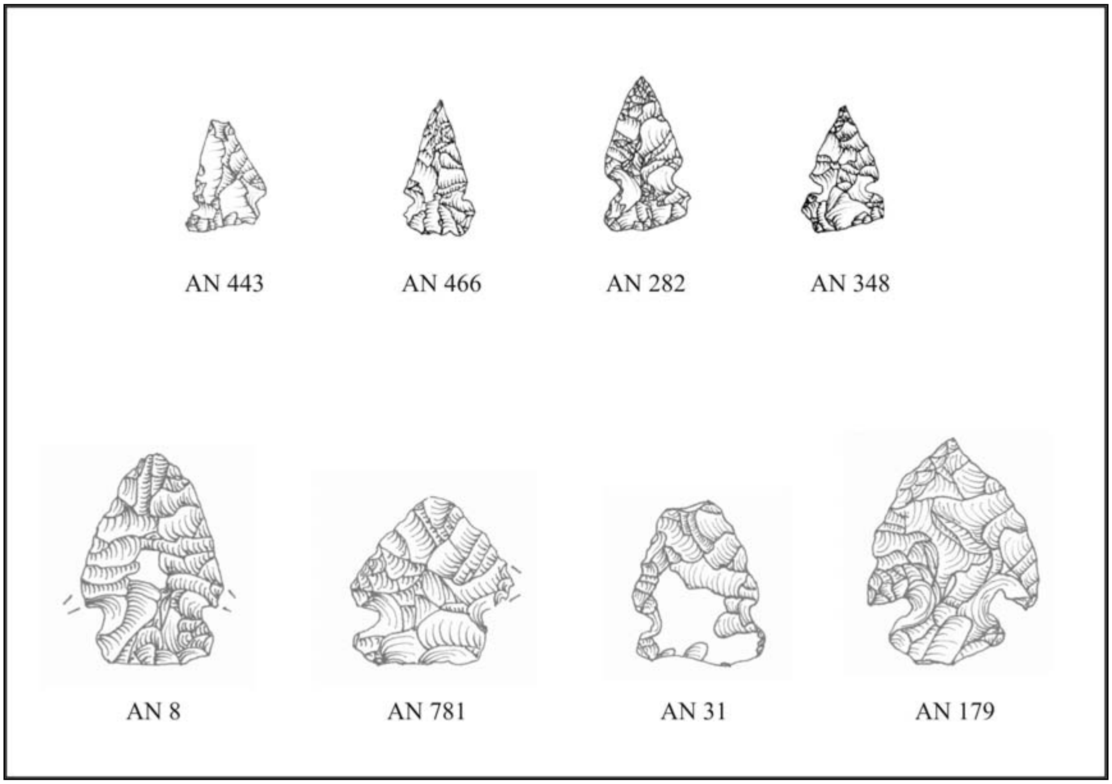


Figure 86.4. Arrow (top) and lance/dart (bottom) points from LA 4618.

6. **How do the ceramics compare with the type descriptions and date spans as provided by McKenna and Miles (1991)?**

Dean (Chapter 58, Volume 3) described Santa Fe Black-on-white as having relatively thin and straight vessel walls and being similar in shape and thickness to Kwahe'e Black-on-white. Pastes are often fairly dense, hard, and can be vitreous. They are usually very fine in texture and fracture along an even plane. Paste color is usually light gray to blue-gray. Surfaces are moderately to well polished, often slipped, and range from white, light-gray, greenish, to tan in color. Decorated surfaces are usually polished and often slipped. Bowls are by far the dominant vessel form in this type. Undecorated exterior bowl surfaces are often unslipped and unpolished and may occasionally display unobliterated coils, striation, or basket impressions. Tempering materials include finely crushed volcanic rock, fine sand, and, in some cases, sherd temper (Habicht-Mauche 1993; Stubbs and Stallings 1953).

Painted decorations are executed in organic pigment, which is sometimes faded and translucent. Paint color ranges from dark gray, bluish-black, to black. Rims are usually tapered and undecorated, while ticked rims, similar to those noted in contemporaneous pottery from regions on the Colorado Plateau, are extremely rare. In bowls, decoration is oriented in a band on the interior surfaces. Decoration consists of banded panels on bowl interiors and the upper portions of jars. These banded panels are often framed by a pair of single lines that are separated by very short spaces between the line and the top and bottom of the panels. Similar lines are also directly incorporated into the top and bottom edges of the panels. These designs are occasionally framed by a series of similar-sized parallel lines or a combination of thick and thin lines. Santa Fe Black-on-white is thought to have first been produced during the middle to late 1100s and continued to dominate assemblages until the middle 1300s and may occur as late as the early 1400s (Habicht-Mauche 1993; Stubbs and Stallings 1953; Sundt 1987). Indeed, a very small percentage of Santa Fe Black-on-white sherds are often represented at Early Classic period fieldhouse sites indicating that it could have been produced during the 14th century. In addition, although smeared-indented corrugated dominates the Coalition period utilityware assemblages, this pottery type also continues into the Early Classic period.

7. **What are the most temporally sensitive attributes for the ceramic types? Can Santa Fe Black-on-white be subdivided into earlier and later varieties?**

Dean's (Chapter 58, Volume 3) ceramic analysis indicates that Santa Fe Black-on-white does not appear to exhibit any significant stylistic changes during the Coalition period. However, there does appear to be some noteworthy long-term changes in temper and paste characteristics. Most of the Santa Fe Black-on-white ceramics appear to be tempered with a fine tuff, although LA 135290 exhibits more of a fine tuff with clay fragments. Nonetheless, this is a variable group that presumably reflects the use of multiple local sources. Miksa's (Chapter 59, Volume 3) petrographic analysis identified five temper groups: anthill sand, anthill/clay, granitic, Tuff 1, and Tuff 2. Anthill sand seems to be more prevalent in the earlier varieties of Santa Fe Black-on-white, while Tuff 2 is more prevalent in the later varieties. Tuff 2 is a natural occurring material that is highly variable and was probably used without alteration. In contrast, Tuff 1 has a more uniform grain sorting, with a finer grain size. It was used primarily for the production of biscuitwares and represents a more selective use of this tempering material. As Dean notes, these changes are first reflected in some of the pastes at the Late Coalition period site of LA 12587 and then are more dramatically represented at LA 4618. As a result, a shift to the use of crushed tuff temper, common during the Classic period, may have first occurred during the Late Coalition period. Therefore, changes in temper and paste appear to be more sensitive than stylistic changes for distinguishing earlier versus later varieties of Santa Fe Black-on-white.

8. **How do Santa Fe and Wiyo Black-on-white compare with similar types that were produced in the Rio Grande Valley (e.g., Pindi and Poge Black-on-white) and later biscuitware types from the plateau?**

Dean (Chapter 58, Volume 3) notes that the styles and manipulations noted in Santa Fe Black-on-white are similar to contemporary whitewares found on sites in other areas of the Rio Grande region including the Albuquerque area, Santa Domingo Basin, Puerco Valley, Pecos Valley, Santa Fe Valley, Tewa Basin, Chama Valley, and Galisteo Basin. Otherwise, any differences are primarily restricted to the use of local paste and tempering materials; however, unlike areas to the west, local Santa Fe Black-on-white ceramics are dominated by bowl vessel forms with the almost complete absence of kiva jars and ladles.

Some of the sherds classified as Santa Fe Black-on-white during the Early Classic period might actually be classified as Pindi Black-on-white. Dean (Chapter 58, Volume 3) states that this type may be distinguished from earlier varieties of Santa Fe Black-on-white by the presence of added vitric temper with distinctive paste and slip clays. Therefore, some of these sherds may have been imported from the nearby valley or represent a local variant of Santa Fe Black-on-white that was produced at the same time as the biscuitwares. In contrast to Santa Fe Black-on-white, the sample size for the later biscuitwares was too small for a detailed stylistic analysis.

9. How do the dated ceramic assemblages compare with Orcutt's seriation sequence?

Harmon and Vierra (Chapter 69, Volume 3) conducted a detailed chronological study of the project dating methods and associated ceramic types. A direct comparison with Orcutt's seriation sequence could not be conducted due to the small ceramic sample sizes. Nonetheless, their preliminary cluster analysis was able to distinguish six distinct ceramic type clusters: 1) Santa Fe Black-on-white and smeared-indented corrugated; 2) smeared plain corrugated; 3) undetermined biscuitware and plain gray; 4) mixed decorated wares and smeared-indented corrugated; 5) Biscuit B or Biscuit C and Sapawe Micaceous, and 6) Biscuit A and Sapawe Micaceous.

10. Is there a difference in accuracy between archaeomagnetic samples taken from tuff versus clay-lined features or burned soil?

All the archaeomagnetic samples were taken from burned adobe or clay-lined features. None were taken from burned tuff. However, a set of archaeomagnetic dates was obtained from two clay-lined features: Feature 20 at LA 12587 and Feature 2 at 127635. Neither of the samples from Feature 20 or Feature 2 returned exactly the same dates, although in both cases there is considerable overlap, particularly with the Wolfman Curve dates.

11. How do the results of the dendrochronology, radiocarbon, archaeomagnetic, obsidian hydration, and luminescence dating techniques compare with each other? Which are the more accurate techniques?

Harmon et al. (Chapter 71, Volume 3) conducted a detailed comparison of the chronometric methods used to date sites on the project. Since tree-ring samples were only obtained at the Serna Homestead, the other four dating techniques were contrasted in this study. In general, the obsidian hydration dates from Ancestral Pueblo sites are much earlier than expected, whereas, the Archaic site dates appear to be accurate, but very imprecise. As previously suggested, it may be that the later inhabitants were scavenging obsidian from these older surface sites.

The radiocarbon and archaeomagnetic dates are generally in agreement indicating that both methods are accurate. Of the two methods, archaeomagnetic dating is often more precise, with a resolution of 20 to 40 years possible for a given sample. Accelerator mass spectroscopy dating also appears to be more precise than the standard radiocarbon dating method. However, between about AD 1460 and AD 1640, the radiocarbon calibration curve flattens out. At two sigma, any radiocarbon date with an AD 1440 to 1600 intercept is almost indistinguishable from any other.

When luminescence dates are compared with other dating methods, they either agree with the other dates or are too early. A similar result was obtained by Dykeman et al. (2002), although late luminescence dates are not unknown (e.g., Ramenofsky and Feathers 2002). In summary, radiocarbon and archaeomagnetic dating techniques appear to be the most accurate and precise.

12. Which suite of historic artifacts provide the most accurate dating mechanism for the homestead site?

Haecker (Chapter 32, Volume 2) conducted the historic artifact analysis for the Serna Homestead. He considers that food cans appear to provide the most useful information for dating because they are more time sensitive due to changes in manufacturing techniques (i.e., lead solder to sanitary seal) and because of the encouragement of the Canning Trade Association to standardize can dimensions (i.e., height and diameter) during the circa 1900 to 1930 time period. In fact, this information could yield the year of introduction and sometimes the year of discontinuation for a particular can dimension. In addition, since canned foods are not curated items like tools, jewelry, or buttons, they can reflect the purchase, use, and discard sequence within a short period of time. Thus, an estimated date range of all cans found on a site would accurately reflect the time period of occupation.

GEOARCHAEOLOGY RESEARCH QUESTIONS

1. What is the geomorphic context of the sites?

Drakos and Reneau (Chapters 3 and 57, Volumes 1 and 3) provide a detailed description of the geomorphic context of each tract and excavated archaeological site. All the tracts are situated in differing topographic and geomorphic settings. Each context has a differing effect on the depositional history of the site area. The highest potential for site preservation exists along small drainage channels on mesas, on alluvial fans, and in canyon bottoms, where net deposition of alluvium and colluvium has occurred during the Holocene, and on the more stable parts of mesa tops where erosion has been minimal or where deposition of eolian sediment has occurred.

In canyon settings, early to middle Holocene deposits are less extensively preserved, except in some canyon bottoms, recording net erosion during the Holocene across most of the landscape. Late Pleistocene soils are truncated, indicating erosion some time during the Holocene, before deposition of the late Holocene colluvium. In Rendija Canyon, the development of shallow hillslope drainages and their subsequent filling is recorded by the ca 1 to 2 ka and ca 6 to 7 ka swale fill deposits. Valley bottoms preserve 1.5- to 2-m-thick mid to late Holocene colluvial deposits and an unknown thickness of underlying early Holocene and/or late Pleistocene deposits. Pre-Coalition period colluvial deposits are apparently preserved over a larger part of the Cañada del Buey landscape, but are apparently very poorly preserved in Pueblo Canyon within the TA-74 South Tract. Use of soil stratigraphic characteristics to differentiate between Coalition and Classic period sites in hillslope settings has not been as reliable as has been found for mesa top sites. This may indicate that the main pulse of recent colluvial deposition has occurred later than the AD 1250–1325 eolian event, likely after AD 1500.

2. Which sites have been affected by sediment deposition or erosion, and how have these processes affected the integrity of the sites?

Archaeological sites examined by Drakos and Reneau (Chapter 57, Volume 3) are situated on mesa top, colluvial slope, fluvial terrace, valley bottom, and ridge top settings. The record of eolian and colluvial deposition on mesa tops and within canyons indicates periods of widespread deposition during the latest Holocene (generally <1 ka deposits) and during the late Pleistocene to early Holocene. Middle Holocene (approximately 6 to 8 ka) and late Holocene (approximately 1 to 2 ka) colluvial deposits are less extensively preserved. Similarly, early Holocene (9 to 10 ka), middle Holocene (approximately 4 to 6 ka), and late Holocene (approximately 2 to 3 ka) eolian deposits are less extensively preserved than late Pleistocene and latest Holocene deposits.

Preliminary regional correlation of eolian stratigraphic units has been developed during investigation of sites located on mesa top settings in the Airport Tract and White Rock Tract, and by comparison with the stratigraphic record exposed in paleoseismic trenches on Pajarito Mesa. A post-Puebloan age eolian deposit is present in each of the mesa top locations; therefore Ancestral Pueblo sites are typically buried and are generally in good archaeological context. It is inferred that 15 to 20 cm of eolian deposition occurred some time after the Middle Coalition period but before the Classic period (i.e., ca AD 1250–1325), and in many cases Coalition and Classic period sites can be differentiated based on soil stratigraphic relationships. The timing of this eolian event corresponds to "The Great Drought" of AD 1276 to 1299 and a locally drier period from AD 1250 to 1255, inferred from tree ring data, and a major regional event associated with the abandonment of Mesa Verde (Rose et al. 1981; also see Chapter 7, Volume 1). A second, more recent eolian event occurred after abandonment of the Early Classic (?) period sites, resulting in deposition of an additional 5 to 10 cm of fine-grained sediment in mesa top settings since approximately AD 1500. Up to 4 cm of eolian deposition has occurred since the mid to late 1800s at one site.

The general processes of erosion versus deposition are best illustrated at the Rendija Canyon Archaic sites. Abandoned roomblock sites act as effective traps to catch soil. They are partially buried by colluvium that is in part derived by the erosion of the roomblock. In addition, the rubble mound acts to catch silty eolian sediment and short-distance colluvium. Whereas, the site area may have exhibited little deposition before the construction of the roomblock, soil deposition increases during the post-occupational period. This process provided an excellent niche for agriculture during the later Classic period.

In contrast, middle to late Holocene deposits are less extensively preserved. Therefore, the older Archaic sites in Rendija Canyon are primarily found in secondary context. For example, at LA 85859 the upper hillslope was eroded during the early to middle Holocene and then deposited in a concave part of the lower hillslope. Then, a second period of erosion likely occurred during the late Holocene, when the upper hillslope was stripped to bedrock and the middle Holocene soils on the lower slope were truncated. These soils were subsequently buried by a thin late Holocene colluvial deposit. Although artifacts were recovered from both the middle and late Holocene colluvium, the highest artifact concentration was located in the middle Holocene deposit, with artifacts present in the late Holocene deposit being supplied by bioturbation.

PALEOENVIRONMENTAL RESEARCH QUESTIONS

1. **What evidence do the tree-ring measurements, and the pollen and floral remains provide for past environmental conditions at the sites?**

Towner (Chapter 7, Volume 1) provides a detailed paleoclimate reconstruction based on the tree-ring sequence from the Jemez Mountains. This sequence is graphically illustrated in Figure 86.5. Agriculturalists colonized the plateau circa AD 1150 during a period of above average rainfall following the Chaco drought. This is followed by two droughts during the 13th century (including the Great Drought) and then a period of increased effective moisture during the 14th century. This period correlates with the Classic period occupation of the plateau. The 15th through 17th centuries are bounded by two droughts, with intervening above average rainfall. It is the megadrought of the 1580s that causes the eventual termination of year-round occupation of the Pajarito Plateau.

The two Middle Coalition period roomblocks (LA 86534 and LA 135290) date to circa AD 1160 to 1270. This time range is bounded by two periods of increased effective moisture with about 35 cm of rainfall, separated by a drought. The two Late Coalition period roomblocks (LA 4618 and 12587) were occupied circa AD 1275 to 1325, also during a period of above average rainfall with about 35 cm.

The 14th through 16th centuries were generally characterized by increased effective moisture (30-40 cm), with a drought circa AD 1420. The Classic period fieldhouses span this time period, although there does appear to be a bimodal distribution with most of the sites dating to earlier and later temporal segments. Smith's study (Chapter 63, Volume 3) does show a marked decrease in the amount of pollen present in the Early-Middle Classic period fieldhouses, which could reflect the early 15th century drought.

The Serna Homestead was occupied during a period of above average rainfall (35 to 40 cm) from circa AD 1910 to 1950. This would have been an excellent time for the rainfall farming of beans.

A pilot paleoenvironmental study was initiated by collecting pollen from geologic contexts, however, the study only met with limited success. That is, only 40 percent of the 41 total samples collected yielded sufficient pollen to describe the spectra. Smith (Chapter 6, Volume 1) identified four major trends in this dataset: 1) pollen concentrations drop dramatically from the A to B horizon and continue to decline with depth; 2) this decrease is in part due to increased amounts of degraded pollen that is unidentifiable; 3) pine pollen decreases with depth; and 4) cheno-am pollen tends to increase with depth. Otherwise, the archaeological pollen indicates an environment similar to today during the Ancestral Pueblo and Historic periods; however, these data do not provide sufficient detail to allow time-specific descriptions of potential changes in vegetation structure. For example, was it open or park-like with more grass, closed, or deforested?

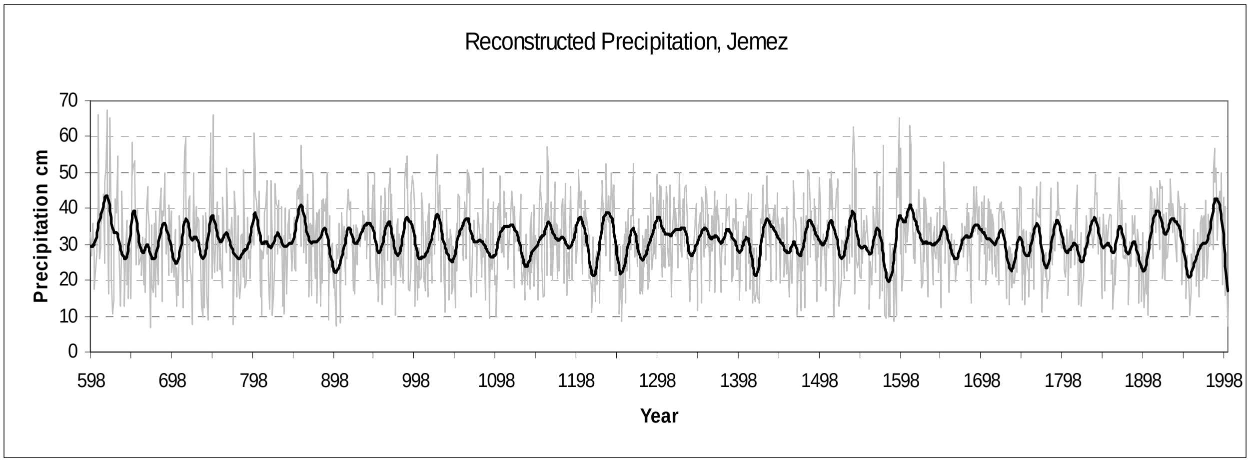


Figure 86.5. Reconstructed precipitation for the Jemez Mountains tree-ring chronology.

McBride's (Chapter 62, Volume 3) fuel wood study indicated that local materials were collected during the Coalition and Classic periods, consisting mostly of piñon, juniper, and ponderosa pine. Although the macrobotanical evidence does not support widespread deforestation, there are indications that some lower-elevation conifers (e.g., juniper) may have been depleted and subsequently replaced with the use of higher-elevation woods during the Late Coalition period.

2. **Are there differences between the Early and Late Archaic period sites versus the Ancestral Pueblo and Historic periods that could reflect changes in past vegetation communities?**

The pollen record provides some excellent baseline environmental data for understanding the changing vegetation setting during the Archaic. Recent studies by Scott Anderson and his students (Chapter 5, Volume 1; Anderson et al. 2007) of pollen cores in the Jemez Mountains indicate that the Late Paleoindian and Early Archaic transition is separated by a period of decreased effective moisture when the Chihuahueños bog had dried up from circa 8000 to 6500 BP. This obviously had a significant effect on the Early Archaic foragers in the area, with their settlement system shifting to a north-south pattern within the northern Rio Grande Valley (Vierra et al. 2005; Chapter 74, Volume 4).

Then during the subsequent Middle Archaic period (6000 to 4000 BP), there is evidence for moister conditions and the expansion of piñon-juniper woodlands in the northern Rio Grande Valley. This evidence is represented by increased percentages of piñon pollen at circa 4500 BP at Chihuahueños Bog, 4300 BP at Alamo Bog, and 4000 to 3500 at Alta Alamo Bog (Chapter 5, Volume 1; Anderson et al. 2007; Brunner-Jass 1999; Stearns 1981). It may be during the Middle Archaic that fall hunts in the Rio Grande Valley were becoming less successful, so these hunter-gatherers would have shifted their residence to the uplands where they could collect piñon nuts and hunt deer (Vierra 2005a; Chapter 75, Volume 4).

The initial use of maize agriculture is dated to about 3000 BP during a period of increased effective moisture (Smith and McFaul 1997; Vierra and Ford 2006). These moister conditions continue until about 2200 BP with the onset of drier conditions. The cyclical nature of the rainfall conditions during the subsequent time period has been described in the El Malpais data (Grissino-Mayer 1996). Late Archaic land-use appears to be characterized by a lowland/upland pattern within restricted areas of the Rio Grande Valley (Vierra 2003, Chapter 75, Volume 4; Vierra and Foxx 2002; Chapter 75, Volume 4).

As previously noted, the pollen record provides little detailed information on long-term structural changes in the local vegetation communities; however, the archaeobotanical evidence does indicate that the juniper population may have been depleted and replaced with the use of ponderosa pine from higher elevations during the Late Coalition period.

LAND-USE, COMMUNITY, AND SITE ORGANIZATION QUESTIONS

1. **Can site structure studies identify the internal organization of the Archaic campsites? If so, what evidence is there for identifying the occupying group size, structure, and site occupational history?**

The answer to this question appears to be no. Four sites were assigned to the Archaic period: LA 85859, LA 99396, LA 99397, and Area 8 at LA 12587. All of the Archaic sites are situated in secondary contexts. A spatial analysis of LA 99396 did identify two artifact clusters (Chapter 71, Volume 3); however, these appear to be the result of both natural and cultural factors. There is no difference in respect to lithic debitage between the two areas, but there are some minor differences in respect to chipped stone tools. That is, the northern cluster primarily contains bifaces and the southern cluster contains a variety of tools. This may in part reflect a mixture of Archaic and Ceramic period components in the northern cluster versus mostly Archaic material in the southern cluster.

2. **Is there any evidence of structures or features on the Archaic campsites?**

No Archaic age features were identified during the excavations.

3. **How do these Archaic campsites contrast with the Late Archaic winter habitation site excavated near San Ildefonso Pueblo?**

Vierra (2003, Chapter 75, Volume 4) did a comparative analysis of Late Archaic lithic assemblages across the various vegetation zones. These zones covered the elevational gradient from river valley to piñon-juniper to ponderosa pine to mixed conifer. In doing so, he determined that these debitage assemblages are all linked by reduction tactic and obsidian procurement patterns. That is, lowland habitation sites are characterized by an emphasis on core reduction while upland campsites are characterized by biface production. Otherwise, obsidian dominated all the lithic assemblages, with sites situated in the lowland juniper-savanna and nearby upland piñon-juniper communities also containing a small amount of material derived from local river gravels.

LA 85859 is an Early Archaic site that emphasizes the reduction of bifacial cores and biface blanks using obsidian derived from the nearby caldera. The Late Archaic site of LA 12587

(Area 8) is also dominated by the production/maintenance of bifacial tools. However, the Middle to Late Archaic sites of LA 99396 and LA 99397 are characterized by a mix of core reduction and biface production/maintenance activities. The implication of Vierra's (2003, Chapter 75, Volume 4) argument was that sites containing a mix of core and biface flakes presumably reflect habitation sites versus temporary campsites with mostly biface flakes. If so, LA 85859 and LA 12587 (Area 8) reflect temporary campsites, whereas LA 99396 and LA 99397 may be habitations. It is, however, unclear whether the Ceramic period component at LA 99396 is contributing to the increased amount of core reduction at this site.

4. What is the general layout of the Coalition period habitation sites?

Most Coalition period habitation sites are linear, north-south-oriented roomblocks that are two to three rooms deep, and have a single or multiple kivas located along the eastern side of the pueblo (Steen 1977, 1982; Worman 1967; Worman and Steen 1978) (Figure 86.6).

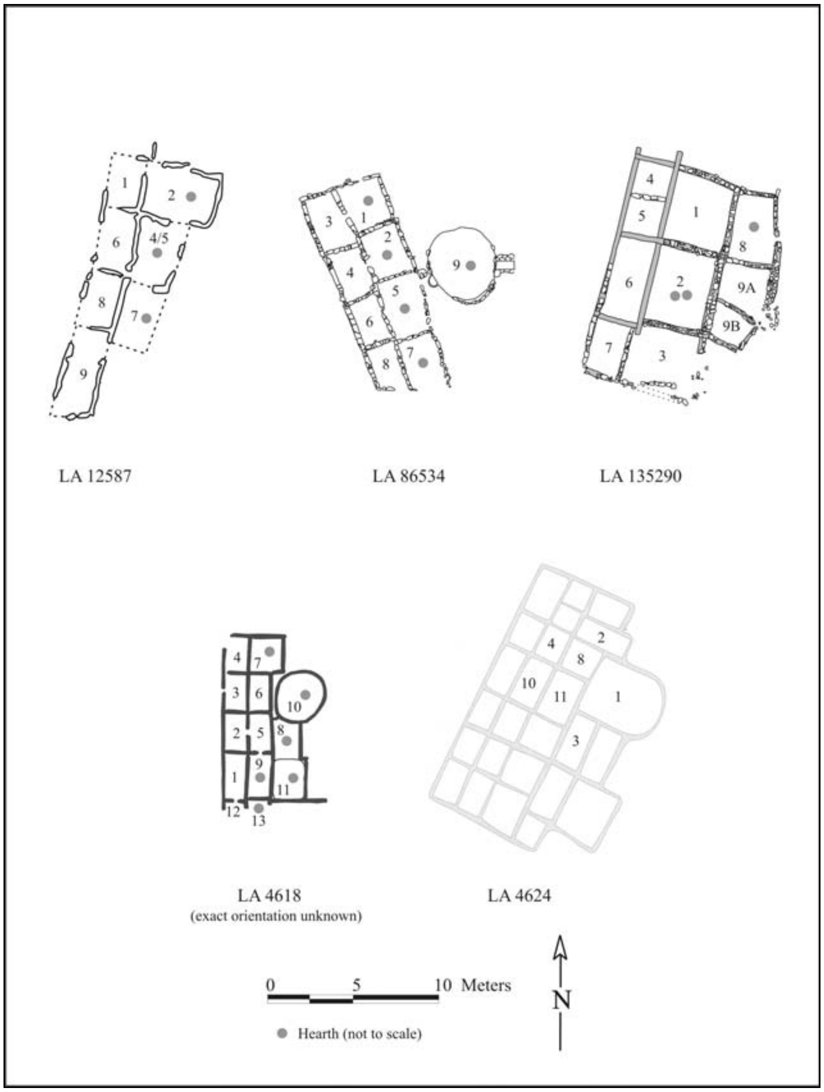


Figure 86.6. Roomblock ground plans.

The three Coalition roomblocks excavated during the C&T Project are quite similar (Figure 86.6). LA 12587, LA 86534, and LA 135290 are all composed of two linear sets of rooms (front and back); however, LA 135290 does contain three plaza-oriented rooms that could represent ramadas and not a fully enclosed space (Chapter 71, Volume 3). Of the three sites, only LA 86534 contains a kiva (Chapter 24, Volume 2). This makes it more similar to LA 4618 and LA 4624 where the roomblocks are three or more rows deep, including both circular and rectangular kivas (Schmidt 2006; Vierra et al. 2002). The roomblocks are generally oriented north-south, with three being slightly tilted towards the northeast and one to the northwest (LA 86534). The kivas are all situated along the east facing (front) of the roomblocks.

5. **Can habitation versus storage rooms be identified and are there kivas (or communal rooms) present?**

Coalition period habitation rooms typically contain hearths and are located along the eastern (front) side of the pueblo, while storage rooms are typically located on the west (rear) side of the pueblo and may contain storage or milling bins. Communal rooms (i.e., kivas) are generally larger in size than the habitation and storage rooms and can be round, square, or D-shaped. In addition, the habitation rooms also tend to be larger than the storage rooms.

Most of the front rooms at LA 12587, LA 86534, and LA 135290 contain hearths; whereas, only a single rear room at LA 86534 contained evidence of a milling bin. The architecture at LA 135290 did differ between front and back rooms, with the front rooms being constructed of masonry and the back rooms of adobe. The fact that the back rooms were consistently burned during the three occupations indicates that these were probably storage rooms that were being hardened to protect stored foods.

The pollen information as provided by Smith (Chapter 63, Volume 3) is variable by room location and site. For example, there is a greater diversity of plant pollen in the front rooms at LA 135290, with similar amounts of maize pollen in both front and back rooms. This would appear to support the contention of the front rooms being used as domestic space and the back rooms as storage. However, the pollen spectra are similar for both front and back rooms at LA 86534 and vary between front and back rooms at LA 12587. That is, the front rooms at LA 12587 contain relatively more maize and beeweed pollen while the back rooms contain more cheno-am, grass, sage, and pine pollen. Overall, cultigen abundance can be high in the front or back rooms; however, prickly pear pollen tends to be associated with the front rooms, with beeweed and cheno-am pollen usually being higher in back rooms.

The single kiva at LA 86534 is circular-shaped, with an east-oriented ventilator shaft, deflector, ash pit, hearth, and sipapu. It appears that the entrance was through the back wall into an adjacent room and not through the roof (Chapter 24, Volume 2). Maize, cholla, prickly pear, and sunflower pollen were all identified on the kiva floor.

A study by Harmon et al. (Chapter 71, Volume 3) indicates some important differences in room size and function for LA 4618, LA 86534, LA 12587, and LA 135290 (Figure 86.7). It appears that the sites without kivas tend to have larger rooms (both front and back); whereas, the sites with kivas have a large ceremonial room, but the other rooms tend to be smaller. Nonetheless, habitation rooms with hearths are generally larger than the rear storage rooms at all the sites. In addition, McBride (Chapter 62, Volume 3) notes that maize is more ubiquitous in samples from the non-kiva versus the sites with kivas. The occupation of these non-kiva sites may therefore have involved a greater emphasis on agriculture.

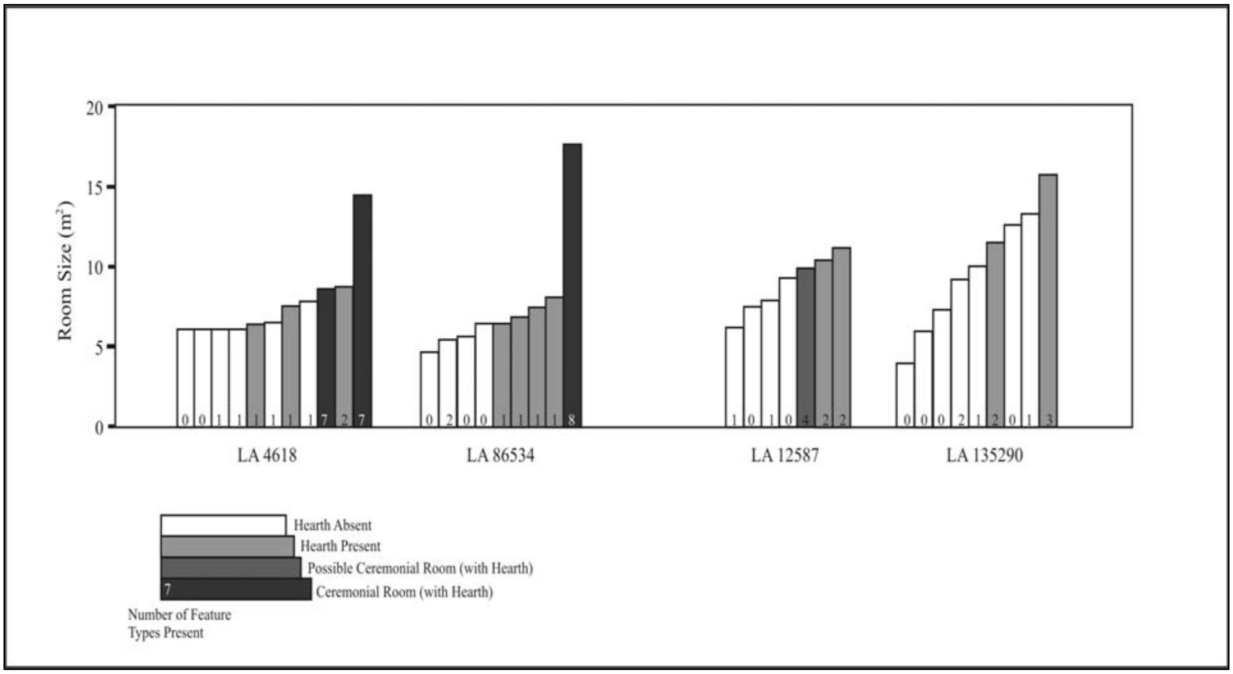


Figure 86.7. Room size at Coalition period roomblocks.

6. Is there an outside midden area located to the east of the roomblocks?

A light surface scatter of artifacts was identified to the east of the Middle Coalition roomblocks at LA 86534 and LA 135290, however, no clear evidence of a midden was identified. On the other hand, a 50-cm-thick midden deposit was exposed at the Late Coalition period site of LA 12587. It appears that this latter site was occupied for a longer period of time, with several burials being interred at this location.

7. Are there exterior activity areas present adjacent to the roomblocks?

There was no obvious evidence of an exterior activity area present adjacent to the roomblock at LA 86534. In contrast, the front rooms at LA 135290 may represent ramadas that could have been used for outside activities. In addition, there is a possible agricultural feature situated to the immediate east of the roomblock, but it is undetermined as to whether it is associated with the roomblock or a later occupation.

Although no clear activity areas were defined at LA 12587, an exterior cist was present along the east wall of the structure and a large tuff mortar was recovered from the back hoe excavations to the immediate east of the structure. The following charred botanical remains were identified from the contents of the cist: pigweed, sagebrush, saltbush/greasewood, goosefoot, cheno-ams, bugseed, unknown conifer, juniper, unidentified pine, piñon pine, ponderosa pine, prickly pear, cottonwood/willow, and maize.

8. What architectural style was used in the construction of the walls?

A variety of architectural styles were used in the construction of the walls at LA 12587, LA 86534, and LA 135290. As previously noted, the front rooms at LA 135290 were constructed of shaped and unshaped tuff block masonry and the back rooms of adobe. Given that the back room walls and floors were consistently burned, it appears that this area was used for storage. Nonetheless, the masonry walls also differed across the site. Some walls were multiple layers of tuff blocks with adobe mortar; whereas, other walls contain larger tuff blocks or upright blocks along the basal sections of the walls, with rows of smaller tuff blocks in the upper section. Lastly, it appears that the rear adobe walls were also capped with masonry.

A diversity of styles is also represented at LA 12587. These walls are built of shaped and unshaped tuff blocks, adobe mortar, and chinking stones. Additionally, dacite cobbles are occasionally used as masonry and one adobe block was encountered during excavation. Most basal courses consist of large tuff uprights set into adobe and/or sunk beneath the floor surface. In one wall these uprights are covered with multiple layers of adobe (turtlebacks) forming a thick platform upon which the overlying course is laid. In several walls the basal course consists of core and veneer segments separated by upright tuff blocks that are perpendicular to the length of the wall. The veneer consists of a thick layer of adobe set with small tuff stones, whereas, the core consists of sediment and rubble. The basal course of one wall consists of two parallel rows of upright tabular tuff blocks, with sediment and rubble probably filling the space between these uprights. The few upper courses still present consist of shaped and unshaped tuff blocks set in adobe and reinforced with chinking stones.

In contrast to the other two sites, the masonry at LA 86534 is consistently made of shaped and unshaped tuff blocks, which are a single course wide, and set into adobe mortar with chinking stones. The one difference is that the kiva was constructed by cutting a pit directly into the bedrock with some tuff block masonry being present at ground level.

9. What is the construction history of the roomblock? Is it similar to the plan used at Nake'muu?

Nake'muu is the only standing-walled pueblo at LANL. Although the final configuration of the site is a plaza-oriented pueblo, this was not the initial site layout. The initial site layout consisted of two separate sets of linear roomblocks with front and back rooms. In each case, the smaller back rooms were built as a single unit and then the larger front rooms bonded to this central wall. In this case, site construction was characterized by rows, rather than blocks of rooms (Nordby et al. 1998; 2003; Vierra and Foxx Chapter 75, Volume 4).

The construction history of LA 135290 follows a similar pattern. That is, the back rooms (Rooms 4 to 6) were constructed first and the front rooms (Rooms 1 and 2) bonded to the back room walls. Room 8 (plaza room) was also constructed during this time. This involved the initial construction of the north-south back wall, the addition of the east-west walls in the back rooms, followed by the central north-south wall and then the front rooms. Later, Room 3 (front) and Room 7 (back) were added on to the southern end of the roomblock and Room 9 as another plaza room. A similar pattern is represented at LA 86534. However, in this case it appears that the central north-south wall was built first, with the wall between back Rooms 6 and 8 built at the same time. The east-west walls in the back rooms were then built, followed by the back north-south wall. It then appears that the front rooms were abutted on to the central north-south wall. Again, a similar pattern is evident at LA 12587. Many of the room corners of the pueblo were in poor condition, thereby making bonding versus abutment determinations quite difficult. Nonetheless, it appears that the central north-south wall was built first and that the other front/back rooms added to it. It could not be determined whether the front or back rooms were the first to be added on to the central wall. Room 9 appears to represent a later back room addition to the south end of the pueblo.

10. Is there any evidence of remodeling in the roomblocks?

LA 135290 contains the greatest evidence of remodeling for the three excavated pueblos. At least three separate occupations are represented by multiple floors in the back rooms. In addition, the hearth in Room 8 was remodeled with two use-events, and there is a temporal sequence of three hearth features present in Room 2. Lastly, Rooms 3 (front), 7 (back), and 9 (plaza) reflect later additions to the southern end of pueblo. On the other hand, LA 86534 contains no evidence for the remodeling of any walls. The only evidence of remodeling is the hearth in Room 1 that represents two use-events. The nature of the standing architecture is difficult to determine given the poor condition of the walls at LA 12587; however, Room 9 (back) certainly represents a later addition to the southern end of the pueblo. Again, hearths in Rooms 4/5 and 7 appear to have been remodeled with two use-events.

11. Do the fieldhouses represent short-term residences, or is there any evidence that they might have been used as long-term habitations?

Harmon et al. (Chapter 71, Volume 3) describe the variability represented by the fieldhouses. In this chapter, Lockard notes that 20 of the Rendija Canyon fieldhouses consist of a single room, with only one having two rooms. Seventeen of the one-room fieldhouses are rectangular in form and one is circular. The form of the two remaining one-room fieldhouses could not be determined due to extensive disturbance of their wall foundations. The estimated masonry wall height for the fieldhouses ranges from 0.94 to 1.63 m, with an average of 1.17 m. Based on the burned remains from LA 85417, the upper structure was presumably built of wattle and daub. Only six of the fieldhouses contained hearths, whereas, both rooms at the two-room structure contained hearths. The number of artifacts recovered from the fieldhouses ranges from 9 to 772, with an average of 253. An above average number of artifacts were recovered from all six of the sites that contained hearths. On the other hand, sites without hearths contained fewer artifacts. This indicates that the sites with hearths were more intensively occupied than sites without hearths. The two-room structure (LA 85411) contains two rectangular-shaped rooms with hearths and an exterior wing wall that encloses a small plaza area. A total of about 430 artifacts were recovered during the site excavation, indicating that it represents one of the longer occupied structures.

12. How does the architecture at the fieldhouses compare to Coalition and Classic period roomblock sites?

Again, Lockard (Harmon et al., Chapter 71, Volume 3) provides information on fieldhouse architecture. The wall foundations of the Rendija Canyon fieldhouses are generally constructed of dacite cobbles and/or slabs. In the case of 17 of the fieldhouses, the entire wall masonry consists of only dacite cobbles. The remaining fieldhouses have masonry that consists of a mix of dacite cobbles, tuff cobbles, and/or shaped blocks. This generally depends on the availability of local building materials. As previously noted the estimated masonry wall height for the fieldhouses ranges from 0.94 to 1.63 m, with an average of 1.17 m. Based on the burned remains from LA 85417, the upper structure was presumably built of wattle and daub. Overall, the construction of these temporary structures is quite different from that exhibited at the Coalition and Classic period pueblos. The pueblos have full height masonry walls that are primarily composed of small to medium versus large tuff blocks at the Coalition and Classic period sites, respectively. Although a Classic period fieldhouse in the area of White Rock was observed with large shaped tuff block masonry, the other excavated Classic period fieldhouses in the White Rock Tract are composed of one to three courses of small- to medium-size tuff block masonry, including both shaped and unshaped pieces of building stone. This building material could have been scavenged from the nearby Coalition period site of LA 12587.

13. What construction techniques were used for agricultural features?

Three sets of Classic period grid gardens were excavated at LA 12587, LA 128803, and LA 139418 (Figure 86.8). Feature 22 at LA 12587 consists of three east-west-running berms of unshaped tuff blocks. The berms are 4 to 5 m long, 0.5 to 1.5 m wide, and 0.15 to 0.20 m high. A few rocks on the west side of the feature created a rough boundary that could form an "E" shape to the feature. If so, the feature is set at an oblique angle to the direction of the slope. The tuff blocks making up the feature are loosely placed together and stacked no more than three high. The A horizon (sandy loam) is somewhat deeper inside the feature, indicating that some of this dirt was intentionally placed inside the berms.

The grid garden at LA 128805 was constructed of local basalt cobbles. The feature consists of two U-shaped grids with a connecting wall that measures 4 by 6 m in size. The opening of each grid is perpendicular to the slope of the hill. Presumably the water drained over the side walls and was caught within the grid. It appears that the native clayey soil was removed from inside the grids and replaced with a more arable mixture of silty loam soil.

The grid garden at LA 139418 consists of a central grid with two partial grids on either side, measuring 3 by 7 m in size. The grids are situated parallel to the slope, allowing the water to flow into the open end of the northern grid. The basal portion of the north and south walls of the central grid were constructed with thin and wide pieces of tuff that were overlain with narrow and larger blocks. On the other hand, the east and west walls were built of a single course of tuff blocks that were mostly situated in an upright position. In contrast, the outside grids were constructed with a single course of shaped and unshaped tuff blocks. Again, the geomorphic study indicates that the grids were filled with a loose, unconsolidated silty loam with small rocks and gravel that appears to be culturally modified.

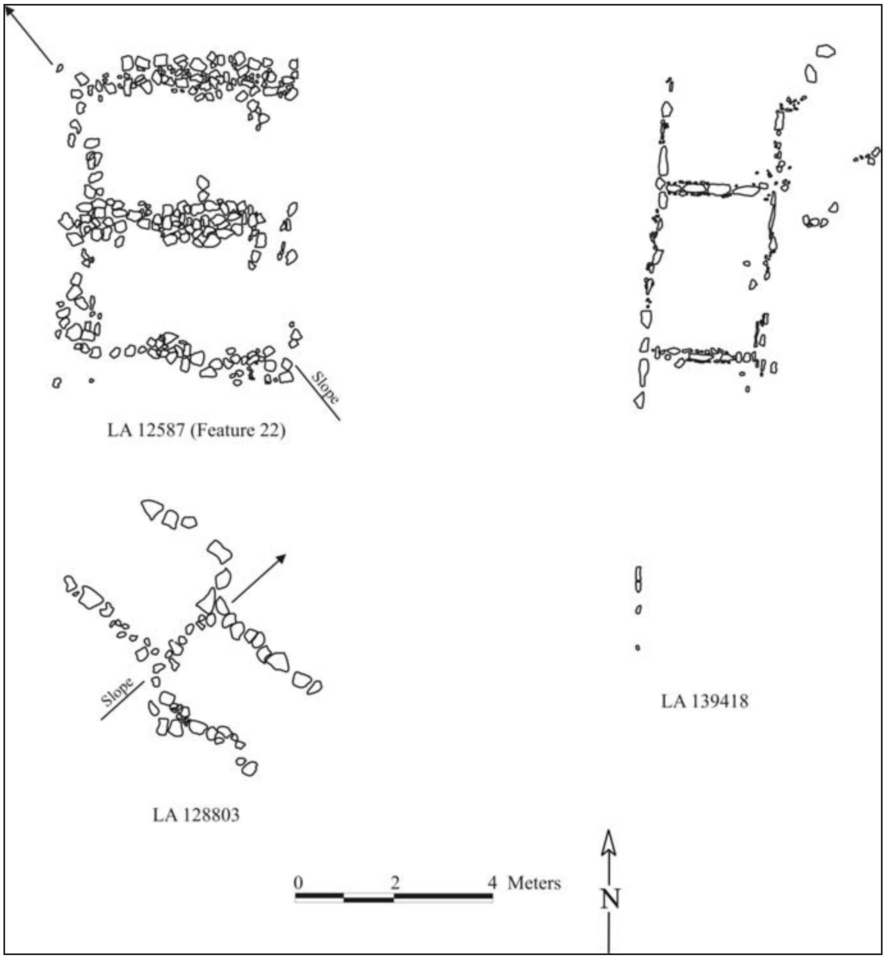


Figure 86.8. Grid gardens at LA 12587, LA 128803, and LA 139418.

14. Can site structure studies identify the internal organization of Ceramic period artifact scatters? If so, what evidence is there for identifying the occupying group size, structure, and site occupational history?

Multi-component lithic and ceramic scatters were present at LA 86637 and LA 127625 in the White Rock Tract. Both of these are situated in secondary context and contain potential Archaic and Ceramic period components. Therefore, the site lacks site structural integrity. LA 86533 and LA 139418 also contain Archaic and Ceramic period components on sites located in the Airport Tract. LA 86533 is a very diffuse artifact scatter; however, LA 139418 exhibited two primary surface artifact clusters in the eastern (Area 2) and southern (Area 3) sections of the site. Most of these artifacts included the by-products of lithic reduction activities, although a few ceramics were present. Nonetheless, the lithic assemblage was dominated by chalcedony core reduction activities, which are more likely to represent a Ceramic period versus Archaic period occupation. Detailed site structure information is lacking, but both Coalition and Classic period occupations appear to be represented.

15. Do LA 85864 and LA 85869 represent Athabaskan campsites?

Both sites appear to represent Jicarilla Apache tipi ring sites that were occupied circa the turn of the 20th century. LA 85864 contains a single rock ring and LA 85869 contains two rock rings. Small charcoal concentrations were present within both tipi rings at LA 85869, indicating the presence of a warming hearth, but no in situ fire. Artifacts recovered from LA 85869 include a .50-caliber unalloyed lead ball, *coscojos* fragments, possible cone tinkler fragments, a pony bead, and numerous seed beads. Seven micaceous sherds that represent two jars and one non-micaceous plainware sherd were also found. One of the vessels can be attributed to Taos, Picuris, or Jicarilla makers, whereas the other vessel was probably made by Jicarilla Apaches and is of the Cimarron Micaceous type. A single micaceous sherd was submitted for luminescence dating, providing a date of AD 1859±13. The lithic assemblage contains a mix of core reduction and tool production /maintenance activities, with an exterior lithic reduction area being located adjacent to one of the tipi rings. Otherwise, most of the worked obsidian appears to have been derived from the nearby Valle Grande caldera source.

16. Given that the Serna Homestead appears to have been sporadically occupied during the growing season, how does the organization of this site contrast with the Romero Homestead that was occupied continuously during the growing season?

Recent excavations were conducted at the McDougall Homestead site located adjacent to the Romero Homestead (McGehee et al. 2006). Comparisons will therefore be made between the McDougall and Serna Homesteads because both of the historic artifact collections were analyzed by Charles Haecker (Chapter 32, Volume 2; McGehee et al. 2006). Comparison of the Serna and McDougall homesteads indicate not-surprising idiosyncratic differences between the daily routines of the two households. As examples, the McDougall household indulged in alcoholic beverages and tobacco, whereas these indulgences were virtually absent at the Serna Homestead. Extensive food can refuse is present at the McDougall Homestead, but significantly fewer cans are present at the Serna Homestead. This difference is presumably due to the Sernas occupying their homestead on a seasonal basis, in contrast, to the McDougalls who lived on their homestead year-round. The McDougall residence also contains a basement where household items and food could have been stored. This too indicates a longer period of occupation. Otherwise, most of the artifact assemblage is similar between the two sites, with the exception of more canning jars being present at the McDougall Homestead. Again, this would stress the importance of stored foods and a longer period of site occupation. Nonetheless, an horno and a corral are present at the Serna Homestead, with a masonry-lined cistern being present at the McDougall Homestead.

SUBSISTENCE AND SEASONALITY RESEARCH QUESTIONS

1. What subsistence foods were exploited by Archaic peoples on the plateau?

No direct evidence of subsistence items were recovered from any of the Archaic sites. The presence of projectile points, bifaces, and ground stone indicate that hunting and gathering activities were occurring.

2. **During what season(s) of the year were Archaic peoples occupying the plateau?**

There is no direct evidence for season(s) of occupation from any of the Archaic sites.

3. **Are there differences in foods and season(s) of occupations between the Early and Late Archaic occupations?**

There is no direct evidence for subsistence or season(s) of occupation from any of the Archaic sites.

4. **Are there differences in foods and season(s) of occupations between Archaic sites in the piñon-juniper versus the ponderosa pine zone?**

There is no direct evidence for subsistence or season(s) of occupation from any of the Archaic sites.

5. **What subsistence foods are represented at the Coalition period habitation sites?**

A variety of botanical remains were recovered during the excavation of the Coalition period habitation sites. The potential economic species identified during McBride's (Chapter 62, Volume 3) analysis consist of maize, beans, squash, beeweed, cheno-am seeds, dropseed grass, four-wing saltbush, goosefoot, ground cherry, mint, pigweed, prickly pear, piñon nuts, purslane, ricegrass, sunflower, and tobacco. Maize cobs included 8- to 14-rowed varieties.

A diverse array of pollen remains were also identified during Smith's (Chapter 63, Volume 3) analysis of the soil samples from the Coalition period roomblocks. The potential economic species include maize, beeweed, cholla, prickly pear, squash, cotton, cheno-am, sunflower, lily family (e.g., yucca), purslane, and rose family.

The remains of various animal species identified at these sites includes turkey, jackrabbit, cottontail, rock squirrel, gray fox, coyote, domestic dog, pronghorn, mule deer, and several different birds (Chapter 64, Volume 3). Elk remains are absent from these assemblages, but they have been identified at other sites in the northern Rio Grande region (Chapter 80, Volume 4). There do, however, seem to be some differences in the relative abundance of certain species through time. For example, mule deer remains are more abundant at the Middle Coalition sites versus turkey and large bird remains at the Late Coalition sites. It appears that mule deer are actually more abundant than rabbit at each site, which is unusual for Southwestern archaeological faunal assemblages. This is presumably due to the upland setting of these sites versus the lowland setting for most Southwestern sites. At any rate, the increased abundance of turkey during the Late Coalition period corresponds with the increased abundance of maize at these sites. Both appear to be indicators of subsistence intensification during this later time period. Lastly, two varieties of turkey were identified. The smaller variety was recovered from midden contexts and the larger variety from room and kiva contexts. These differences in size and context could reflect wild versus domesticated turkeys.

6. **Were the Coalition period habitation sites occupied seasonally or throughout the year?**

LA 86534 contains a kiva and LA 12587 a midden, with both sites containing domestic and storage rooms. Indeed, burned maize cobs were stored in one of the rooms at LA 12587. Overall, the evidence would seem to indicate that these sites were occupied throughout the year. Nonetheless, as McBride (Chapter 62, Volume 3) points out, the habitation sites without kivas appear to exhibit a stronger focus on agricultural activities than those sites with kivas (including LA 4618). The pollen evidence also indicates a strong agricultural focus for LA 135290. This site contains back storage rooms that were built of adobe and then burned to harden the floor areas. This activity was repeated during the subsequent two periods of occupation. On the other hand, the lack of a midden deposit indicates that this site experienced a much lower occupational intensity than the non-kiva site at LA 12587, but a similar occupational intensity as the nearby kiva site at LA 86534. So, the variability exhibited by the excavated Coalition period roomblocks indicates a range in site function and occupational histories. Presumably LA 86534, LA 12587, and LA 4618 were all occupied throughout the year; however, it is unclear as to whether LA 135290 was occupied on a seasonal basis or throughout the year. It is possible that the site was occupied for part of the year, with the back rooms being used for storage without the occupants residing there; however, this would seem unlikely.

Smith (Chapter 63, Volume 3) discusses the issue of seasonality and notes that the pollen results cannot determine whether roomblocks were occupied year-round, but there are seasonal signals in the data. The overwhelming evidence for maize agriculture indicates spring through early fall occupation. The interpretation of the use of cholla as a cultigen at the pueblos supports an interpretation of late spring activities, as most cacti species flower between late April and June. Lily family encompasses both early spring plants (e.g., wild onion) and late spring and early summer resources, such as yucca. The prickly pear fruits or tunas are harvested later in the summer and into the early fall months. Beeweed, several cheno-am, and sunflower family taxa are late summer through early fall resources.

7. **What subsistence foods are represented at fieldhouses?**

Very few botanical remains were recovered from the Coalition period fieldhouses, with most of the evidence having been derived from the Classic period sites. These economic species include maize, beans, squash, beeweed, bugseed, cheno-am, goosefoot, pigweed, purslane, and tobacco (Chapter 62, Volume 3).

The fieldhouses also contained much less evidence of pollen remains when compared with the habitation sites (Chapter 63, Volume 3). A comparison of floor samples indicates lower pollen concentrations (2069 versus 4677) and a lower mean number of economic species (1.8 versus 3.1), respectively. Economic pollen present at the fieldhouse locations includes maize, squash, pea family, prickly pear, beeweed, sunflower, lily family, purslane, and cholla.

Very few faunal remains were recovered from the fieldhouses (Chapter 64, Volume 3). Taxa identified in the fieldhouses included mule deer, cottontail, pocket gopher, and elk (modern surface remain). Small-medium and medium-large sized mammal remains were also identified.

8. What season(s) were fieldhouses occupied?

Given the economic species identified in Question 7 and the seasonality data presented in Question 6, it would appear that the fieldhouses could have been occupied from spring to fall. Nonetheless, as previously noted, several of the fieldhouses did contain internal hearths. It is therefore possible that at least some of these structures were also occupied during the winter while hunting in the area. Grooved abraders were recovered from LA 85861 and LA 85414, however, an internal hearth was only present at LA 85861.

9. Are there differences in subsistence items and season(s) of occupation between Coalition and Classic period fieldhouses?

As McBride (Chapter 62, Volume 3) notes, the meager non-wood cultural plant material from Coalition period fieldhouses consists of burned cheno-am and purslane seeds, grass stems, and immature piñon nuts. Although lacking the diversity of taxa from Classic fieldhouses, the assemblage from one of the Coalition fieldhouses (LA 85861) resembles those of several Classic period fieldhouses in that beeweed seeds were recovered in two samples from the hearth. The increased plant species diversity represented at the Classic period fieldhouses may indicate an increase in the number of species being cultivated (or collected), that they were occupied for a longer part of the growing season, and/or that differential preservation is a factor.

Smith (Chapter 63, Volume 3) also identified a similar pattern with Classic period fieldhouses exhibiting a higher representation of maize than Coalition period fieldhouses. Of the 39 floor samples collected from 16 Classic period fieldhouses, 12 (33%) produced maize pollen as compared to 2 of 9 floor samples (22%) with maize pollen from five Coalition period sites. Only three Classic sites did not produce any maize pollen, but two of the Coalition sites lack maize. The pollen samples collected from LA 85413 produced the highest maize and beeweed concentrations of all the Rendija Tract fieldhouses.

10. What crops were grown in the agricultural features (e.g., grid gardens)?

As previously noted, three sets of Classic period grid gardens were excavated at LA 12587, LA 128803, and LA 139418. Very few botanical remains were recovered from the grid gardens, however, these include carbonized maize cupules, goosefoot, and cheno-am seeds and wood charcoal (Chapter 62, Volume 3). Otherwise, most of the botanical evidence was derived from the pollen remains (Chapter 63, Volume 3). Most of the pollen identified in the grid gardens consists of cheno-ams, sunflower, and piñon. However, pollen representation from these features is intermediate between fieldhouses and pueblos. That is, cheno-am percentages from gardens are moderate, and piñon and juniper values tend to be higher than observed within structures. This pattern makes sense, as gardens were open to atmospheric pollen deposition; thus tree pollen input drives the conifer percentages higher. The feature sampled at LA 12587 is an exception among the gardens, with pollen concentrations and cheno-am percentages comparable to the LA 12587 roomblock. Otherwise, maize is represented in all three features, with its abundance being greatest at LA 12587 (93%), with less at LA 128803 (44%), and the least at LA 139418 (15%). Cotton pollen was also documented at LA 12587 and LA 128803.

Lastly, although cholla and prickly pear pollen were identified in all of the features, their relative abundance is significantly greater at LA 12587, indicating that they may have been cultivated.

11. What subsistence foods were exploited at the possible Athabaskan campsites?

Very few botanical remains were recovered from the two Jicarilla Apache sites, however, charred goosefoot and a possible wheat seed were identified. Otherwise, beeweed and sunflower pollen were the only other potential economic plant species identified.

12. During what season(s) were the possible Athabaskan campsites occupied?

The presence of goosefoot and sunflower could indicate a late summer or early fall occupation. Given the presence of warming hearths within the tipi rings, it seems likely that the occupation was during the fall when the nights were becoming cooler.

13. What subsistence foods are represented at the Serna Homestead? What relative contribution did hunting, gathering, agricultural produce, herding, and store-bought foods provide for the diet?

The plant remains of several cultigens were recovered from the site including maize, bean, grape, and peach. On the other hand, maize pollen was the only domesticated plant pollen identified at the homestead. Prickly pear, beeweed, and sunflower pollen was also present, but it is not known whether these were environmentally or culturally introduced. The paucity of plant remains is surprising given that informants state that 40 acres of beans, corn, wheat, pumpkins, and various vegetables were cultivated at the homestead. In addition, only 27 pieces of bone were recovered from the site, including cow, goat, deer, elk, and blue grouse. The latter three species were presumably hunted in the area.

Haecker (Chapter 32, Volume 2) states that the measurable cans indicate that the homestead inhabitants depended on canned fruits, juices, vegetables, and baked beans. Sardine cans were also present, but represented less than 3 percent of the total number of food cans. In addition, coffee, condensed milk, and lard cans were also identified. Canned meats likely were not a regular item on the menu, and neither were home-canned foods. An informant recalled that his family regularly ate fresh beef (Peterson and Nightengale 1993:66), which would explain the virtual absence of meat cans and the presence of cow bone. Glass containers that once held food or condiments are also present, including canning jars. It is likely that, at least during the harvest season, the Sernas were consuming some of what they were harvesting (e.g., onions, beans, squash, chili, and corn).

14. What evidence for season(s) of occupation is represented at the Serna Homestead?

Informants state that the Serna Homestead was used as a seasonal farm, with the family traveling to the rancho three times during the year: in the spring for planting, the summer to weed and clean the fields, and in September/October to harvest the crops. They stayed about two weeks at a time and brought milk, cows, chickens, and all the supplies and tools they needed (Peterson and González-Peterson 1993). Even though 40 acres of beans, corn, wheat, pumpkins, and various vegetables were cultivated, the archaeological evidence is limited to corn and beans. The limited archaeobotanical evidence could be interpreted as reflecting an occupation during the spring to fall growing season, however, the oral history information refutes this interpretation.

15. How does the subsistence and seasonality information recovered from the Serna Homestead contrast with that recovered from the Romero and Vigil y Montoya Homesteads?

In contrast to the Serna Homestead, the Romero Homestead appears to have been occupied most or all the time from April to November. An informant stated that the Romero family moved to the homestead in "the first part of spring, usually in late April, and stayed until cold weather set in at about the middle of November" (Foxx and Tierney 1999:15). They also brought some chickens and pigs to the rancho in a horse-drawn wagon. Beans were the main crop, with some squash, pumpkins, peas, and corn; whereas, melons, watermelons, and chile were mainly grown in the Rio Grande Valley. A kitchen garden contained peas, pumpkins, sweet corn, and melons, and peach trees were also present on the homestead. Archaeological excavations at the Romero Homestead yielded evidence of cheno-ams, watermelon, squash, sunflower, piñon pine nuts, apricot, wild and domestic plum, domestic cherry, peach, chokecherry, acorn, and maize. Many of the seeds were obtained from deposits adjacent to the cabin where a lean-to had been attached (Foxx and Tierney 1999). Obviously, a much wider variety of plant remains were recovered from the excavations conducted at the Romero Homestead, including several structures and trash dumps. In contrast, very little was recovered from the excavations of the McDougall cabin, including amaranth, goosefoot, grape, and peach seeds (McBride 2006). This paucity could be due to the cabin having burned and the lack of trash deposits at the site. These deposits solely consisted of a surface concentration of cans.

16. How do these data on subsistence and seasonality reflect changes in the long-term use of the plateau from Archaic through Homestead Era times?

Vierra (2003, 2007; Vierra and Foxx 2002; Chapter 75, Volume 4) suggests a changing pattern of land-use from Early to Middle to Late Archaic times. These long-term patterns reflect the increasing use of upland areas like the Pajarito Plateau. However, this interpretation is based on a limited amount of subsistence information. In fact, direct subsistence information is lacking from the excavated Archaic sites on the plateau. Information is solely available from the excavation of two Late Archaic sites situated in the Rio Grande Valley near San Ildefonso Pueblo. The botanical remains recovered from these sites include chenopodium, prickly pear, and squawberry seeds. These sites have been interpreted as representing habitation sites (winter?) based on the lithic assemblages and the presence of a structure and storage facilities at one of the sites, whereby the upland sites are assumed to represent limited campsites (Vierra 2003; Vierra and Foxx Chapter 75, Volume 4). On the other hand, a variety of plant and animal species have been identified from the excavations conducted at Jemez Cave. The botanical remains include maize, yucca, pumpkins, prickly pear, piñon pine, and cotton. The faunal remains include turkey, grouse, crane, bison, ground squirrel, prairie dog, porcupine, black bear, mountain lion, jackrabbit, cottontail, bobcat, skunk, mountain sheep, mule deer, fox, and badger. Not all of these were necessarily introduced by the site occupants, and not all of these are associated with the Archaic occupation of the rockshelter (Alexander and Reiter 1935).

Nonetheless, Ford (1975) suggests that Late Archaic people occupied the rockshelter from late spring to summer based on the growing of maize near the site. Overall, the Late Archaic land-use pattern appears to be characterized by a lowland/upland pattern within restricted areas of the Rio Grande Valley. This may have involved movements from the juniper-savanna in the early summer (Indian ricegrass), to the ponderosa pine/mixed conifer in the mid to late summer (cheno-ams, wild onions, berries, and wild potatoes), and then down to the piñon-juniper woodlands in the fall (acorns, pine nuts, yucca, and cacti). As previously noted, the riverine settings also appear to have been used for winter campsites (Vierra 2003; Vierra and Foxx 2002, Chapter 75, Volume 4).

It seems likely that Archaic foragers continued to seasonally occupy the Pajarito Plateau until the 12th century when agriculturalists began to move into the area as full-time residents. Although a few Developmental period sites are present on the central plateau, these are mostly situated at lower elevations and presumably reflect the first attempt to occupy the plateau by agriculturalists; however, it was probably not productive to implement a year-round strategy until 12- to 14-rowed varieties of maize could be planted in these upland settings (Vierra and Ford 2006, 2007).

Not until the 12th century was the Pajarito Plateau occupied on a year-round basis as reflected by the immigration of Coalition period agriculturalists into the area. Most of these early sites consist of 10- to 20-room pueblos; however, excavations conducted by this project indicate that a variety of floor plans and architectural styles were used in the construction of these roomblocks. As previously noted, it seems likely that LA 12587, LA 86534, and LA 4618 were all occupied throughout the year; however, it is unclear as to whether LA 135290 was occupied seasonally and/or on a year-round basis. A variety of wild and domesticated plants and animals are represented at the sites, but a general lack of remodeling presumably indicates that these sites were occupied for 10 to 15 years and then abandoned once the local resources were exhausted. The roof beams appear to have been removed and subsequently integrated into the new structure. The presence of middens and evidence for subsistence intensification reflects that these Late Coalition period pueblos were occupied for longer periods of time than their Early-Middle Coalition period counterparts.

This evidence of subsistence intensification is also represented in the expansion of farming plots into higher elevation settings during the Late Coalition period. However, as pointed out by Gabler (Chapter 79, Volume 4), there does not appear to be significant difference in the distribution of Coalition versus Classic period fieldhouses in respect to elevation. Nonetheless, comparisons of Late Coalition versus Classic period fieldhouses in Rendija Canyon indicate that the latter were more intensively occupied. This is of course associated with a marked increase in the number of Classic period fieldhouses present in the Rendija Tract, but fieldhouses and grid gardens are also present in the Airport and White Rock tracts during this time period. Overall, these fieldhouses appear to have been occupied during the growing season, with some possibly being used for hunting during the winter months.

Eventually a series of droughts during the 1580s forced the Ancestral Pueblo occupants of the plateau down to the Rio Grande Valley for year-round habitation. Nonetheless, these peoples continued to seasonally use these upland settings for agriculture and hunting and gathering activities. Evidence from test excavations at the Otowi grid gardens indicates that the features continued to be used during the 18th century, with both squash and maize pollen being recovered (Chapter 55, Volume 2). In addition, Steen (1977) suggests that the various game pits situated along deer trails were used from the 17th through the early 19th centuries.

Eventually the plateau was occupied on a seasonal basis by Jicarilla Apaches at the turn of the 20th century. During this time, Apaches roamed this area of the northern Rio Grande prior to the designation of a reservation near Dulce. In addition, the Homestead Act opened up the plateau to mostly Hispanics who filed for patent claims during the 1890s to early 1900s. As previously noted, this was a period of above average rainfall that provided the moisture necessary for dry land farming. The rainfall farming of mostly beans provided a cash crop to the residents who seasonally occupied the plateau during the growing season. Otherwise, their primary residences were located in the nearby Rio Grande Valley. With the exception of the Los Alamos Boys Ranch, it was not until the arrival of the Manhattan Project during the 1940s that the plateau would again witness a year-round occupation.

TECHNOLOGY, PRODUCTION, AND EXCHANGE RESEARCH QUESTIONS

1. **Are the Archaic lithic assemblages dominated by the production and maintenance of bifacial tools?**

The answer to this question is obviously yes, however, it is much more complicated than that. Figure 86.9 illustrates the relationship between core flakes, biface flakes, and angular debris for Archaic (n = 3), Coalition period roomblocks (n = 5), Classic period fieldhouses (n = 2), and Jicarilla Apache (n = 1) sites. As can be seen, the Archaic sites form a cluster with a greater emphasis on bifacial cores and tools and the Coalition period roomblocks another cluster emphasizing core reduction. There are three sites situated between these two groups, including an Archaic site, a fieldhouse, and the Jicarilla Apache site. Nonetheless, significant changes in biface technology were occurring during the Archaic (Chapter 74, Volume 4). The lithic assemblage at LA 85859 indicates that the Early Archaic site occupants were gearing up with bifacial cores at the nearby caldera obsidian source. These cores were then being reduced and used to produce biface blanks for dart points. A similar situation is represented at the La Bajada site (LA 9500), except that the Early Archaic occupants of this site were using dacite instead of obsidian. Figure 86.10 presents an example of bifacial cores and biface blanks from the La Bajada site. This pattern of using bifacial cores and biface blanks for the production of dart points continues during the Middle Archaic period as is represented by the San Jose point technology; however, it changes during the Late Archaic period when flake blanks replace biface blanks for the production of dart points. Analyses of biface flake platform angles at LA 85859 and LA 99397 (Middle-Late Archaic) indicates that the early to middle stage bifacial cores and biface blanks were being reduced at LA 85859 versus early, middle, and late stage bifaces including bifacial knives and points at LA 99397. Therefore, the former site probably represents a temporary campsite and the latter a habitation site (e.g., see Vierra 2003)

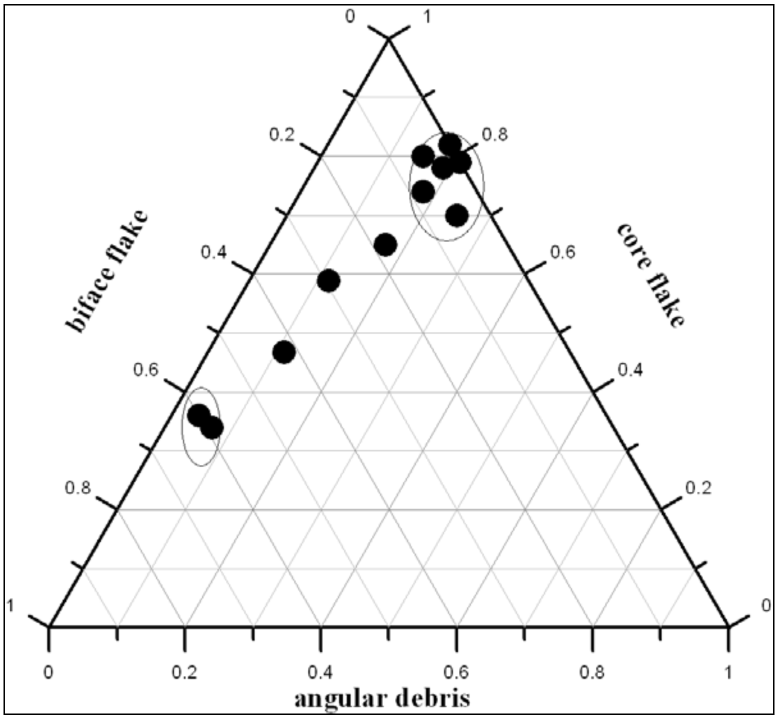


Figure 86.9. The relative distribution of debitage types for Archaic, Ancestral Pueblo, and Jicarilla Apache sites.

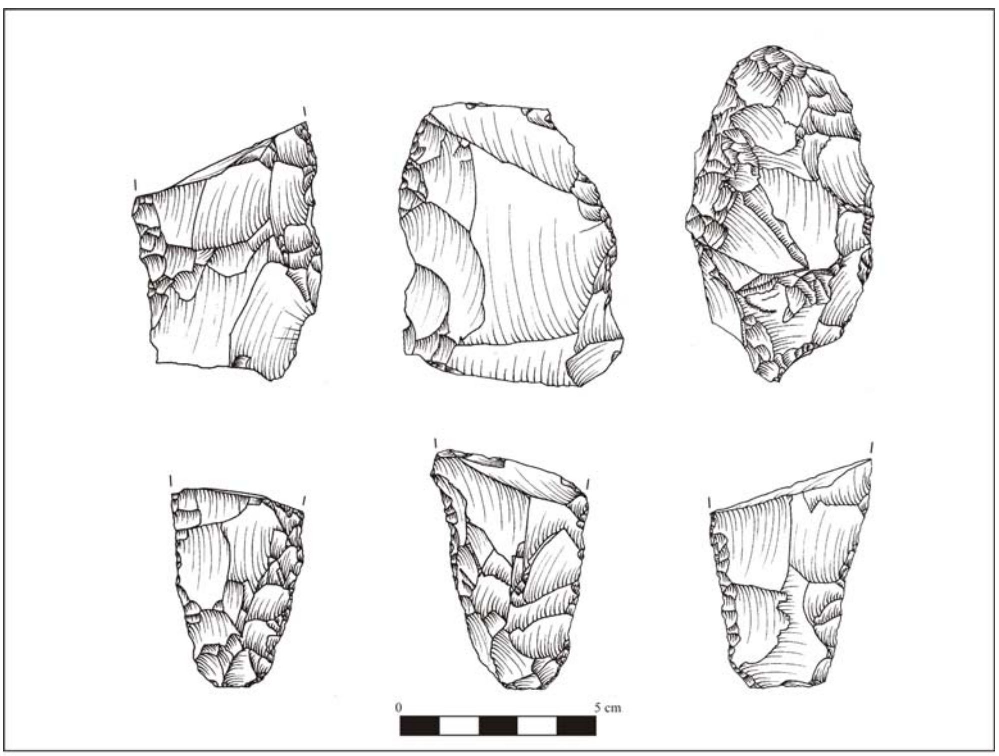


Figure 86.10. Early Archaic bifacial cores (upper) and biface blanks (lower) from the La Bajada site.

2. What nonlocal lithic materials are present on the Archaic sites, in what form were these items brought to the sites, and what artifacts were being produced on these materials?

Figure 86.11 illustrates the distribution of obsidian, chalcedony/chert, and basalt for Archaic, Ancestral Pueblo, and Jicarilla Apache sites. As can be seen, the Archaic and Jicarilla sites form a cluster that is dominated by obsidian, the Ancestral Pueblo sites by chalcedony/chert, and a single fieldhouse by both obsidian and chalcedony/chert. However, the obsidian was obtained from several different sources. Larger cobbles were available from the Valles Caldera (Valle Grande) and the Rabbit Mountain/Obsidian Ridge (Cerro Toledo) source areas; however, small nodules were also scattered in surface lag gravels on the mesa at Rendija Canyon (Cerro Toledo). Nonetheless, it appears that the primary sources were mostly used by the Archaic inhabitants. Larger nodule sizes would have been critical to the production of large biface and flake blanks for the production of dart points and bifacial knives. As previously noted, both bifacial cores and platform cores were being brought to campsites on the plateau for further reduction and tool production. At least some artifacts made of El Rechuelos obsidian were also identified. Given the lack (or paucity) of this material in nearby gravels, it is assumed that most of the material used for the production of these items was obtained to the north near the Abiquiu source area.

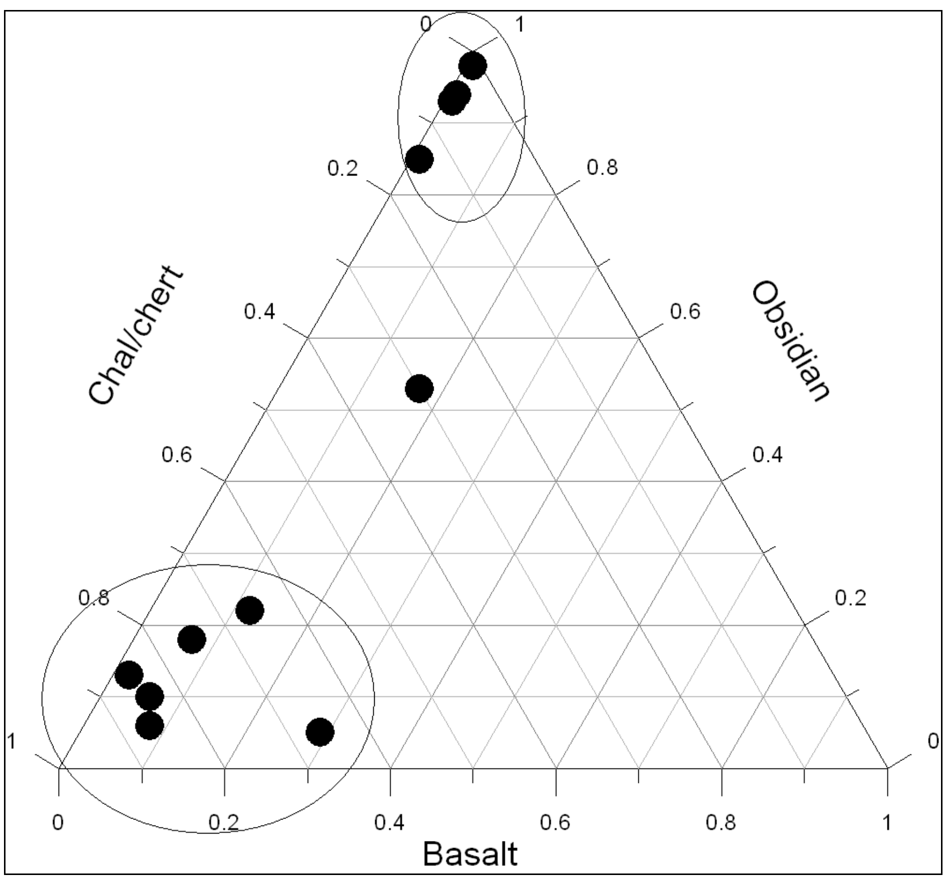


Figure 86.11. The relative distribution of debitage material types for Archaic, Ancestral Pueblo and Jicarilla Apache sites.

3. **What information do these nonlocal materials provide concerning possible Archaic mobility patterns?**

Vierra (2007, Chapter 75, Volume 4; Vierra et al. 2005) presents a potential model for long-term changes in Archaic mobility patterns. This study was based on the X-ray fluorescence (XRF) sourcing of projectile points made of both obsidian and dacite, which are available in the Jemez Mountains (Zone 1) and San Antonio Mountain (Zone 2) areas. It appears that the central Jemez Mountains sources dominate Zone 1 with mostly Cerro Toledo and Valle Grande obsidian; however, the Early Archaic and San Jose points are also represented by obsidian derived from the southern Bear Springs source and a few items from the northern El Rechuelos source. On the other hand, the San Jose points are dominated by the Valle Grande source. Since the Valle Grande obsidian source is restricted to the caldera, this pattern provides support for the contention that these Middle Archaic foragers were integrating these upland resource areas into their summer and fall seasonal rounds, and thereby collecting more of this obsidian. This contrasts with the Cerro Toledo source, which is present along the eastern periphery of the caldera and in secondary deposits along the nearby canyon and Rio Grande Valley.

In contrast, most of the Archaic points are made of El Rechuelos obsidian in Zone 2. However, the Early Archaic reflects a north-south pattern with all three central and northern obsidian sources being represented. San Jose points continue to reflect the importance of Valle Grande obsidian, but now with El Rechuelos. Together, the obsidian data seem to support a north-south seasonal pattern of movement during the Early Archaic period, with a more restricted north-south pattern during the Middle Archaic period. On the other hand, the Late Archaic points were made on flake blanks with shorter tool use-lives. In this case, these points are dominated by the most proximate obsidian source. That is, the central Jemez Mountains sources in Zone 1 and the El Rechuelos source in Zone 2.

The dacite sourcing study corroborates the obsidian study. That is, the Early Archaic points contain examples of dacite derived from all three southern and northern sources. In contrast, the later periods are mostly characterized by the increasing use of local dacite.

4. **Are there significant differences between Early and Late Archaic period stone tool technology, and, if so, what are the implications of these differences for understanding changes in past land-use strategies?**

As Vierra (2007, Chapter 75, Volume 4) points out, changes in Early and Middle Archaic period point technology may be associated with the expansion of piñon-juniper woodlands in the region and a shift from hunting large game in open settings to more medium to small game in wooded settings. This projectile point technology was characterized by low point diversity and low tool replacement rates. In contrast, the Late Archaic period point technology was characterized by high tool replacement rates and high point diversity. Overall, these changing patterns could reflect a "replacement when exhausted" versus a "replacement based on probability of failure" strategy (Kuhn 1989). That is, Early and Middle Archaic groups were residentially mobile, with a technology that was continuously used and maintained; whereas, Late Archaic groups were becoming more logistically organized, while focusing on specific target-species. Higher tool replacement rates would be used as a means of increasing tool reliability (also see Vierra 1992a:104). The changing emphasis on lowland versus upland resource use is reflected in the long-term pattern of using mostly dacite from lowland sources to obsidian derived from upland sources from the Early to Late Archaic period.

5. **Do Ceramic period lithic assemblages emphasize core reduction activities?**

The answer to this question is yes, as illustrated by the cluster of sites emphasizing core reduction in Figure 86.9. All of the Coalition period roomblocks and most of the fieldhouses emphasize core reduction activities; however, one Classic period fieldhouse does exhibit a mix of core reduction and biface production/maintenance activities (LA 128805). This fieldhouse is situated in the White Rock Tract and contains both a one-room structure and associated artifact scatter that dates to the Middle Classic period (15^{th} century). Most of the biface flakes are made of obsidian, with only two obsidian artifacts dating to the Classic period; whereas, the remaining eight artifacts date to the Archaic period. Therefore, at least some of the evidence for biface production could be associated with an older Archaic component.

6. **What nonlocal lithic materials are present on the Ceramic period sites, in what form were these items brought to the sites, and what artifacts were being produced on the materials?**

Obsidian is the only potential nonlocal lithic raw material that appears to have been brought onto the Ceramic period sites. Overall, about 11 percent to 15 percent of the total flake assemblages from roomblock and fieldhouse sites exhibit cortical platforms, indicating that cobble raw materials were being brought to the sites for reduction. On the other hand, most of the flakes exhibit single-faceted platforms (52% to 56%), indicating the reduction of platform (or flake) cores was also important. Obsidian comprises about 5 percent to 10 percent of the Early-Middle Coalition period roomblocks and increases to 17 percent to 22 percent at the Late Coalition and Classic period fieldhouses. Most of these fieldhouses are located in Rendija Canyon where small obsidian nodules were present in surface lag gravels situated on the mesa top. Bipolar reduction was one technique used to reduce these small pebbles. Nonetheless, some of the obsidian present at these sites was also derived from the Valle Grande source located in the nearby caldera. On the other hand, both Cerro Toledo and Valle Grande sources were exploited by the occupants of the Coalition period roomblocks. About 8 percent of the flakes on these sites exhibit cortical platforms, with 34 percent being single-faceted, and 33 percent being crushed. Therefore, both nodules and prepared cores (or flakes) appear to have been brought to the roomblock and fieldhouse sites for reduction.

A total of four prepared cores and a single tested obsidian nodule were identified at the Coalition roomblock sites, whereas, one prepared core and four tested obsidian nodules were recovered from the fieldhouses. The relative increase in tested nodules at the fieldhouses presumably reflects the use of local lag gravels. In contrast, the obsidian materials used at the roomblocks were probably obtained from the original source areas. For example, a large obsidian flake was observed at a Late Coalition period cavate site along Mesita del Buey near the White Rock Tract. The flake is 18.5 cm long and weighs 1274 g. The dorsal surface is covered with nodular cortex, indicating that it represents a large primary flake removed from a very large nodule. XRF analysis indicates that the item was obtained at the Valle Grande source. A similar procurement tactic was employed by Pueblo groups in the Flagstaff area while collecting obsidian from the Government Mountain source (Vierra 1993a).

7. What is the nature of the Ceramic period ground stone assemblages?

The Coalition roomblock sites contain mostly one-hand manos, but two-hand manos are represented as well (Figure 86.12). The percentage of two-hand manos actually increases slightly from the Early/Middle Coalition period to the Late Coalition period at the roomblock sites, but is highest at the Late Coalition period fieldhouses. Slab metates are also present at the roomblock sites, but no trough metates being identified. The fieldhouses contain both one- and two-hand manos, with some grinding slabs and undetermined metate fragments.

The sample sizes vary greatly when attempting to compare mean mano lengths; that is, Early/Middle Coalition roomblock (*n* = 11), Late Coalition roomblocks (*n* = 38), Late Coalition fieldhouses (*n* = 3), and Classic fieldhouses (*n* = 13). These comparisons are also difficult given that two-hand manos tend to be discarded when broken and cannot therefore provide overall length measurements. Nonetheless, there is a similar pattern with smaller mean lengths for Early/Middle Coalition (mean = 133 mm, *std* = 44.9) and Late Coalition roomblocks (mean = 120 mm, *std* = 48.2) versus larger lengths for Late Coalition period fieldhouses (mean = 176.6 mm, *std* = 52.5) and Classic period fieldhouses (mean = 151, *std* = 57.6). This again emphasizes the general importance of smaller-size manos at the roomblock sites.

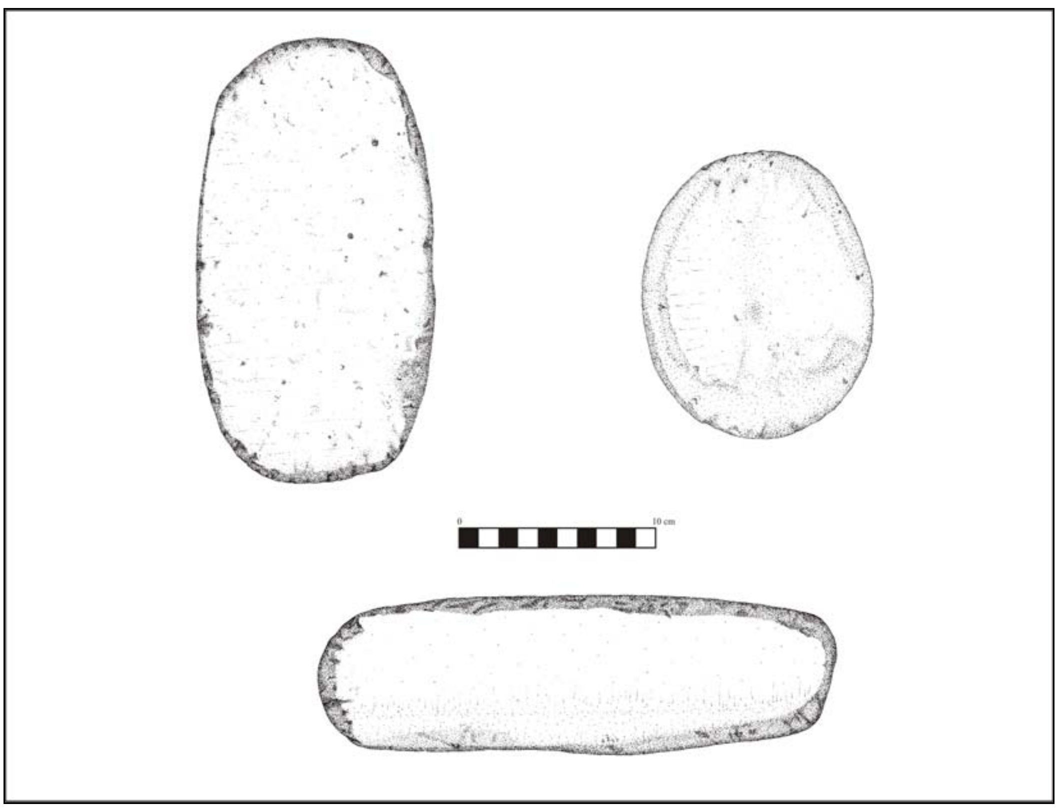


Figure 86.12. One- and two-hand manos.

8. How do the Ceramic period site types differ in respect to chipped and ground stone assemblage composition?

This question has partially been addressed by Questions 5, 6, and 7. That is, both roomblock sites and fieldhouses emphasize chalcedony core reduction activities. Although a single fieldhouse does deviate from this pattern, the increased proportion of biface flakes may actually represent an older Archaic component. Cortical:noncortical flake ratios do vary with somewhat lower ratios at the fieldhouses (0.24 and 0.29) versus higher ratios at the roomblocks (0.35 and 0.38). Given the small assemblage size at most of the fieldhouses, this probably indicates that prepared cores were often being brought to these sites for reduction. However, a closer inspection of cortical platforms by material types also reveals some subtle differences. Cortical platforms make up a minor portion of the flake platform types in all the assemblages, reflecting an emphasis on reducing platform cores at these sites. Nonetheless, the Classic period fieldhouses contain some obsidian (11%) and chalcedony (8%) cortical platforms, but no basalt cortical platforms. In contrast, the Early-Middle Coalition period roomblock assemblages contain obsidian (10%), chalcedony (13%), and basalt (9%) cortical platforms. Lastly, the Late Coalition period roomblock assemblages contain obsidian (9%), chalcedony (26%), and basalt (9%) cortical platforms. This indicates that some local obsidian pebbles and chalcedony cobbles were being brought to the fieldhouses for reduction, with a notable increase in the presence of basalt nodules at the roomblock sites and a marked increase in the reduction of chalcedony cobbles at the Late Coalition period roomblocks. Several cobble unifaces and tested nodules were recovered from the fieldhouses (n = 8). All of the latter are obsidian pebbles. In contrast, only two cobble bifaces and three tested nodules were actually found at the roomblocks. These consist of chalcedony, pedernal chert, basalt, and obsidian materials.

In respect to the ground stone assemblages, both roomblocks and fieldhouses contain mostly one-hand manos with fewer two-hand manos. The Late Coalition period roomblock manos tend to be more heavily used than either the Early-Middle Coalition period or fieldhouse sites; however, the large loaf-shaped two-hand manos were only identified at fieldhouse sites in Rendija Canyon. Lastly, formal slab metates were identified at the roomblock sites versus grinding slabs and undetermined metate fragments at the fieldhouses. Nonetheless, the presence of larger two-hand manos at some fieldhouses indicates that slab metates must have been present at some time.

9. What types of tools are present on Ceramic period agricultural sites?

A single hoe was the only agricultural tool recovered from the three grid garden sites at LA 12587, LA 128803, and LA 139418. It consists of a thin oval-shaped quartzite cobble with notches along either side (Figure 86.13) from LA 128803. Hoes that were presumably used for maintaining their agricultural fields and axes for construction or possibly clearing forested land for field plots were also recovered from fieldhouses.

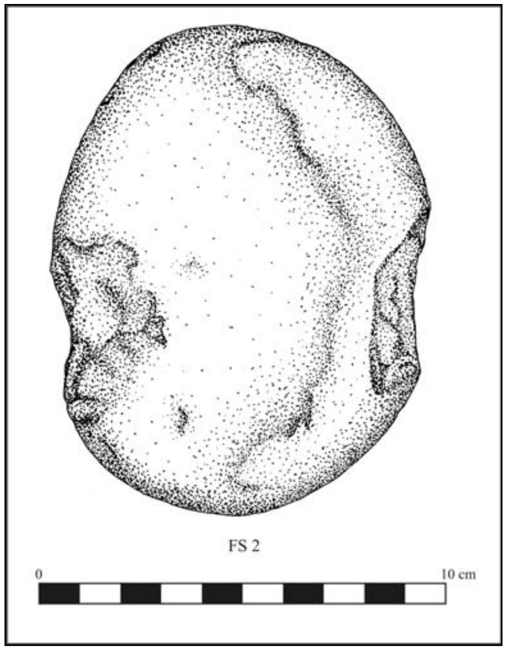


Figure 86.13. Hoe from LA 128803.

10. Can compositional studies of clay and temper sources identify distinctive signatures that can then be used to evaluate long-term changes in ceramic production and exchange on the plateau?

Miksa's (Chapter 59, Volume 3) petrographic study identified five basic temper groups. These groups consist of anthill sand, anthill sand with clay lumps, granitic, Tuff 1, and Tuff 2. Although source samples were taken from local alluvial sands, these were not sufficiently distinct to separate from the anthill. Santa Fe Black-on-white exhibits the greatest degree of variability including all but the granitic temper types. Overall, there appears to be a temporal trend with anthill tempers generally occurring earlier and tuff tempers later in time. This includes more Tuff 2 and less Tuff 1. The majority of the corrugated wares are tempered with anthill sand, although three sherds did contain granitic temper. All the biscuitware sherds are tempered with tuff, although there is more Tuff 1 represented than Tuff 2. Sapawe Micaceous is always tempered with granitic material, whereas most of the plainware pottery is tempered with anthill sand and a few with granitic temper.

11. Can compositional studies of paste and temper identify different sources for these materials? If so, which of these sources are local versus nonlocal?

Miksa's (Chapter 59, Volume 3) petrographic study identified five basic temper types. Four of these appear to be from local sources, consisting of anthill sand, anthill sand with clay lumps, Tuff 1, and Tuff 2; whereas, ceramics with granitic temper were presumably obtained from nearby villages in the Rio Grande Valley. The latter includes all of the Sapawe Micaceous, and a few of the plainware sherds. In addition, three corrugated sherds also exhibited granitic temper. These consist of two smeared-indented corrugated sherds that were recovered from Classic period fieldhouses and an indented corrugated sherd that was obtained from the Coalition period roomblock site at LA 4624. Otherwise, all the Santa Fe Black-on-white and biscuitware sherds appear to have been locally made. However, Curewitz and Harmon (2002) and Dean (2006) note the presence of igneous and sand, and granite and sand temper in several Santa Fe Black-on-white sherds from excavated Coalition period roomblocks on Mesita de Buey near the White Rock Tract. In addition, Dean (Chapter 58, Volume 3) also identified about 50 sherds with granite and sand temper from LA 12587, LA 86534, and LA 135290. These items presumably represent nonlocal trade wares.

12. Can refiring and tensile strength studies help us understand past ceramic production techniques?

Sam Duwe conducted a tensile strength study of Coalition and Classic period ceramics. In his preliminary test, it appears that ceramic strength, and hence durability, remained relatively consistent through the entire Pajarito whiteware chronology (Table 86.3). In fact, tensile strength may have actually *increased* with the advent of biscuitware technology. This is likely due to the average increased width of vessel walls, which likely compensated for the use of a softer and more porous paste.

From this analysis of tensile strength, it appears that although potters in the Classic period were changing the construction techniques and material sources of their pottery, these changes in ceramic technology allowed for the maintenance of vital performance characteristics, such as durability. This would have been important for the pottery to endure both domestic and ceremonial use and also long-distance exchange. Whatever the reasons for the transition to biscuitware technology, certain performance characteristics were inherent in all types of Pajarito whiteware through prehistoric occupation on the northern Pajarito Plateau.

Table 86.3. Results of the Pajarito whiteware ceramic tensile strength analysis.

Type	Date	Site	Unit	Thickness (mm)	Mean Thickness (mm)	Load (lbs)	Mean Load (lbs)
Santa Fe B/w	AD 1175–1475	LA 170	N	4.50	3.75	20	38
		LA 170	N	3.00		52	
Wiyo B/w	AD 1175–1425	LA 169	A	4.00	4.00	18	18
Abiquiu B/g	AD 1325–1450, 1540?	LA 169	A	7.00	7.50	33	42
		LA 169	A	8.00		51	
Bandelier B/g	AD 1550–1650	LA 169	A	7.00	6.75	56	42
		LA 169	A	6.50		27	

13. What nonlocal ceramics are present during the Coalition period? Besides the Red Mountain whitewares, is there evidence for the presence of nonlocal Santa Fe Black-on-white or other intra-regional painted wares? What are the implications of these data for understanding regional trade networks?

Nonlocal ceramics are very rare at Coalition period sites (Chapter 58, Volume 3). The Early-Middle Coalition sites of LA 86534 and LA 135290 contain eight Chupadero Black-on-white and three Reserve Smudged sherds, which indicate ties with the Jornada Mogollon to the south; whereas, a Gallup Black-on-white, a Socorro Black-on-white, and two Cibola whiteware sherds reflect ties to the west and to the San Juan Basin. Lastly, two White Mountain redwares also represent long-distance trade relationships to the west into east-central Arizona. The petrographic analysis indicates that all the sampled Santa Fe Black-on-white sherds were locally made (Chapter 59, Volume 3). The presence of Mogollon and Cibola ceramics may reflect ancestral ties by immigrants from the lower Rio Grande Valley and San Juan Basin to the Pajarito Plateau. In contrast, the White Mountain redwares reflect a region-wide Pueblo III exchange network that links many of these upland communities.

The Late Coalition site of LA 12587 contains a single Chupadero Black-on-white and three Reserve Smudged sherds, which indicate continuing ties to the south; however, the absence of any Jornada Mogollon ceramics at LA 4618 also reflects that these ties were more restricted (or terminated) near the latter part of the Coalition period. On the other hand, the presence of a Tularosa Black-on-white and six Cibola sherds reflects continuing ties to the San Juan Basin, and seven White Mountain redware, and four St. Johns Black-on-red and St. Johns Polychrome sherds to the regional Pueblo III trade network. On the other hand, two Gallina Black-on-white and four Mesa Verde Black-on-white sherds were also recovered from both sites, again reflecting subtle changes in regional contacts (recent immigrants?) during the latter part of the Coalition period. Gabler's (Chapter 79, Volume 4) study does identify peak population levels on the central plateau at about AD 1300 to 1350. This peak could reflect a second immigration into the area, this time from the four-corners region. Nonetheless, Duwe's (Chapter 77, Volume 4) analysis of the ceramic assemblage from Otowi, which includes Late Coalition and Early Classic period components, failed to identify any non-local Pueblo III ceramics (with the exception of three Red Mountain redware sherds). Two of these sherds were recovered from the older Late Coalition period component situated at Roomblock A. Overall, the ceramic evidence indicates that there was only a limited amount of regional interaction between the residents of the Pajarito Plateau and their neighbors during the Coalition period, although the effects of immigration into the area are still poorly understood.

14. What nonlocal ceramics are present during the Classic period? Besides the glazewares, is there evidence for the presence of nonlocal biscuitwares and utilitywares? What are the implications of these data for understanding regional trade networks?

The limited evidence of regional interaction that characterizes the Coalition period changed dramatically during the Classic period. There is a marked increase in the trade relationships between the occupants of the Pajarito Plateau and their Tewa neighbors in the nearby Rio Grande Valley. This is best illustrated by the presence of Sapawe Micaceous at the Classic period fieldhouses. Duwe's (Chapter 77, Volume 4) study at Otowi and Tsirege determined that micaceous ceramics composed 59 percent and 35 percent of the utilitywares, respectively. In addition, a locally produced micaceous slipped pottery was also identified at the Classic period fieldhouses, which appears to mimic the nonlocal type. Curewitz's (Chapter 76, Volume 4) study also identified that vessel size range, the proportion of large jars, and the degree of size standardization increases for utilitywares from the Coalition to the Classic period at sites on the Pajarito Plateau. The production of large jars requires a higher degree of skill, and these may have been made by fewer potters, resulting in a more standardized size range. However, it is unclear as to whether these Classic period jars were being exchanged with communities in the nearby valley.

Small amounts of nonlocal glazeware sherds are represented at the Classic period fieldhouses (3 to 8%). Otherwise, the petrographic analysis indicates that Sapawe Micaceous and a few plainware and corrugated sherds were obtained from villages in the nearby Rio Grande Valley. In contrast, all the sampled biscuitwares were produced using local tuff temper (Chapter 59, Volume 3).

Glazewares compose 5 percent to 12 percent of the decorated ware assemblages at Otowi and Tsirege, respectively (Chapter 77, Volume 4). Larson et al. (1986) determined that most of the glazewares in their sample from Tsirege were being produced on the Pajarito Plateau, with some from Cochiti and the Galisteo Basin. In addition, about 6 percent of the biscuitwares at Tsirege were obtained from the Chama Valley area. Larson et al. (1986) consider that there was more trade among the biscuitware sites than between the biscuitware and glazeware producing sites. On the other hand, Duwe (Chapter 77, Volume 4) suggests that the increase in glazewares at Tsirege may reflect increasing exchange relationships with Keres populations to the south.

Munson's (Chapter 82, Volume 4) rock art study could not identify a clear cut border between Tewa and Keres social boundaries. In fact, the majority of the conflict-related glyphs (e.g., shields) were observed in the area of Otowi and Tsankawi, which is north of the proposed Tewa-Keres boundary along Ancho Canyon. Snead's (Chapter 81, Volume 4) trail study denotes several major east-west trails from the Rio Grande Valley into the Jemez Mountains; however, he also defines an important north-south trail that spanned the entire Pajarito Plateau (the Old Pajarito Trail). This trail includes segments in the area between Tsirege and Mortandad Canyon and the Bayo Staircase near Otowi.

15. **Is there any evidence of ceramic production on the Ceramic period sites? Or, is there any evidence that a lithic and ceramic scatter site could reflect a kiln(s) used in pottery production?**

Petrographic analyses indicate that most of the decorated ceramics were produced using local tuff tempers, whereas, anthill sand was used for the utilitywares (Chapter 59, Volume 3). There seems little doubt that the majority of the Coalition period ceramics and much of the Classic period ceramics were produced by the residents of the Pajarito Plateau. However, no direct evidence of kilns or any other ceramic production features were identified during the excavations. The lithic and ceramic scatters appear to represent limited activity areas or temporary campsites, but not pottery production locales.

16. Is there evidence of ceramic craft specialists during the Classic period, and if so, what are they producing for exchange?

As previously noted, Curewitz's (Chapter 76, Volume 4) study identified that vessel size range, the proportion of large jars, and the degree of size standardization increases for utilitywares from the Coalition to the Classic period at sites on the Pajarito Plateau. The production of large jars requires a higher degree of skill, and these may have been made by fewer potters, resulting in a more standardized size range. However, it is unclear as to whether these Classic period jars were being exchanged with communities in the nearby valley. The biscuitwares are also represented by a marked increase in the proportion of jar forms when contrasted with decorated bowls during the Coalition period.

Duwe's (Chapter 77, Volume 4) study of biscuitwares from Otowi and Tsirege revealed that vessel size and standardization differed between the two sites. In general, the mean size of the Biscuit B bowls recovered from Otowi were smaller than those from Tsirege. Also, Tsirege had a much smaller standard deviation for bowl size than that from Otowi. If consistency of pottery is a sign of standardization, Tsirege is producing more standardized vessels, which could be interpreted as a higher degree of craft specialization. The same sort of relationships between Otowi and Tsirege was also identified when comparing the width of the interior framing line. That is, the standard deviation of framing line width was much smaller at Tsirege when compared with that of Otowi, also indicating increasing craft specialization in pottery production.

Lastly, Miksa (Chapter 59, Volume 3) suggests that the shift from sand and tuff temper sources for the production of Santa Fe Black-on-white to tuff temper sources for the production of biscuitwares represents a "much more controlled selection of materials and possibly much better control of production technology." This also presumably reflects a shift from household production to ceramic specialists.

17. What evidence is there for domestic versus agricultural activities at the Serna Homestead site?

A variety of domestic artifacts were identified at the Serna Homestead, including food cans, commercial food jars, canning jars, medicine bottles, whiteware and stoneware ceramics, kerosene lamp, lard pails, tools, and personal possessions. The latter consists of glass beads, a brooch fragment, a harmonica fragment, a clasp knife fragment, a pocket compass fragment, shirt and blouse fragments, jacket buttons, shoe and boot fragments, a comb, and a cold cream jar. In addition, various tools were also recovered including metal files, scissors, a wrench, and a hacksaw blade. Lastly, a Mexican-style slab metate and one-hand mano were also found near the cabin.

Four horseshoes and one horseshoe nail were identified in the collection, as were fragments of what is believed to be a leather harness. The presence of several fence staples in the collection indicates that the homestead included a wire fence. Strands of barbed wire were also present, with several fence posts still remaining around the periphery of the compound. With the exception of a shovel blade, no other agricultural implements were recovered from the site. Several large pieces of sheet metal with multiple holes punched in them may have been used to wash or clean the beans.

18. Were any manufactured items recycled into other tools?

The only example of a manufactured item being recycled into another tool appears to the use of sheet metal as bean sieves. Multiple holes were punched into large sheets of sheet metal and presumably used to wash or clean the beans.

19. Are there any historic Pueblo ceramics or other artifacts that would indicate interaction between Hispanic homesteaders and local Pueblos?

A total of 10 sherds representing nine historic Pueblo vessels were identified during Eiselt's (Chapter 78, Volume 4) analysis of the Serna Homestead. These consist of two Tewa Blackware sherds, four Tewa Micaceous slipped sherds, and four Hispanic/Tewa Buff sherds. Two of the Tewa Micaceous sherds could have been derived from a vessel produced at nearby San Ildefonso or Santa Clara Pueblos, while the other two sherds could have been derived from a vessel produced at Nambe, Tesuque, or Pojoaque. In addition, an isolated pot drop was recovered from near the Serna Homestead. It is an excellent example of a medium-sized Cimarron Micaceous long-necked olla or cook pot with an orifice diameter of around 26 cm. The 77 recovered fragments include five rim sherds, three neck sherds, and 69 body fragments. The vessel likely dates from around 1850 to 1880 or 1890 based on similarities with dated Jicarilla Apache types in the Río del Oso Valley (Eiselt 2006). In addition, a total of seven micaceous sherds were recovered during the excavations of the McDougall Homestead site west of the White Rock Tract. The ceramic assemblage is small, but relatively diverse with input from Jicarilla Apache, Hispanic, and Tewa or Picurís potters. These sherds were identified as Cimarron Micaceous (n = 4), Hispanic Blackware (n = 1), Peñasco/Tewa Micaceous (n = 1), and indeterminate micaceous (n = 1).

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