Excavations at the Pojoaque Interchange Site (LA 101412), U.S. 84/285, Santa Fe County, New Mexico

Nancy J. Akins

Museum of New Mexico • Office of Archaeological Studies
Archaeology Notes 238 • 2004

Excavations at the Pojoaque Interchange Site (LA 101412)   Akins   AN 238   OAS•MNM

MUSEUM OF NEW MEXICO

OFFICE OF ARCHAEOLOGICAL STUDIES

Excavations at the Pojoaque Interchange Site (LA 101412), U.S. 84/285, Santa Fe County, New Mexico

BY

NANCY J. AKINS

WITH CONTRIBUTIONS BY

GLEN GREENE

DAVID V. HILL

STEPHEN C. LENTZ

MACY MENSEL

MOLLIE S. TOLL

JOHN A. WARE

C. DEAN WILSON

SUBMITTED BY

TIMOTHY D. MAXWELL, PH.D.

PRINCIPAL INVESTIGATOR

ARCHAEOLOGY NOTES 238

SANTA FE 2004 NEW MEXICO

ADMINISTRATIVE SUMMARY

Data recovery at LA 101412, located near the intersection of US 84/285 and the road to Pojoaque Pueblo, was conducted during August and September of 1994 at the request of the New Mexico State Highway and Transportation Department (which became the New Mexico Department of Transportation—NMDOT—on July 1, 2003). Excavation of backhoe trenches, extensive clearing in three areas, and hand-excavated test units located two fire pits and a charcoal stain. The fire pits and stain were isolated features with no associated structures or activity areas. Much of the cultural material accumulated in the site area through colluvial washing. The artifacts and features are most likely associated with LA 61, the Pojoaque Pueblo site, which lies north and east of LA 101412. Permission to work on Pojoaque Pueblo land was given by George Rivera (July 25, 1994). Bruce Harrill of the Bureau of Indian Affairs, Albuquerque Area Office, gave verbal permission to proceed (July 27, 1994).

MNM Project No. 41.578 (Pojoaque Interchange)
NMSHTD No. SD-(NH)-084-6(217)

Submitted in fulfillment of the Joint Powers Agreement between the New Mexico State Highway and Transportation Department and the Office of Archaeological Studies, Museum of New Mexico, Office of Cultural Affairs.

CONTENTS

FIGURES

TABLES

CHAPTER 1

Introduction

LA 101412 lies within the area of a proposed interchange for US 84/285 and the road to Pojoaque Pueblo (Fig. 1). The area was tested during March and April of 1994 and was found to have the potential to provide information on local history and prehistory (Lentz et al. 1994). In July 1994, Stephen Lentz began the excavations at the site. When scheduling conflicts prevented him from continuing, Nancy Akins completed the excavations, directed the laboratory analysis, and prepared this report. Field assistants during the August and September 1994 excavations were Deborah Johnson, Larry Sitney, Christine Sterling, and Sonya Urban. Glen S. Greene of Stratigraphic Service examined and reported on the soils at the site. Ceramic artifacts were analyzed by C. Dean Wilson and Macy Mensel. Raul Troxler analyzed the lithic artifacts, and James L. Moore provided invaluable comments on an early draft of the lithic report. Pete Brown edited this report, produced the graphics, and designed the cover. Timothy D. Maxwell was principal investigator.

Lentz's limited testing at the site encountered fairly dense deposits containing prehistoric artifacts dating from the Developmental to the Classic period, and a possible occupation surface. Based on these findings, the data recovery plan and research objectives anticipated finding an activity area or habitation structures. During data recovery, excavation of several backhoe trenches revealed that the supposed occupation surface was a geological phenomenon rather than a prehistoric feature. This recognition changed the direction of the excavation and research plan considerably, although some of the more general issues raised in the data recovery plan can still be addressed.

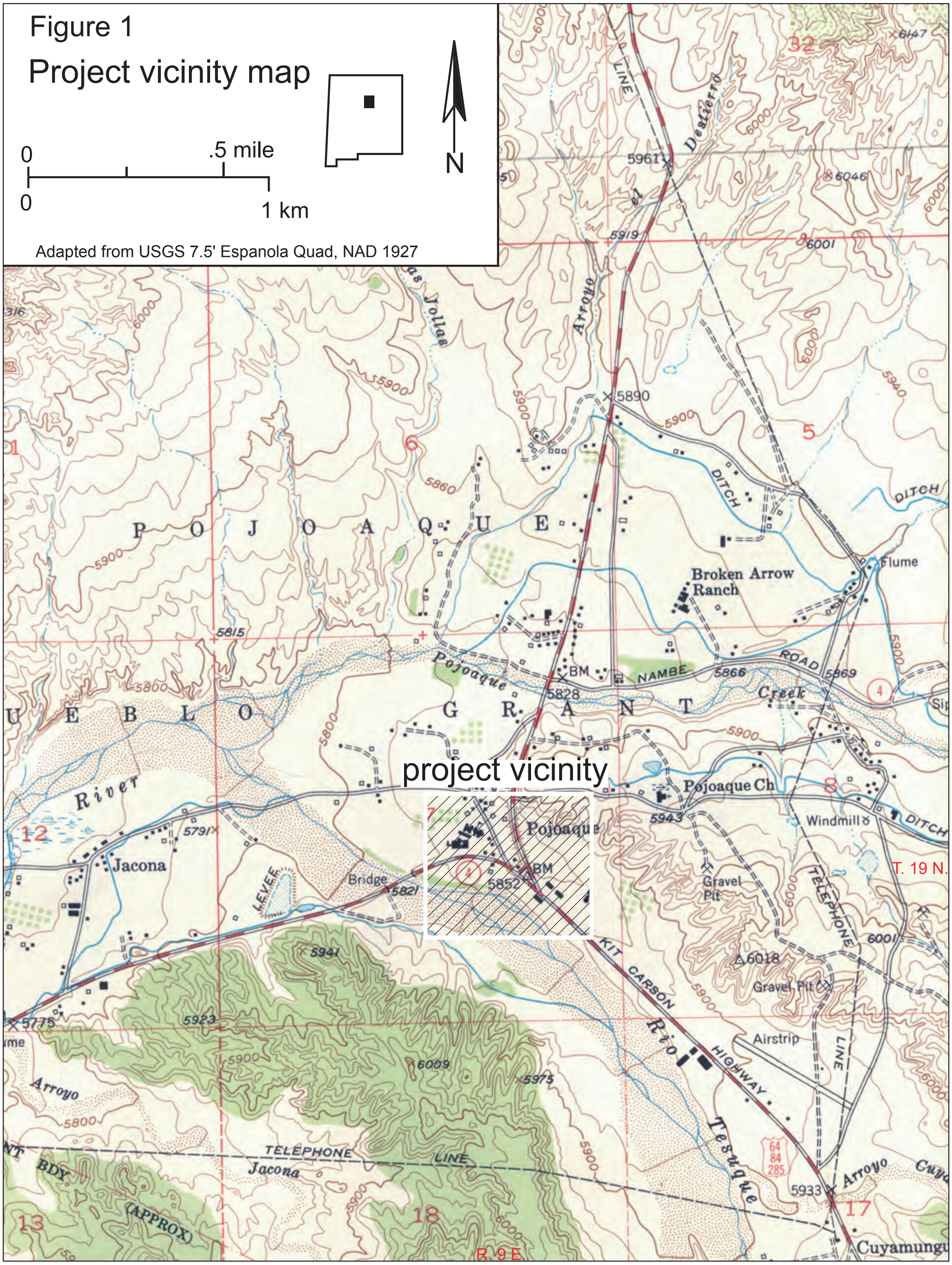

Figure 1. Project vicinity map.

CHAPTER 2

Physical Environment

STEPHEN C. LENTZ

PHYSIOGRAPHY

Pojoaque Pueblo is located in a fault-zone feature known as the Española Basin, which is one in a chain of six or seven basins composing the Rio Grande rift, which extends from southern Colorado to southern New Mexico (Kelley 1979:281). This basin, which is considered an extension of the Southern Rocky Mountain Province (Fenneman 1931), is enclosed by uplands of alternating mountain ranges and uplifted plateaus. The Rio Grande flows along the long axis of this feature (Kelley 1979:281). The northern boundary of the Española Basin is composed of the eroded edge of the Taos Plateau. The Sangre de Cristo Mountains form the east edge, and the southern boundary is marked by the Cerrillos Hills and the northern edge of the Galisteo Basin. The La Bajada fault escarpment and the Cerros del Rio volcanic hills denote the southwestern periphery. The basin is bounded to the west by the Jemez volcanic field; the Brazos and Tusas Mountains form the northwestern boundary. Elevations along the Rio Grande through the basin vary from 1,845 m (6,053 feet) in the north to 1,616 m (5,302 feet) in the south, and altitudes in the surrounding mountains reach 3,994 m (13,104 feet) in the Sangre de Cristos, 3,522 m (11,555 feet) in the Jemez Mountains, and 2,623 m (8,606 feet) in the Brazos and Tusas (Kelley 1979:281).

The Española Basin is centered about the confluence of the Rio Grande and its principal tributary, the Rio Chama (Kelley 1979:281). This juncture is about 18.5 km (11.5 miles) north of the present study area. The principal perennial drainages within the Pojoaque Pueblo Grant are the Rio Pojoaque and the Rio Tesuque, which have their headwaters in the Sangre de Cristo Mountains, 25.6 km (15.9 miles) to the southeast. Both drainages form narrow valleys that range between 400 and 800 m wide. These valleys merge just northwest of Pojoaque Pueblo, at which point the Rio Pojoaque flows west to the Rio Grande.

GEOLOGY

The Rio Grande rift was established during the late Oligocene epoch (ca. 30 million years B.P.) when a cycle of crystal downwarping and extensional faulting succeeded a period of regional uplift (Kelley 1979:281). As the subsidence of the Española Basin proceeded through the Miocene and Pliocene epochs (ca. 3 to 25 million years ago), erosion from the Nacimiento, Jemez, and Brazos uplifts to the north and northwest, and from the mature Laramide Sangre de Cristo uplift to the east, provided most of the sediments for what is known as the Santa Fe group, the prominent geologic unit within the Española Basin. Other sources of sediments of this geologic unit include volcanic fields in the Jemez, Brazos, and Sangre de Cristos (in an area northeast of the Española Basin). Formations within the Santa Fe group, such as the Tesuque formation, consist of deep deposits (over 1 km thick) of poorly consolidated sand, gravel and conglomerates, mudstone, siltstone, and volcanic ash beds (Lucas 1984).

The Española trough was subjected to extensive tilting and faulting during the late Pliocene, after which widespread tectonic stability set in. The resulting geologic structure of the basin is characterized by west-dipping strata traversed by numerous north-trending normal faults. These stratigraphic characteristics, coupled with rapid sedimentation, allowed deposition to reach a maximum depth of 2 km at the western periphery of the basin. The subsequent erosion of upturned beds and elevated scarps has resulted in the highly dissected, rugged topography found in much of the project area (Kelley 1979; Lucas 1984).

A second notable geologic unit found in the vicinity of the project area is the Quaternary Valley and Arroyo alluvium (Lucas 1984). Ortiz Pediment gravels once covered the Tesuque formation of the Santa Fe group; because of extensive erosion, these gravels are now found only on isolated high ridges and hilltops, such as the Las Barrancas badlands area northwest of the Rio Pojoaque and Rio Tesuque confluence (see Kelley 1979:Fig. 1). The Cerros del Rio volcanic field lies along the Cañada Ancha drainage southwest of the project area. This field extends some distance to the west and consists of a variety of volcanic features. The Quaternary Terrace gravels are river gravel deposits that are exposed in the bottoms of the tributary arroyos between the higher piedmont deposits and the lower valley bottom alluvium.

Climate

Latitude and altitude are the two basic determinants of temperature; however, altitude is the more powerful variable in New Mexico (Tuan et al. 1973). In general, mean temperatures decline faster with increased elevation than with increased latitude. Cold air drainage is a common and well-known feature of New Mexico valleys (Tuan et al. 1973). Narrow valleys create their own temperature regimes by channeling air flow: the usual patterns are warm up-valley winds during the day and cool down-valley winds at night. In contrast, shifts in temperature over broad valley floors are influenced by the local relief (Tuan et al. 1973).

Climatic data for the immediate Pojoaque area are unfortunately incomplete (see Reynolds 1956a, 1956b; Gabin and Lesperance 1977). The comparative data presented in the following discussion are taken from the Santa Fe and Española weather stations. The Santa Fe station, which is 24 km south of the study area, is at an elevation of 2,195 m. The Española station lies 12.4 km to the north at an elevation of 1,732 m. These stations, therefore, bracket the study area, which is at an elevation of 1780 m.

The mean annual temperatures reported by the Santa Fe and Española stations are 48.6-49.3 degrees C and 49.4-50.7 degrees C, respectively (Gabin and Lesperance 1977). The climatological data further indicate that the study area conforms to the general temperature regime of New Mexico: that is, hot summers and relatively cool winters.

The average frost-free period (growing season) at Santa Fe is 164 days. The earliest recorded frost is September 12 (in 1898); the latest is May 31 (in 1877) (Reynolds 1956a:251). In contrast, Española reports an average growing season of 152 days, with an extreme first frost date of September 12 (recorded in 1898) and a last frost date of June 6 (in 1927) (Reynolds 1956a:250). The shorter growing season for Española, which is approximately 450 m lower than Santa Fe, may be attributable in part to cold air drainage through the Rio Grande and Rio Chama valleys. Although a frost-free season of 130 days is sufficiently long to allow the growing of most indigenous varieties of maize through dry farming (Schoenwetter and Dittert 1968; Hack 1942), the unpredictability of late spring and early fall frosts creates agricultural risk. The best agricultural strategy is to plant late enough that seedlings will not erupt above the ground until after the last frost, but early enough that they will be able to fully mature prior to the first killing fall frost (Anderson and Oakes 1980).

The lower Española area reports annual precipitation means of 2.37 cm for the period between 1895 and 1929, and 2.41 cm for the years 1938 to 1975 (Gabin and Lesperance 1977:24, 270). Annual precipitation records from these stations, as from much of the northern Southwest, vary greatly from year to year. For example, a maximum of 63 cm of precipitation was recorded in Santa Fe during 1855, compared to a minimum of 12.8 cm in 1917 (Reynolds 1956b). The amount of precipitation is even more variable for any given month in successive years.

Late summer is the wettest season in the annual cycle of the study area, whereas June is one of the driest months. Precipitation records from Santa Fe and Española indicate that more than 45 percent of the mean annual precipitation falls between July and September (Gabin and Lesperance 1977). Although October is drier than September, it is nevertheless the fourth wettest month of the annual cycle in the Española records. Significant precipitation (7.6 percent of the annual total) also falls in Santa Fe during this month. Late summer and fall moisture is derived from the Gulf of Mexico, when air masses from this region push inland to bring the economically important monsoons (Tuan et al. 1973:20). Summer rains tend to be violent and localized. This saturates the ground surface in the beginning of a storm, resulting in the loss of much of the moisture through runoff.

Moisture is also lost through evapotranspiration (ET), the combined evaporation from the soil surface and transpiration from plants when moisture is unlimited (Chang 1959). Mean annual ET loss is 93.2 cm in Española (Gabin and Lesperance 1977), creating a potential annual moisture deficit of 69.1 cm. June, which is a critical time for the germination of plants, suffers the greatest moisture deficits.

The above temperature, precipitation, and potential evapotranspiration data suggest that Pojoaque is climatologically a high risk area for dry-farm agriculture. The dates of the first and last frosts are unpredictable, and frost damage may result in significantly reduced crop yields in some years even though the long-term mean growing season is more than adequate for maize agriculture. Cold air drainage within the valleys increases the risk of frost damage. Precipitation levels are clearly not sufficient to overcome the deficits of potential evapotranspiration, and the amount of precipitation in any given year cannot be predicted from year to year, let alone from month to month. The seasonality of rainfall is a third problem because there may be too much moisture in the early fall when many agricultural plants need to dry for harvesting and storage.

Soils

Soils within the project area fall into two geomorphic groups: soils of the Dissected Piedmont plain and soils of the Recent Alluvial valleys (Folks 1975). The former, which is most common, is largely composed of Pojoaque-Rough Broken Land association. Pojoaque soils are derived from Quaternary period surficial deposits, as well as mixed sandstone, shale and siltstone alluvium of the Tesuque formation of the Santa Fe group (Lucas 1984). These well-drained soils are characterized as moderately sloping to moderately steep (5 to 25 percent), deep, loamy and gravelly deposits that are often covered with lag gravels (Folks 1975:4). Pojoaque soils are intermingled with Rough Broken Land soils and most often occur on the ridgetops between drainages. This soil association is not used for farming today.

Soils of the Recent Alluvial valleys geomorphic group are composed of the El Rancho-Fruitland soil association. These deep, loamy soils, which commonly occur on the low terraces of the Rio Pojoaque and Rio Tesuque drainages within the vicinity of the study area and at the site itself, are derived from Tesuque formation sedimentary rocks and Sangre de Cristo granitic rocks (Folks 1975:3). Slopes range from 0 to 5 percent. This soil association is used today for irrigated crops.

Flora

Pojoaque Pueblo is located in or near three habitat types: piñon-juniper grasslands, dry riparian, and riparian/wetlands. Piñon-juniper grasslands, which support a variety of plant and animal species, are the most common habitat. The characteristic vegetation includes piñon, juniper, prickly pear, cholla, yucca, and several species of muhly and grama grass (Pilz 1984).

The dry riparian habitat occurs in arroyo bottoms, on their banks and in the level to nearly level floodplains adjacent to some of the wider drainages. Some of the more common plants found are rabbitbrush, fourwing saltbush, mountain mahogany, Gambel oak, Rocky Mountain beeplant, and numerous grasses, including Indian ricegrass, three-awn, side-oats grama, and flax (Pilz 1984).

The riparian/wetlands habitat is found only along the perennial streams, such as the Rio Pojoaque and Rio Tesuque. Modern vegetation includes willow, cottonwood, salt cedar, rushes and sedges (Pilz 1984). In the wider valley bottoms, ditch irrigation is practiced.

Fauna

Fauna found within the project area include coyote, badger, porcupine, blacktailed jackrabbit, desert cottontail, spotted ground squirrel, and many species of birds. Mule deer and black bear are known to occur, but in low numbers (Pilz 1984). Use of the area by elk, black and grizzly bear may have been more common prior to the turn of the century (Carroll 1984:2). Plains animals such as bison and pronghorn may have also been present or within a few days access.

CHAPTER 3

Overview of Culture History

STEPHEN C. LENTZ

To place the prehistoric Puebloan developments of the northern Rio Grande (and specifically the Tewa Basin) in perspective, an overview of the developments in the vicinity of the project area is given in the following section.

Chronology

Researchers in the Rio Grande area have perceived the developments in that area as departing from the traditional Pecos classification (Kidder 1927), although developments in the Tewa Basin may have paralleled the Pecos classification more closely than previously thought. As defined here, the geographical boundaries of the Tewa Basin are Tesuque to the south, the northern edge of San Juan Pueblo to the north, along the eastern piedmont of the southern Rocky Mountains to the east, and the west bank of the Rio Grande drainage to the west, not including the foothills of the Pajarito Plateau.

Wendorf and Reed (1955) have redefined the Pueblo I-Pueblo V Pecos classification periods based on the occurrence of ceramic types, changes in settlement patterns, economy, and other characteristics. The principal temporal intervals outlined by Wendorf and Reed include the Developmental, Coalition, and Classic periods.

The Developmental Period (A.D. 600-1200)

The early portion of the Developmental period in the northern Rio Grande dates to between A.D. 600 and 900, and is comparable to the late Basketmaker III and Pueblo I periods of the Pecos classification. Late Basketmaker sites are rare and tend to be small with a ceramic assemblage composed primarily of Lino Gray, San Marcial Black-on-white, and various plain brown and red-slipped wares. The majority of the documented early Developmental sites are in the Albuquerque and Santa Fe districts (Frisbie 1967; Peckham 1984; Reinhart 1967). The settlement of the Rio Grande drainage has typically been attributed to immigration from either the southern areas (Bullard 1962; Jenkins and Schroeder 1974), or from the Four Corners/San Juan area (e.g., Stuart and Gauthier 1981:49).

Within the vicinity of the study area, early Developmental sites are scattered along the Rio Tesuque and Rio Nambe drainages (McNutt 1969; Peckham 1984:276). Based on excavation data, early Developmental habitation sites are small villages of shallow, circular pit structures. The sites commonly feature between one and three pit structures (Stuart and Gauthier 1981:48), and rectilinear surface storage cists are often found in association. These pit structures appear to be more similar to San Juan Anasazi examples than those of the Mogollon, although San Juan architectural "elaborations" such as benches, partitions, and slab linings are absent (Cordell 1979:43).

Sites of the Developmental period tend to be located near intermittent tributaries of the Rio Grande, presumably for access to water and arable land. A preference for elevated settings near hunting and gathering resources is also exhibited, possibly because of their use as an overlook (Cordell 1979, 1989:305).

The transition to above-ground rectilinear and contiguous habitation structures is more apparent in the Santa Fe district (Wendorf and Reed 1955:140). However, McNutt (1969) reports the presence of pit houses in the Red Mesa component of the Tesuque By-Pass site near modern Tesuque Pueblo. LA 835, the Pojoaque Grant site, is a late Developmental community composed of 12 to 15 small room blocks with associated kivas and a Cibola-style great kiva. Ceramics from tree-ring-dated proveniences suggest an occupation between A.D. 800 and 1150. The variety of pottery and other material of nonlocal origin associated with the site suggests that LA 835 may have served as a regional economic center (Stubbs 1954). At the northeast juncture of the Pojoaque Pueblo access road and US 84/285 is LA 61, the ancestral component of Pojoaque Pueblo. The associated site complex consists of an extensive series of prehistoric components and the historic and modern Tewa pueblo of Pojoaque. Pueblo occupation in the area began around A.D. 950 and has continued with occasional abandonment to the present day.

More typical of the Developmental period are the KP site (LA 46300) and LA 103919. At the KP site, located on top of a ridge along the north side of the Santa Fe River valley, a single trash-filled burned structure was tested (Wiseman 1989). The pottery types recovered during testing were Red Mesa Black-on-white, Kwahe'e Black-on-white, "Chaco II" (Red Mesa, Rio Grande variety) Black-on-white, Escavada Black-on-white, Gallup Black-on-white, Chaco Black-on-white, Puerco Black-on-red, Cebolleta Black-on-white, Socorro Black-on-white and Los Lunas Smudged. Obsidian chipped stone predominated, although local chert types, particularly red jasper, were also used. Eleven tree-ring and two radiocarbon dates indicate that the structure was occupied in the mid to late 1000s; the accumulating fill dates into the early 1100s. Dendrochronological cutting dates of A.D. 1116, 1117 and 1120 are associated with the Kwahe'e Black-on-white pottery. A wide variety of plant remains were recovered, including corn, squash, and beeweed. The fauna consisted of deer, antelope, and cottontail (Wiseman 1989:139).

LA 103919, located northeast of LA 101412, is a multicomponent site situated on both sides of NM 503. Although LA 103919 was recorded as a single site, two components (LA 103919 East and LA 103919 West) were defined during excavation and investigated separately. The site contained a small pit structure, two rooms and a possible room, seven human burials, one animal burial, and 39 interior and extramural features. These included thermal features (primarily roasting pits and fire pits), pits, burial pits, historic features, postholes, stain features of unknown function, and a human footprint. Based on the predominance of Red Mesa Black-on-white pottery in the western component, and Kwahe'e Black-on-white pottery in the eastern component (Lentz 2004), it is probable that the western and eastern portions of LA 103919 were not contemporaneous, and date to A.D. 900-1000 and A.D. 1000-1200, respectively,

The Coalition Period (A.D. 1200 to 1325)

The Coalition period (A.D. 1200 to 1325) in the northern Rio Grande is marked by a shift from mineral pigment to organic paint (primarily Santa Fe Black-on-white) on decorated pottery. Substantial increases in the number and size of habitation sites coincide with expansion into previously unoccupied areas. Although aboveground pueblos were built, pit structure architecture continued into the early phases of this period. Rectangular kivas, which are incorporated into room blocks, coexisted with the subterranean circular structures (Cordell 1979:44). Frisbie (1967) notes the shift away from less than optimal upland settings and movement to the permanent water and arable land adjacent to the major drainages.

In the northern Rio Grande, the Coalition period is characterized by two interdependent trends in population and settlement. Whether population growth is due to immigration or indigenous population growth is problematic. The Chama, Gallina, Pajarito Plateau, Taos, and Galisteo Basin districts, which had been the focus of little Anasazi use before A.D. 1100 to 1200, were settled (Cordell 1979), although little growth is seen in the Tewa Basin at this time. In excess of 500 Santa Fe Black-on-white sites are listed for the Pajarito Plateau, although many of these sites are poorly documented (New Mexico Cultural Records Information System [NMCRIS], Archeological Management Section, Historic Preservation Division). Among the representative sites of the Coalition period are LA 4632, LA 12700, and Otowi or Potsuwi'i (LA 169).

The Classic Period (A.D. 1335-1600)

The Classic period (A.D. 1325-1600) postdates the abandonment of the San Juan Basin by sedentary agriculturalists. It is characterized as a time when regional populations may have reached their maximum size, and large communities with multiple plaza and room block complexes were established (Wendorf and Reed 1955). The beginning of the Classic period in the northern Rio Grande coincides with the appearance of locally manufactured red-slipped and glaze-decorated ceramics in the vicinity of Santa Fe, Albuquerque, Galisteo, and Salinas after ca. A.D. 1315, and Biscuit wares in the Pajarito Plateau, Santa Fe, and Chama areas (Mera 1935; Warren 1979a). In the Santa Fe area, the Galisteo Basin saw the evolution of some of the Southwest's most spectacular ruins. Many of these large pueblos were tested or excavated by N. C. Nelson in the early part of the twentieth century (Nelson 1914, 1916). Possibly the first stratigraphic excavation in the United States was conducted by Nelson in the room blocks and the midden of San Cristobal Pueblo (LA 80).

Sites of the Classic period are characterized by a bimodal distribution—large communities associated with small structures, fieldhouses, or seasonally occupied farmsteads. This contrasts with the preceding Coalition period, during which a greater range of site types characterized the settlement pattern. Investigations of the large biscuit ware pueblo sites on the Pajarito Plateau include initial studies by Adolph Bandelier (Lange and Riley 1970), Hewett (1953), and Steen (1977), who recorded sites within Frijoles Canyon including Pueblo Canyon, Tshirege, and Tsankawi.

Several large archaeological projects include Cochiti (Biella and Chapman 1979), a UCLA intensive survey and limited excavation project (Hill and Trierweiler 1986), and a National Park Service survey of Bandelier National Monument (McKenna and Powers 1986).

The biscuit ware series and incised wares were produced in the study area. Beginning with Wiyo Black-on-white (A.D. 1300-1400), the series includes Biscuit A (A.D. 1375-1450), Biscuit B (A.D. 1400-1500 or 1550), and Sankawi Black-on-cream (A.D. 1500-1600) (Breternitz 1966). The appearance of Potsuwi'i Incised about the time that Biscuit B became common suggests contact with the Plains. The Chama Valley and Pajarito Plateau were mostly abandoned by the end of this period, and population was concentrated along the Rio Grande when the Spanish arrived in A.D. 1540.

Native groups underwent numerous changes in lifestyle, social organization, and religion after the Spanish settlement of New Mexico. The introduction of new crops and livestock contributed to major changes in subsistence, as did mission programs which taught new industries (Simmons 1979:181). Incursions by Plains groups caused the abandonment of many pueblos and a constriction of the region occupied by Pueblo groups (Chavez 1979; Schroeder 1979). A combination of new diseases against which the Pueblos had no natural defenses, intermarriage, conflict attendant with the Pueblo Revolt of A.D. 1680-1692, and abandonment of the traditional life for that of the Spanish contributed to a significant decrease in pueblo populations over the ensuing centuries (Dozier 1970; Eggan 1979). The addition of a red slip to Sankawi Black-on-cream was the origin of the Tewa Polychrome series, ancestral to types still produced in the Rio Grande pueblos.

Pojoaque Pueblo

Little is known of the prehistory of Pojoaque Pueblo. Local inhabitants indicate two sites as ancestral to the current pueblo, LA 61 and LA 835. LA 61 is a large site distributed over most of the western half of Pojoaque Pueblo mesa, directly east of the intersection of NM 84/285 and 300 meters south of the Rio Pojoaque. The scatter extends east into the modern Pueblo north of the cemetery and includes rubble mounds, associated plazas and kivas, as well as the old Franciscan church which fell into ruins shortly after the turn of the century and was never rebuilt.

Ceramic types from LA 61, as described by Ellis, consisted of "Chaco II Black-on-white" (probably local or imported Red Mesa Black-on-white), Pueblo II-III corrugated and Tewa Polychrome. Ellis estimated this site to date to between A.D. 1100 to 1300, with "some use in the 18th or 19th century" (Ellis 1979:5-7). The presence of Tewa Polychrome indicates an occupation around A.D. 1550 or 1600 to A.D. 1700. It is now commonly thought that the occupation of LA 61 was relatively unbroken, starting about A.D. 950, and continuing through the Rio Grande late Developmental, Coalition, and Classic periods (approximately A.D. 950 through 1600). Historically, the site was intermittently active from the seventeenth century to modern times.

The other possible Pojoaque ancestral site is LA 835 (the Pojoaque Grant site), located a short distance north of Cuyamungue. LA 835 is a cluster of 15 small mounds, associated pit structures and a great kiva. It was originally excavated by Stubbs (1954), and additional work was undertaken by Wiseman (1995:237-248).

The oldest extant map of the Rio Grande pueblos in 1598 was drawn in 1602 by Enrique Martinez, the King's Mexican cosmographer, on the basis of information provided by Juan Rodriguez, a member of Oñate's party. It shows Pojoaque Pueblo in its twentieth-century locale (Hammond and Rey 1953:1). However, San Gabriel appears to be mislocated.

The first known mention of Pojoaque Pueblo was in 1582 by Antonio de Espejo (Hammond and Rey 1966). Pojoaque Pueblo became the seat of the Spanish mission of San Francisco in the early seventeenth century (Hodge 1910). Bandelier claims that Pojoaque Pueblo (along with those of Tesuque and Nambe) was settled after 1598 by people of Santa Clara, San Ildefonso, and San Juan (Lange and Riley 1970:172). In the early twentieth century, Pojoaque was described as abandoned by Indians (Hodge 1910:274). In 1916, Harrington found no one living there, although he located two Pojoaque families living in Santa Fe, and one family in Nambe. Five houses north of the old church were occupied as late as 1909 or 1910 (Ellis 1979:27). There is also evidence that Pojoaque Pueblo was not occupied between 1912 and 1934, although some Pojoaque Pueblo members may have lived in the vicinity. It is likely that, during the early part of the twentieth century, the population of Pojoaque was severely diminished, and the pueblo itself virtually abandoned. This allowed many settlers to appropriate pueblo land for their private use (Stanley 1965). In the 1930s these individuals were evicted from what had turned into a Spanish-American settlement. Livestock owners were forced to remove their animals from the land, and by 1934 the Pojoaque grant was fenced (Lambert n.d.).

CHAPTER 4

Project History

The area south and east of the intersection of US 84/285 and the road to Pojoaque Pueblo was initially investigated by Stephen C. Lentz (Lentz 1978). A series of test pits determined that much of the area was disturbed and that the cultural material in this area was probably associated with LA 61, the Pojoaque Pueblo site located north and east of the intersection (Lentz et al. 1994:13). A resurvey of the area by Michael P. Marshall identified three sites in this same area, including LA 101412, which lies just west of the area tested by Lentz. Marshall (1993:12) describes LA 101412 as a ceramic and lithic artifact scatter dating from late Pueblo III to early Pueblo IV.

In March and April of 1994, OAS conducted limited testing at the three sites identified by Marshall (Lentz et al. 1994). LA 101411, on the terrace just north of LA 101412, was described as a probable unit house that was extensively disturbed. Two test pits and five auger tests revealed that the site is redeposited shoulder fill containing artifacts (Lentz et al. 1994:13-14). LA 101413, southeast of LA 101412 and described as a ceramic and lithic scatter, was tested through five test pits and 19 auger tests. These revealed that the surface of the site had been removed by mechanical equipment. Subsurface cultural materials were confined to the top 20 cm, and there were no features present (Lentz et al. 1994:13-14).

At LA 101412, Lentz excavated two test pits and 26 auger holes. The first test pit, placed in a concentration of artifacts, was excavated to a depth of 96 cm. Fill is described as (top to bottom): 20 cm of disturbed overburden containing gravel and cobbles; 14 cm of a more homogenous soil, also containing gravel and with an increase in artifacts and charcoal; 25 cm of gravel and sandy loam with decreasing artifact and charcoal densities; and a 35 cm level of homogeneous sandy loam. At the base of the last level was a compact sandy clayey loam interpreted as a possible extramural activity area or use-surface. Findings in the second test pit were similar; the fill between 32 and 105 cm was believed to be intact prehistoric subsurface deposits (Lentz et al. 1994:14).

CHAPTER 5

Research Objectives

Based on limited testing of the site, Maxwell (1994:36-45) proposed a research program aimed at addressing issues of regional settlement and subsistence patterns in the Developmental and Coalition periods. As a Developmental period site, LA 101412 could represent the earliest year-round settlement of this portion of the Rio Grande Valley. During this period, both surface rooms and pit structures were constructed, and change from one architectural form to the other could reflect concomitant changes in social organization and subsistence strategies. Some researchers believe that a shift to surface rooms reflects an increasing dependence on agriculture and the need for specialized food preparation and storage areas (e.g., Gilman 1983). Others feel that the socio-organizational differences associated with surface rooms versus pit structures are the result of increasing population, differentiation and integration of activities, and technological change (Plog 1974). It was hoped that LA 101412 would provide information useful in the study of this transition in living space and of the diversity of activities performed by Rio Grande Valley inhabitants.

In addition, LA 101412 was thought to have the potential to provide information on early subsistence. Paleoenvironmental reconstructions have shown a series of changes in rainfall patterns during this period. Early farmers may have adapted to this type of uncertainty by varying their subsistence pursuits (e.g., Gasser 1982) or by increasingly specialized strategies (e.g., Leonard 1989). Increasing diversity has been attributed to a decrease in agricultural productivity, or human destruction of the environment (e.g., Doebley 1981). Finally, if the activity surface was within an enclosed living space, the data would provide information useful in assessing population size within the valley for future studies.

Specific questions directed toward issues of social organization and the structure of living space include whether the surface represents an outdoor activity area, an enclosed living area, or a pit structure, and what was the function of that living space. Subsistence issues concern the spectrum of foods utilized and their implications for identifying the potential of the local environment for farming, hunting and gathering, or a mixture of both. Additional issues concerning the various artifact categories are outlined in Chapter 10 of this report.

CHAPTER 6

Site Description

LA 101412 is a large artifact scatter situated east of US 84/285 and south of the road to Pojoaque Pueblo. To the north and east are a series of gravel terraces formed by downcutting of the Rio Tesuque. The terrace to the north has been modified to accommodate the road to the Pueblo by filling erosional cuts in the terrace in a number of locations. To the east, the terrace has been cut by an old and abandoned road. The area to the south has been disturbed by mechanical scraping; the area to the west is interrupted by the berm for US 84/825. Site elevations are highest to the northeast: the mapping point rises 1.13 m above the site datum established by Lentz during limited testing. The southeast corner of Area 3B is 0.07 m above datum whereas the same corner of Area 2 is 1.02 m below datum. The southwest corner of Backhoe Trench 5 is 0.43 m above datum whereas the southeast corner of Backhoe Trench 4 is 1.03 m below datum. Thus, the site area slopes down from the northeast to the southwest and from the north to the south.

At the site (Fig. 2), juniper grows at the base of the terrace and in depressions where water collects. Annual grasses, prickly pear, cholla, rabbitbrush, and four-wing saltbush are found throughout the general area.

Figure 2. Overview of LA 101412.

CHAPTER 7

Field Methods

In late July 1994, Stephen Lentz began the data recovery phase by excavating four backhoe trenches (Backhoe Trenches 1-4) within the site area (Fig. 3). Backhoe Trenches 1 and 2 were excavated through the layer thought to represent the occupational surface (hereinafter referred to as the Pojoaque paleosol or the paleosol), and Backhoe Trench 3 was excavated to just above that layer. Overburden was removed from the area between Backhoe Trenches 1 and 2 to above the paleosol. Backhoe Trench 4, perpendicular to and west of Backhoe Trenches 1 and 2, was beyond the paleosol.

Fill in all backhoe trenches was carefully removed by Alley Cat in thin (3 to 5 cm) layers so that any features would not be destroyed. Trenches were one meter wide and varied in length. No features were found in Backhoe Trenches 1-4. A few artifacts were collected during excavations and from the backdirt piles.

In August, four contiguous 1-by-1-m test pits (Test Pits 3-6) were hand excavated adjacent to the north edge of Backhoe Trench 2. All test pit fill was removed in arbitrary 10-cm levels due to the lack of clear stratigraphic breaks above the paleosol. Test pit fill was passed through quarter-inch screen, and all artifacts were collected and bagged by test pit and level. Excavation Unit Forms were completed for each level in each pit. Profiles were generally not drawn because the test pits were adjacent to backhoe trenches which were profiled.

Partway through the excavation of Test Pits 3-6, profiles were drawn of Backhoe Trenches 1 and 2 to help in interpreting the stratigraphy. Based on the observation that artifacts occur primarily in colluvial or washed layers rather than in primary deposits, additional backhoe trenches were excavated. Backhoe Trench 5 was excavated north of Backhoe Trenches 1 and 2. No features or layer corresponding to the Pojoaque paleosol was found. Backhoe Trench 2 was extended 14 m to the east. Excavation in that trench stopped when a cobble-rimmed fire pit was found. Overburden was cleared from above and adjacent to the fire pit, and the remaining 70 cm of fill above the fire pit was hand excavated as Test Pit 7 (1 square meter) in 10-cm levels. The fire pit was excavated and recorded as a feature. A feature form was completed, it was mapped, a profile drawn, and photographs taken. Radiocarbon and flotation samples were collected. The Pojoaque paleosol did not continue as far east as the fire pit, and there was no apparent surface related to the fire pit. Augering through the fire pit bottom indicates that colluvial wash continues for at least 60 cm.

At this point, geomorphologist Dr. Glen Greene was contacted to study and interpret the stratigraphic sequence and history of the site. Backhoe Trench 5 and the extension to Backhoe Trench 2 were profiled, and hand-excavated test pits were placed adjacent to and south of Backhoe Trench 5 (Test Pits 8 and 9), and adjacent to and west of Backhoe Trench 4. When heavy rains interrupted hand excavations at the site, mechanical equipment was used to aid in removing the overburden from large areas of the site (Areas 1-3). Again, fill was carefully removed in thin layers to avoid damaging any features. An additional fire pit (centered in Test Pits 10-13) and a charcoal stain (Test Pits 14 and 15) were located and excavated as features. Large decorated ceramics were the only artifacts routinely collected during backhoe excavations. These could help determine dates for the colluvial washing episodes and could be used to document changes in the Developmental period ceramic types. Other artifacts were out of context and had no chronological value, and were not collected.

The site datum was placed along the right-of-way fence during limited testing of the site. Depth measures are tied into the datum (elevation 0.0 m). A secondary mapping station was established to produce the site map.

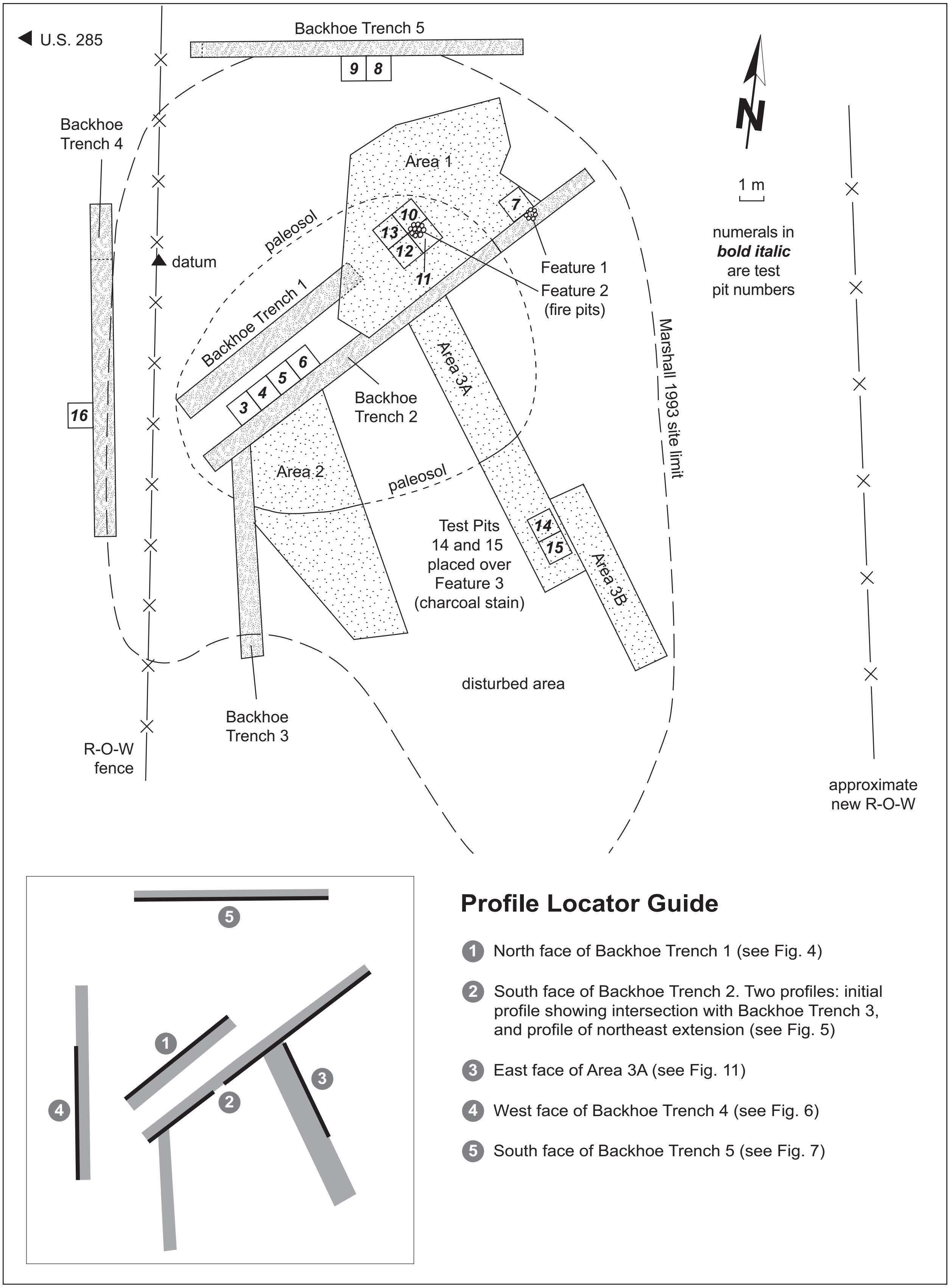

Figure 3. Plan of LA 101412.

CHAPTER 8

Geoarchaeological Assessment

GLEN S. GREENE

A geoarchaeological assessment of Backhoe Trenches 1-5 at Site LA 101412 was made on August 29, 1994. On September 7 and 13, 1994, two additional locations, Area 3 and Feature 2, were examined.

Stratigraphy and Pedology

Setting and Soil Classification

LA 101412 lies at the base of an escarpment adjacent to the Rio Tesuque. This escarpment is composed of the remnants of alluvial fans made up of alluvial and colluvial materials of the Santa Fe group (Chronic 1987:136) that are eroding from the Sangre de Cristo Mountains to the east. The deposits, which make up the alluvial/colluvial materials exposed in the LA 101412 backhoe cuts, are composed of pediment gravels, landslide and slump materials, and terrace-pediment gravels of the Pleistocene and Holocene (New Mexico Geological Society 1982).

Soils of the area, as defined by the Santa Fe Area Soil Survey (Folks 1975:23), fall into the El Rancho-Fruitland complex. Sixty-five percent of the soils of the area are in the El Rancho loam and 35 percent are in the Fruitland sandy loam.

The El Rancho series is classified as an ustic torriorthent of the fine-loamy, mixed (calcareous), mesic family. The Fruitland is classified as a typic torriorthent of the coarse-loamy, mixed (calcareous), mesic family. The suffix "ent" places both soil series in the order entisols. Entisols have little or no horizon expression because they have had little (or no) exposure to the flux-state factors of climate, organisms, parent material disintegration, and time.

Basically, these are young soils that have not had the stability to develop strong soil horizons. The formative element indicates the suborder—"orth" places these soils into the middle of the moisture and texture regime ranges of entisol suborders. The prefix indicates the great group "torri," which denotes a dry, hot moisture and temperature regime. The "ustic" extragrade refers to a hot summer climate and defines the soil's subgroup classification. "Typic" simply means that it is the average representation of that classification (Buol et al. 1989:219-226).

Profile Descriptions

Backhoe Trenches 1-5 were examined, and Backhoe Trenches 1, 2, and 4 selected for profile description. None of the trenches were oriented on a magnetic north/south or east/west axis. Trenches 1 and 2 were approximately parallel and oriented northeast to southwest. Trenches 3 and 4 were oriented approximately north to south, and Backhoe Trench 5 is approximately east to west. Area 3 is perpendicular to and at the eastern end of Trench 2.

Backhoe Trench 1. The section described is four meters from the southeast end of the trench.

STRATUM 1: Ak horizon (0-28 cm); light brown (7.5 YR 6/3 d) sandy loam; structureless; loose noncoherent, nonsticky, nonplastic; very few microvesicular roots; moderately alkaline (pH 7.9-8.4); abrupt clear boundary.

STRATUM 2: Ck horizon (28-84 cm); pink (7.5 YR 7/3 d) sand; structureless; loose, noncoherent, nonsticky, nonplastic; very few microvesicular roots; moderately alkaline (pH 7.9-8.4); abrupt clear boundary.

STRATUM 3: 2Abk horizon (84-102 cm); brown (10 YR 5/3 d) fine sandy loam; weak fine to medium subangular blocky; soft, slightly sticky, slightly plastic; minimal thin colloidal staining on mineral grains; moderately alkaline (pH 7.9-8.4); smooth clear boundary. This stratum is a paleosol, and for the purposes of this report is designated the Pojoaque paleosol. Coarse-textured colluvial features are also evident in this stratum.

STRATUM 4: 2Ck horizon (102 cm to base of trench at 120 cm); pink (7.5 YR 8/4 d) sandy loam; structureless; loose, noncoherent, nonsticky, nonplastic; moderately alkaline (pH 7.9-8.4). Coarse colluvial features do not persist in this lower component.

Backhoe Trench 2. The section described is 14 meters from the east end of the trench.

STRATUM 1: A horizon (0-25 cm); pinkish-gray (7.5 YR 7/2 d) loamy sand; structureless; loose, noncoherent, nonsticky, nonplastic; very few microvesicular roots; moderately alkaline (pH 7.9-8.4); abrupt smooth boundary. No evidence of eluvial processes. Matrix-supported with inclusions of unsorted, unaligned colluvium mainly at surface; stony, cobbly, gravelly, and very coarse sands.

STRATUM 2: C horizon (25-80 cm); pink (7.5 YR 7/3 d) sand to fine sand; structureless; loose, noncoherent; nonsticky, nonplastic; very few very fine tubular roots; moderately alkaline (pH 7.9-8.4); abrupt smooth boundary. There is no evidence of illuvial processes. Deposit is matrix-supported with inclusions similar to those noted above in the A horizon.

STRATUM 3: 2Abk horizon (80-95 cm); brown (10 YR 5/3 d) fine sandy loam; moderate fine to medium angular to subangular blocky; slightly hard, slightly sticky, slightly plastic; very few thin colloidal stains on mineral grains; moderately alkaline (pH 7.9-8.4); abrupt clear boundary. This stratum is comparable with Backhoe Trench 1, and is another expression of the Pojoaque paleosol. The Pojoaque paleosol disappears laterally within 3.5 meters of the east end of this trench. Some of the coarse-textured colluvial features persist throughout the length of the trench.

STRATUM 4. 2Cbk horizon (95 cm to base of trench at 180 cm); pink (7.5 YR 7/3 d) sandy loam; weak fine to medium subangular blocky; very soft, very slightly sticky, very slightly plastic; moderately alkaline (pH 7.9-8.4). Coarse colluvial features do not persist in this lower component.

Backhoe Trench 4. The section described is 7 meters from the north end of the trench.

STRATUM 1: A horizon (0-35 cm); pinkish gray (7.5 YR 6/2 d) loamy fine sand; structureless; loose, noncoherent, nonsticky, nonplastic; very few microvesicular roots; moderately alkaline (pH 7.9-8.4); clear smooth boundary.

STRATUM 2: C horizon (35 cm to base of trench at 80 cm); pink (7.5 YR 8/4 d) sand; structureless; loose, noncoherent, nonsticky, nonplastic; moderately alkaline (pH 7.9-8.4).

Observations

In the LA 101412 deposits exposed in the trenches and in Area 3, the alluvial and colluvial materials represent interbedded multiple stages of high-, medium-, and low-energy deposits. These materials range in texture from very coarse sands to fine and coarse gravels up to cobble size. Because the modern terrace surface on which the site is located is highly colluvial, there is little evidence of size sorting. Microdrainages on the surface of the site, as well as older cut-in fill events seen in modern microscarps, reflect this consistent pattern.

Most of the deposits are unsorted, have some coarse sand with a preponderance of gravel and cobble-sized materials, and are short in length. These represent high-energy events such as runoff following sudden heavy precipitation or fast-melting snow pack. In the few examples of sorted deposits observed, the materials are finer grained and the deposits lengthier, reflecting slower, low-energy events. Both low- and high-energy events occur as lenticular deposits.

Backhoe Trenches 1 and 2 include examples of both high- and low-energy deposition. Near the base of both trenches in Stratum 3, a dark soil component or paleosol is visible. A paleosol is a fossil soil—a zone of stability occurring in past times that allows for the development of some elements of the solum (Retallack 1990:9-19). Climatic and depositional events are stable enough for organic material to accumulate and sufficient enough for an A horizon to develop. At LA 101412, little or no alluvial or colluvial material was deposited upon this surface during this time.

Backhoe Trench 3 is shallow but the subsurface exposure confirms the depositional history of the site. Lying farther from the terrace edge than Backhoe Trenches 1 and 2, the deposits contain predominantly fine-grained materials from low-energy deposition with a few high-energy (cobble sized) events evident. The shallowness of Backhoe Trench 3 precluded confirmation of the paleosol.

There is minimal evidence of high-energy deposition in Backhoe Trench 4, again a factor of the distance from the terrace edge. The paleosol was not observed in Backhoe Trench 4—although this may be a factor of the trench depth, the author (Greene) believes that the paleosol does not extend into the area of Backhoe Trench 4. There were two ashy deposits observed in the trench, both in Stratum 2 and above the position of the paleosol observed in Backhoe Trenches 1 and 2. These are lenticular—horizontally short and vertically thin. Both may be the remains of localized grass or brush fires.

Two fire pits were observed, one within Backhoe Trench 2 (Feature 1), another (Feature 2) just to the north of Backhoe Trench 2, and a charcoal stain (Feature 3) in Area 3A. The base of Feature 2 is 11 cm above the paleosol as measured in the south wall of Backhoe Trench 2. The profile drawn by the excavators shows the base of the fire pit to be approximately 20 cm from the paleosol upper limit. The top of the fire pit in Backhoe Trench 2 is 10 cm above the top of the paleosol as measured in the south wall of Backhoe Trench 2. The top of the Area 3A stain is 20 cm above the top of the paleosol as measured in the exposed east wall of Area 3A. All three of the features are slightly above the upper limits of the paleosol, but only within a margin of 10 to 20 cm. The paleosol surface (or any surface for that matter) is not an absolute plane. The present surface, for example, has undulations of significant variation. Given the small elevational distances involved here, there is a strong possibility that these features are manifestations of the prehistoric culture that sometimes occupied the Pojoaque paleosol.

Synthesis of Site Sedimentary History

The following sequence of events is proposed to explain the sedimentary history of site LA 101412.

Event 1. Alluvial fan deposition during the latter half of the Quaternary and the Holocene is responsible for the alluvial/colluvial, rounded and angular, sorted and unsorted material found in the site.

Event 2. Erosion of the alluvial fan at the location of the site included both high- and low- energy colluvial events.

Event 3. At some time in the prehistoric past, colluviation was interrupted and there was a period of climatic and floristic stability. This resulted in an accumulation of organic material deposited upon a stable surface, and soil-forming processes occurred. At least an A horizon developed—designated as the Pojoaque paleosol. At some time in the site history, human occupation occurred on this surface, as evidenced by the fire pits resting only very slight elevations above it and possibly intruding into it in two instances.

Event 4. The surface was buried by subsequent erosional deposition and a paleosol was formed.

Event 5. Colluviation continued at the site into modern times.

Event 6. Modern road building and drainage alteration have interrupted the natural patterns of colluvial deposition at the site.

In conclusion, prehistoric occupation of the site probably first occurred during Event 3. Because cultural materials have been recovered in the colluvium overlying the Pojoaque paleosol, occupation may have occurred on the site after formation of the paleosol. Further, some of these materials mixed into the colluvium may be the result of downslope erosion from archeological sites located on the terrace above the site.

CHAPTER 9

Excavation Units

Backhoe Trenches

Backhoe trenches were one meter wide and varied in length. Fill was removed in thin layers to expose any features that might be present. Artifacts were generally not collected, except for large decorated sherds that could be used for chronological and typological analyses.

Backhoe Trench 1

Backhoe Trench 1 was located at about the center of the site area and oriented northeast to southwest. It was just over 8.0 m long and fill removed varied from between 0.35 and 1.85 m below datum. At ground surface, the east end of the trench was 36 cm below datum, and the west was 63 cm below datum. Fill (Fig. 4) consisted of five layers which roughly correspond to those defined by Greene.

Layer 1. The upper 20 to 40 cm was a loosely consolidated sandy loam with sparse charcoal, occasional pea-sized and larger gravel, and many fine rootlets throughout.

Layer 2. This layer was 25 to 40 cm of alternating bands of sand and gravel. Some lenses had primarily larger cobbles (3 to 5 cm), and others had peas-sized or smaller gravel. In some areas bands were distinct, but other areas were more like one big churned lens. Charcoal and artifacts were present within the gravel lenses, as were a number of clay wash lenses.

Layer 3. This layer, considered by Greene to be the same as Layer 1, was 20 to 45 cm of predominantly sandy clay with occasional pockets of gravel and charcoal flecks.

Layer 4. Clean sandier fill with a fine smooth texture and some gravel pockets. This layer is present only at the west end and was 10 to 20 cm thick.

Layer 5. At the base of the trench was the Pojoaque paleosol, a hard gray-brown clay with occasional charcoal flecks.

Backhoe Trench 2

Backhoe Trench 2 was oriented northeast to southwest approximately 1.5 m south of Backhoe Trench 1. The initial portion was 7.5 m long, and fill removed was between 0.20 and 2.15 m below datum. The northeast extension of Backhoe Trench 2 was 14 m long. Because the northeast corner of the trench was so high, 0.95 m above datum, the fill removed from the extension ranged from 0.95 m above to about 1.4 m below datum. Five layers of fill were observed (Fig. 5).

Layer 1. Upper fill, removed from much of the original part of the trench by backhoe, was loosely consolidated sandy loam up to 28 cm thick with fine rootlets.

Layer 2. This was the colluvial layer consisting of up to 1.0 m of fill with numerous lenses of small gravel and fewer lenses of larger gravel, clay wash, and clean, sometimes laminated, sand. Occasional charcoal flecks up to 2 cm in diameter were scattered throughout with a slight concentration at the east end. Artifacts were present throughout this layer.

Layer 3. Below the colluvium, the Pojoaque paleosol was visible from the west end to just over 7.0 m from the east end of the trench, and ranged from 5 to 25 cm thick. At 6 to 7 m from the east end of the trench, it became two distinct layers separated by a brown clay with darker gray clay at the base. The paleosol was hard-packed and individual charcoal flecks could not be distinguished. The color was more mottled and the lens less distinct in the central and more eastern portions of the trench. No artifacts were observed in this lens.

Layer 4. Beneath the paleosol was 20 to 55 cm of hard-packed brown fine sand or clay with a very small amount of lensed gravel near the Backhoe Trench 3 intersection. Occasional very small flecks of charcoal were present with dispersed nodules of precipitate near the base.

Layer 5. A small amount of a very smooth-textured hard brown clay was found in the deepest portion of the trench at the west end. An auger test placed in the bot-

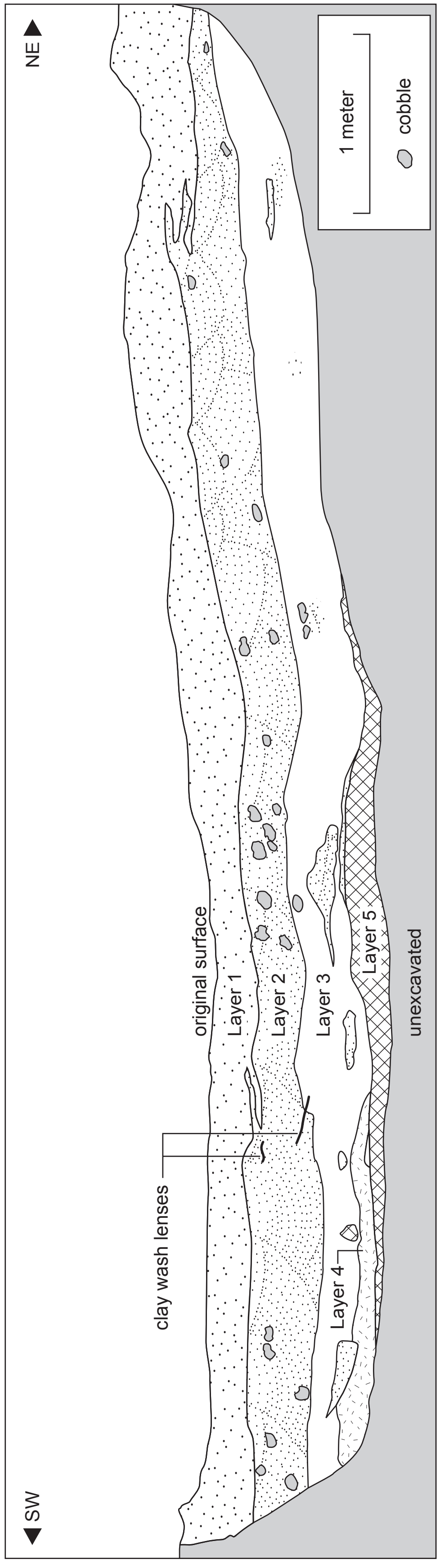

Figure 4. Profile of Backhoe Trench 1 (north face).

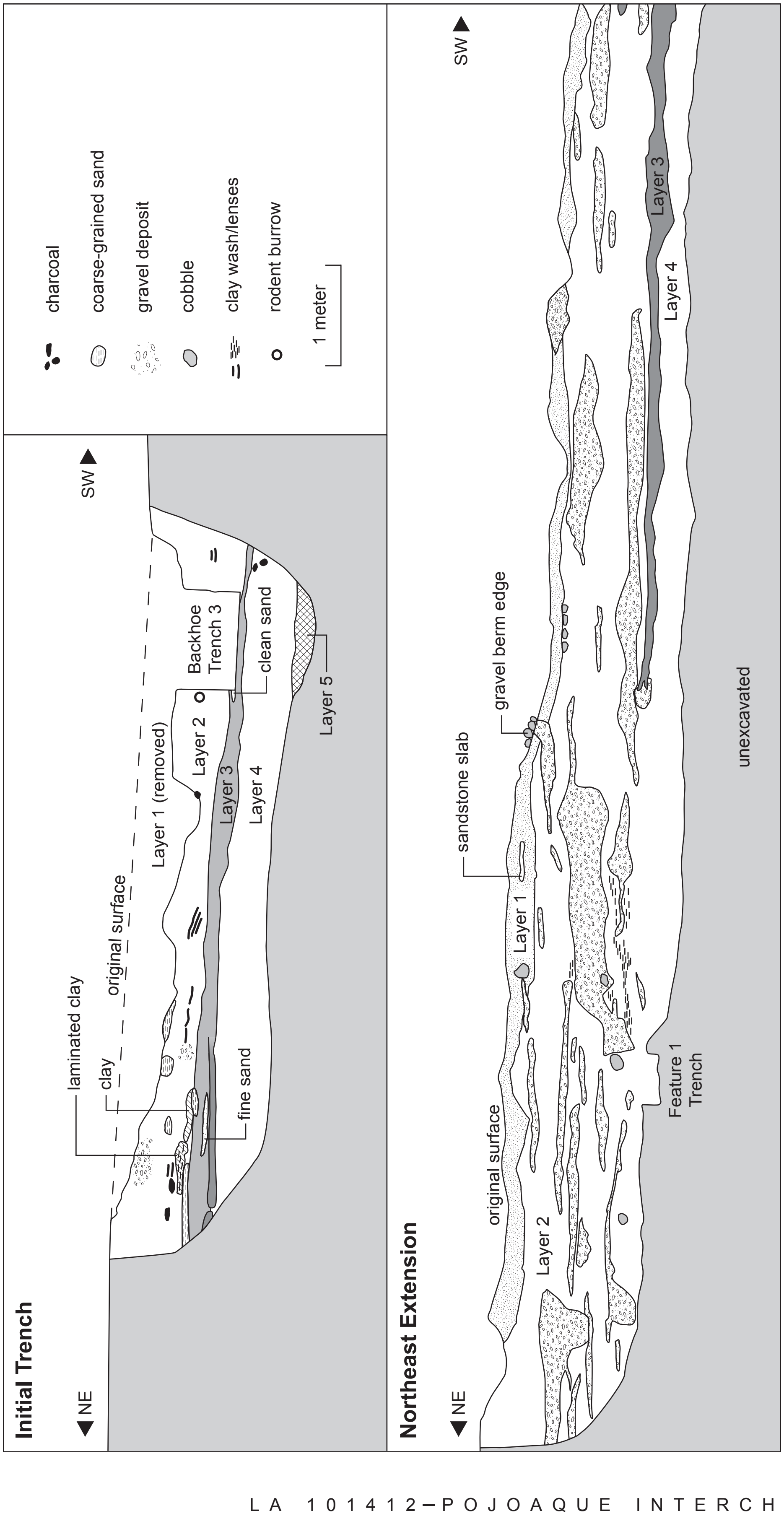

Figure 5. Profiles of Backhoe Trench 2 (south face)

tom of Feature 1, approximately 3.5 m from the east end of the trench, indicated that sandy clay with only scattered pieces of gravel extends down at least 60 cm (approximately 1.55 m below datum).

Backhoe Trench 3

Backhoe Trench 3 extended south from near the west end of Backhoe Trench 2. It was shallow, only 50 cm deep, and terminated at the top of the paleosol. Fill was essentially the same as in Backhoe Trenches 2 and 4. Upper unconsolidated soil was removed by backhoe so that only the upper colluvial layer remained. This trench was not profiled because only one stratum was exposed.

Backhoe Trench 4

Backhoe Trench 4 was oriented north to south just inside (west of) the US 84/285 right-of-way fence. It was almost 12 m long and fill was removed from between 0.45 and 1.7 m below datum (Fig. 6).

Layer 1. Upper fill consisted of the usual 10 to 30 cm of loose sandy loam with rootlets. It was difficult to distinguish this layer from Layer 2.

Layer 2. Brown, loosely consolidated sandy clay, 30 cm deep with isolated gravel and gravel pockets, moderate amounts of charcoal, and occasional artifacts. Greene considered Layers 1 and 2 to be a single stratum.

Layer 3. Between 4 and 6 m south and at the base of Layer 2 was a charcoal lens consisting of sandy clay with chunks and powdered charcoal.

Layer 4. Beneath the charcoal lens was a 5-to-20-cm-thick gravel lens composed of fine gravel with a few larger cobbles and containing sherds and charcoal.

Layer 5. This layer consists of 30 to 40 cm of loose brown sandy clay with pockets of gravel and a fair amount of charcoal and artifacts.

This trench is apparently beyond the extent of the paleosol. The paleosol lies at approximately 0.95 m below datum in the west end of Backhoe Trench 2, and the base of Backhoe Trench 4 reached a depth of 1.7 m below datum. The stratum ended, as indicated on the site map (see Fig. 3), with the edge curving northward in Area 2.

Backhoe Trench 5

Backhoe Trench 5 lies as far north as was possible to excavate without removing a stand of juniper. The trench was oriented almost east-west and was just over 14 m long. Fill was removed from between 1.08 cm above datum and about 1.5 m below datum. The surface along the trench varied from 43 cm above datum at the west end to 1.08 m above datum at the east end. Fill (Fig. 7) was similar to that observed in the other trenches.

Layer 1. The upper 10 to 30 cm was loosely compacted sandy loam that occurred in finely laminated lenses alternating with larger-grained sand to fine gravel at the west end, and was more irregular at the east end.

Layer 2. This is the colluvial layer, which in this case consists of a number of distinct lenses composed of various sizes of gravel. Pockets of laminated clay occur within this lens, as do artifacts, isolated pieces of charcoal, and two more concentrated lenses of charcoal. Again, the paleosol is not found in this trench. Two auger tests placed in the base of the trench encountered sandy loam and gravel. Both auger tests were placed in the bottom of the deepest portion of the trench. The first was terminated at 35 cm when a rock stopped the auger. The other was ended at the maximum extent of the auger, 85 cm below the trench bottom (approximately 2.0 m below datum).

Test Pits

All test pits were excavated in arbitrary 10-cm levels, and fill was screened through quarter-inch mesh. Excavation generally terminated once sterile fill was reached (usually the paleosol). Test Pits 1 and 2 were excavated during the testing phase of this project (Lentz et al. 1994).

Test Pits 3-6

Test Pits 3 through 6 were contiguous 1-by-1-m pits adjacent to the north edge of Backhoe Trench 2. Some of the overburden had been removed from above the pits by backhoe, more from the western units than the eastern. Thus, Test Pit 3, the farthest to the west, had less fill remaining above the paleosol than the pits to the east. The paleosol slopes down to the west (Table 1). Artifact

Table 1. Characteristics of Test Pits 3-6.

	Test Pit Number			
Characteristic	3	4	5	6
Beginning elevation	1.39 m	0.91 m	0.76 m	0.64 m
Ending elevation	1.79 m	1.61 m	1.46 m	1.35 m
Top of paleosol	1.65 m	1.60 m	-	1.35 m
Number of levels	3	7	7	7
Level with most artifacts	1	3	2	2 and 3
Total ceramics	24	199	344	403
Total lithics	6	54	86	133

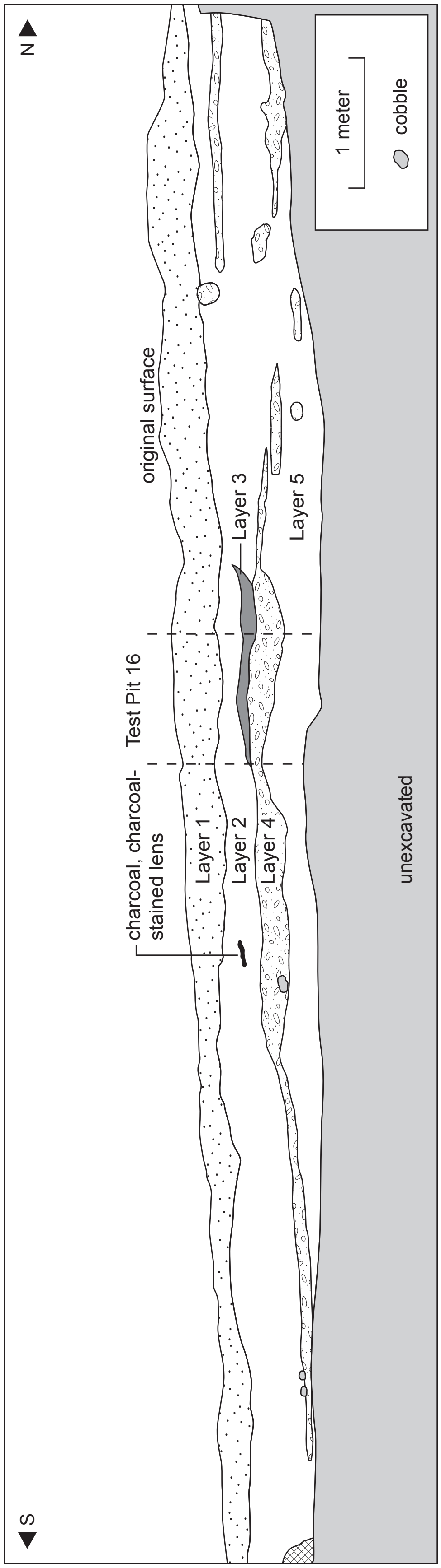

Figure 6. Profile of Backhoe Trench 4 (west face).

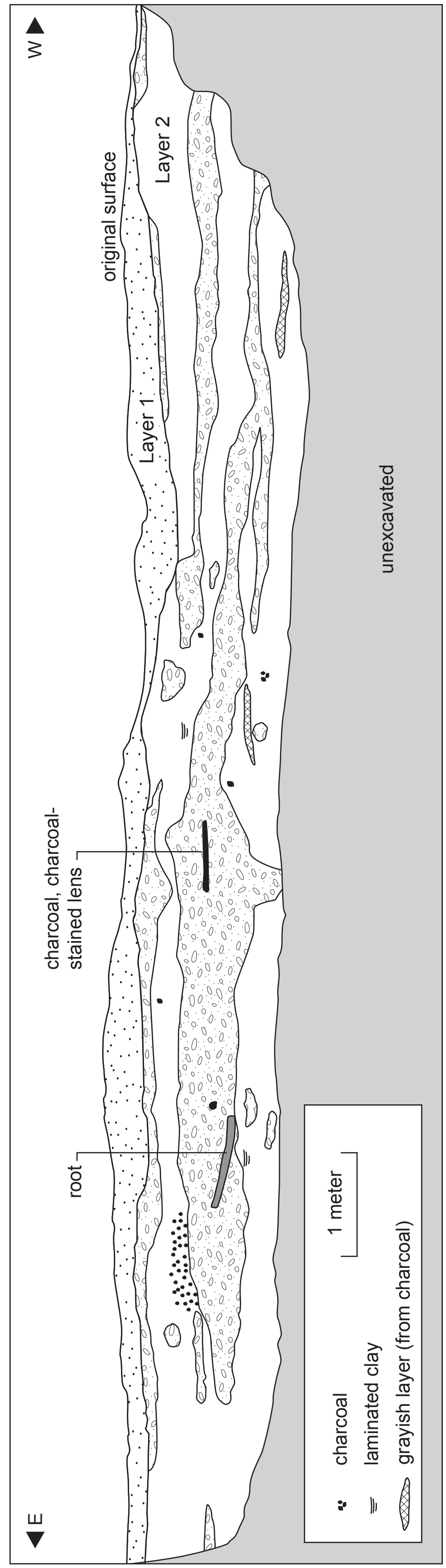

Figure 7. Profile of Backhoe Trench 5 (south face).

densities increase from east to west and are greatest between about 0.80 and 1.20 m below datum. Densities decrease with depth, and artifacts essentially disappear in the paleosol. The few artifacts recovered from the paleosol layer were found in rodent burrows or pockets of gravel. In these test pits, the uppermost fill contained mainly Coalition period ceramics, mostly Santa Fe Black-on-white. These overlaid strata containing developmental period ceramics.

Test Pit 7

Test Pit 7 was placed over the fire pit discovered in Backhoe Trench 2. Overburden (about 80 cm) was removed by backhoe, and a 1-by-1-m grid established along the north edge of Backhoe Trench 2. Seven 10-cm levels of fill were removed from the test pit (0.23 to 0.93 m below datum). The edge of the fire pit appeared in Level 6.

Sediment throughout the trench was the colluvial stratum (Fig. 8). Much of the grid was occupied by a large colluvial channel (Fig. 9). The deposit outside the channel was loose to moderately compact clayey sand grading into sandy clay. Charcoal was present near the rock comprising the fire pit but no discernable use-surface remained. Artifacts at the level of the fire pit were from the gravel-filled channel rather than being associated with the matrix into which the fire pit was excavated.

Artifact densities were much lower than in Test Pits 3-6. Stratigraphy rises in this area and it is possible that the denser deposits were removed as overburden by the backhoe. Ceramics from this test were nearly all from the Developmental period and consistent with the A.D. 910 radiocarbon date (Beta-82887) of the fire pit.

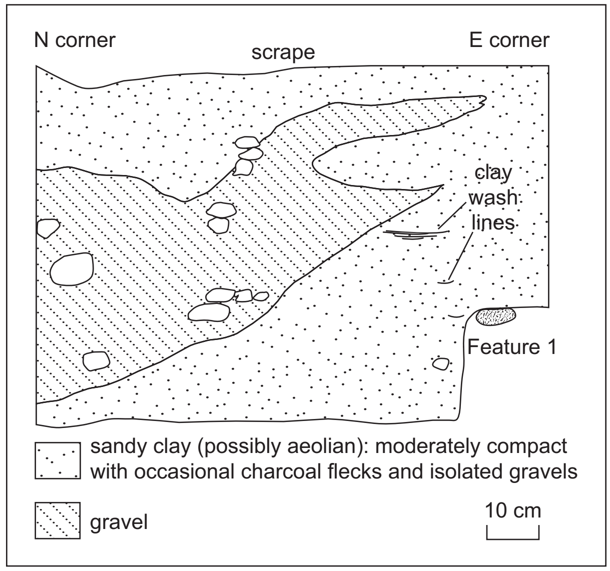

Figure 8. Profile of Test Pit 7 (northeast wall).

Figure 9. Colluvial channel above Feature 1.

Test Pits 8 and 9

Test Pits 8 and 9, adjacent 1-by-1-m units, were placed along the south edge of Backhoe Trench 5 over the charcoal lens revealed at the center of the trench. Because of the slope, the subdatum (in this case the southeast corner) for Test Pit 9 was 10 cm higher than that for Test Pit 8. Partway through the excavation of these pits, heavy rain completely filled the backhoe trench leaving a thick layer of clay and washing out the subdatum stakes. Consequently, there was a hiatus of about 25 cm after Level 3 in Test Pit 9 and Level 4 in Test Pit 8 due to soil being washed away and removed in conjunction with the clay wash. Test Pit 9 was excavated from 80 cm above datum to about 65 cm below datum; Test Pit 8 was excavated from 70 cm above datum to about 45 cm below datum. The charcoal lens was centered at 10 cm below datum. In Test Pit 8, the charcoal concentration was a discontinuous ephemeral stain about 3 cm thick and extending 10 cm into the grid from Backhoe Trench 5. Several heat-fractured lithics were recovered from the area, suggesting a possible activity area. In Test Pit 9, the stain appeared in the northeast corner after the flood-deposited clay was removed from the pit. It was fairly ephemeral and thinned out within a few centimeters. A flotation sample collected from the charcoal lens contained burned goosefoot, purslane, and corn. Fuel was local brush, including saltbush with fruit and juniper branches. Excavation was terminated before the base of the backhoe trench was reached. The fill was too wet to continue and the prospects for it drying slim and long term.

Artifact densities were greater in these pits than in those to the south: over 400 ceramic sherds were recovered from the first level of fill in Test Pit 8. Densities decreased with depth until the hiatus, then increased in the vicinity of the charcoal stain. Ceramics found in these pits are a mixed assemblage with an appreciable amount of Biscuit A, which gradually decreases with depth. Even the basal level contained a mix of Classic and Coalition period sherds.

Test Pits 10-13

Test Pits 10 to 13 were superimposed over Feature 2, a fire pit exposed during the backhoe clearing of Area 1. One level of fill was removed from Test Pits 11 and 12, and three levels from Test Pit 10, enough to expose the rim of the fire pit. Six levels were removed from Test Pit 13 to determine how the feature relates to the paleosol. Fill was removed from between 47 and 66 cm below datum in Test Pit 10, between 50 and 63 cm in Test Pit 11, between 52 and 56 cm in Test Pit 12, and between 0.61 and 1.24 m in Test Pit 13. No definable occupational surface was associated with the feature, although small clayey patches among the rock in Test Pit 11 and in the northwest corner of Test Pit 13 could be the remains of an activity surface. Unfortunately, the fragility of the colluvial deposits above and below the fire-pit rim prevented any surface from being preserved. Fill above and at the level of the fire-pit rim was sandy silt and gravel. Some gravel was in pockets and definite channels. In Test Pit 13 (Fig. 10), fill was alternating layers of loose colluvial sand, silt, and colluvial gravel overlying the paleosol. Placement of the fire pit over a gravel channel indicates that it was built in a period of active cutting and filling. An auger test in the bottom of the grid revealed that the paleosol was about 10 cm thick and overlaid at least 20 cm of a less compacted red silt that had no charcoal or other cultural material.

Only Test Pit 13 contained ceramic and lithic artifacts. These extended from Level 2, above the rim of the fire pit, to Level 6, which contained both gravel and paleosol. An obsidian thinning flake lay directly on the paleosol. Ceramics were from the Developmental through Classic periods with a mix of Coalition and Developmental at the base. The Coalition sherds are consistent with the A.D. 1220 radiocarbon date (Beta-82888) for this feature.

Test Pits 14 and 15

Test Pits 14 and 15 were placed over a stain exposed by the backhoe in Area 3A (Feature 3). One level of fill was removed from Test Pit 14 (61 to 71 cm below datum), and three from Test Pit 15 (58 to 88 cm below datum). The stain was diffuse with shifting edges. Fill above and at the level of the stain was sandy clay with some gravel lensing. A gravel channel interrupted the stain and bottomed out in Level 1 of Test Pit 15. A gray soil, probably a remnant of the paleosol, was present in portions of Level 2 and in Level 3. It was grayer from more charcoal content at the top of the layer and graded into brown so that only the upper 2-3 cm was real gray, and this was dispersed and irregular rather than a band or layer. Because the profile of fill in Area 3A indicates that the paleosol thinned and stopped about 4 m north of Test Pit 15, near the end of the profile, the paleosol may occur in patches outside of the main concentration indicated in Fig. 3. Artifacts, especially ceramics, were numerous in the level of and just below the stain, and continued into the upper 5 cm of the clay layer. Ceramics in these pits are largely Coalition period wares.

Test Pit 16

Test Pit 16 was adjacent to the west edge of Backhoe Trench 4 above a concentration of charcoal noted in the profile (see Fig. 6). Eight levels of fill, ranging from 67 to 145 cm below datum, were removed before excavation was stopped by standing water in the bottom of Backhoe Trench 4. Fill was similar to that reported for the site in general. On top was the loose sandy clay loam with occasional small gravels and extensive rootlets, overlying brown sandy clay with some isolated gravels and moderate amounts of charcoal. In Level 4, the charcoal lens consisted of a dispersed stain in a layer of sandy clay with scattered small pieces of gravel. Charcoal density increased in the next level with small concentrations 3 to 4 cm thick but not uniform or dense enough to be considered a feature. Beneath this was a major gravel layer with sizes ranging from pea-sized to larger (10 to 20 cm) cobbles. Charcoal was sparse and scattered in the gravel. Beneath the gravel was a brown sandy clay with scattered charcoal flecks and a marked decrease in cultural material. Ceramics were mostly Coalition wares with some Developmental-Coalition mix near the base.

Areas

Areas are portions of the site where considerable amounts of fill were removed by backhoe in search of features. Fill was carefully removed in 1-m-wide swaths 3 to 5 cm thick.

Area 1

Area 1 (roughly 6 by 10 m) was north of and adjacent to Backhoe Trench 2. It removed the east end of Backhoe

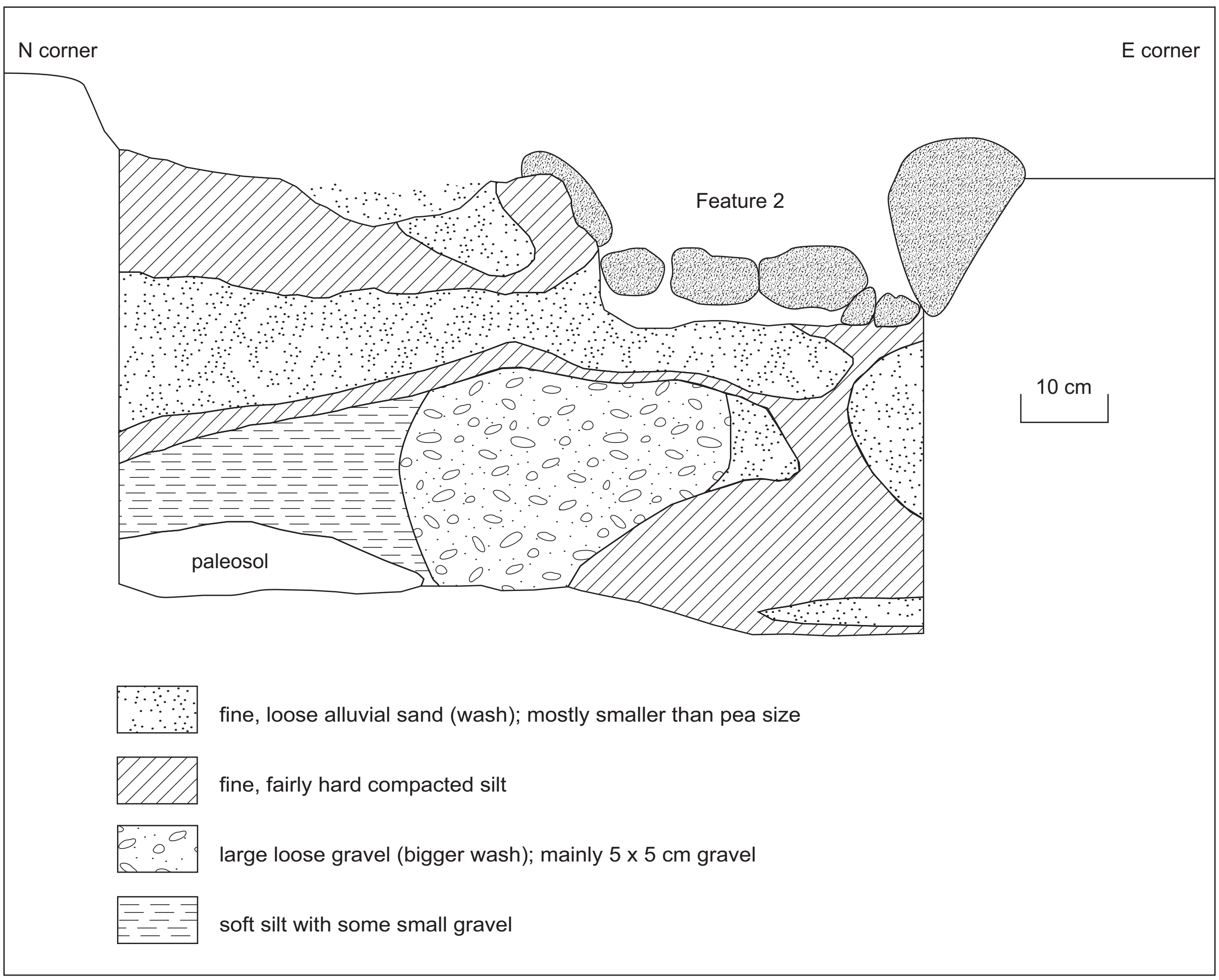

Figure 10. Profile of Test Pit 13 (northeast wall).

Trench 1 and extended just past Test Pit 7 to the east. Backhoe excavation in the west half was terminated when a fire pit (Feature 2) was discovered. The east half was taken down another 15 to 20 cm, but no features were found. Fill removed by the backhoe ranged from between 55 and 93 cm above datum to between 66 and 81 cm below datum in the east half. The west-half fill ranged from 64 cm above datum to 52 cm below datum.

Area 2

Area 2 extended about 10 m south from the west end of Backhoe Trench 2, and 4.5 m east of Backhoe Trench 3. About 40 cm of fill was removed down to the level of the paleosol, which ended approximately 4 m south of Backhoe Trench 2. No features were found.

Area 3

Area 3 was divided into 3A and 3B. Area 3A was a trench 2 m wide and 12 m long that extended south from Backhoe Trench 2 at about the center. Area 3B was about 1.5 m wide and 8 m long, and began just west of the stain found in Area 3A. Area 3A was excavated to 30 to 50 cm below datum or just below the paleosol until the paleosol thinned out 6.9 m from its intersection with Backhoe Trench 2. The remainder of the scrape was 30 to 40 cm shallower. It was in this more shallow area that Feature 3, an amorphous stain, was found. No features were found in Area 3B. Fill in Area 3A was essentially the same as found elsewhere at the site (Fig. 11).

Layer 1. Alternating bands of large-grained sand, aeolian sand, and clay wash lenses.

Layer 2. Thick band of sandy clay; very hard with a platy texture.

Layer 3. Colluvium with alternating bands of gravel and sand or silt. Artifacts seemed to come from the gravel lenses rather than the sand

Layer 4. The paleosol was generally diffuse with indistinct boundaries.

Layer 5. Similar to Level 3 but with less banding and little gravel.

Features

Feature 1

Feature 1 (Fig. 12) is the fire pit found in the extension of Backhoe Trench 2. The fire pit was roughly circular and 60 to 65 cm in diameter. The rim was formed by about 30 cobbles in a somewhat irregular pattern (Fig. 13), due to a partial collapse and sliding downslope. The north and west edges of the fire pit were intact.

Charcoal was densest in and around the cobbles with small amounts in the feature fill. Pit walls were unlined and the sides and bottom were not distinct from the surrounding colluvial fill. Fill was brown sandy clay with scattered charcoal, some of which was identified as saltbush or greasewood. A ceramic, white mineral or precipitate, and flotation and radiocarbon samples were collected. The rim was at 0.71 m below datum, 1.37 m below ground surface. Feature 1 appears to represent an expedient fire pit consisting of a ring of rock, possibly with a slight depression, and only a small fire.

A radiocarbon date of 1040 ± 60 B.P. (A.D. 910) (Beta-82887) is consistent with Developmental period ceramics found at the base of several of the test pits. Material recovered by flotation gives few clues to the use of this fire pit. The only nonwoody taxa were unburned seeds from widespread species, including goosefoot and purslane, which are probably intrusive.

Feature 2

This fire pit was between about 50 and 75 cm below datum in Area 1, and was roughly circular with an interior diameter of 71 cm, an exterior diameter of 93 to 95 cm, and a depth of 15 cm (Fig. 14). It was lined with about 50 cobbles embedded in a layer of clayey fill. Cobbles were ovoid and upright along the south and east edges, less regular elsewhere (Fig. 15). Those lining the bottom range in size from 3 cm to over 20 cm in diameter. All of the cobbles were sooted. The southwest edge of the fire pit was disturbed, possibly by rodents, and no cobbles remained in place. Several cobbles were split and spalled from heat, and there was abundant charcoal in the fill. A small area of soil to the southeast of the fire pit appeared burned. Upper fill of the fire pit was a colluvial sandy clay with isolated pieces of charcoal and gravel. Lower fire-pit fill was a fine sandy silt with diffuse charcoal giving it a gray color. Also present were burned twigs of saltbush or greasewood. Ceramics and lithic artifacts, and flotation and radiocarbon samples were collected from the fire pit fill. The radiocarbon sample (Beta-82888) dates to 730 ± 60 BP (A.D. 1220). Flotation analytical results were again disappointing, revealing only unburned intrusive seeds.

This fire pit was more substantial than Feature 1. It was completely lined with heat-spalled stones, and appears to have been used for a greater duration, and more effort was put into its construction. Fuel woods were the same in both features, probably reflecting the availability of fuel resources.

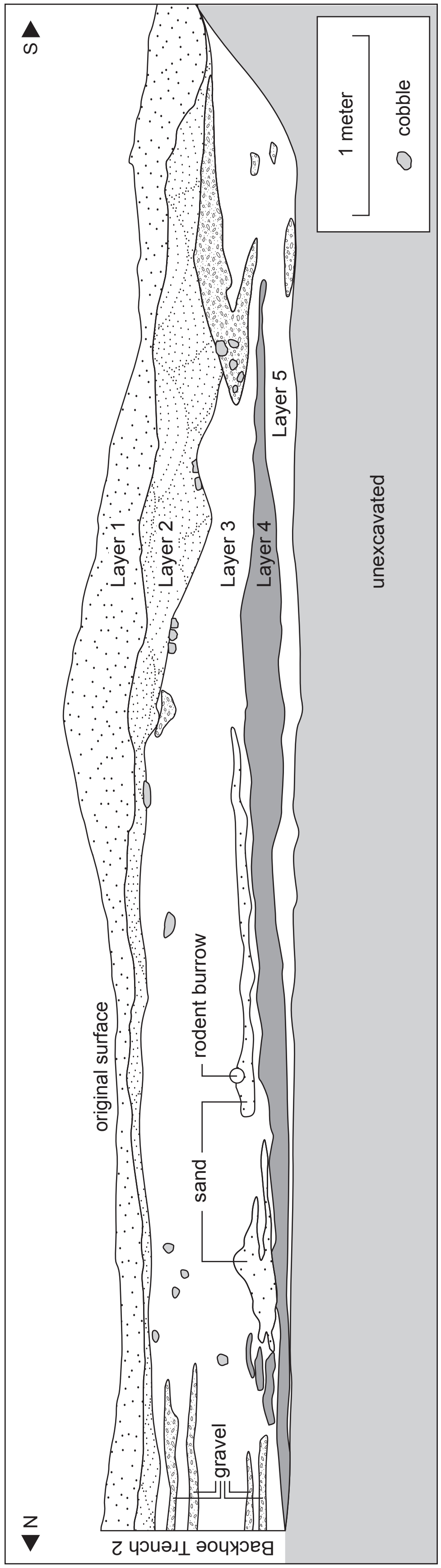

Figure 11. Profile of Area 3A (east face).

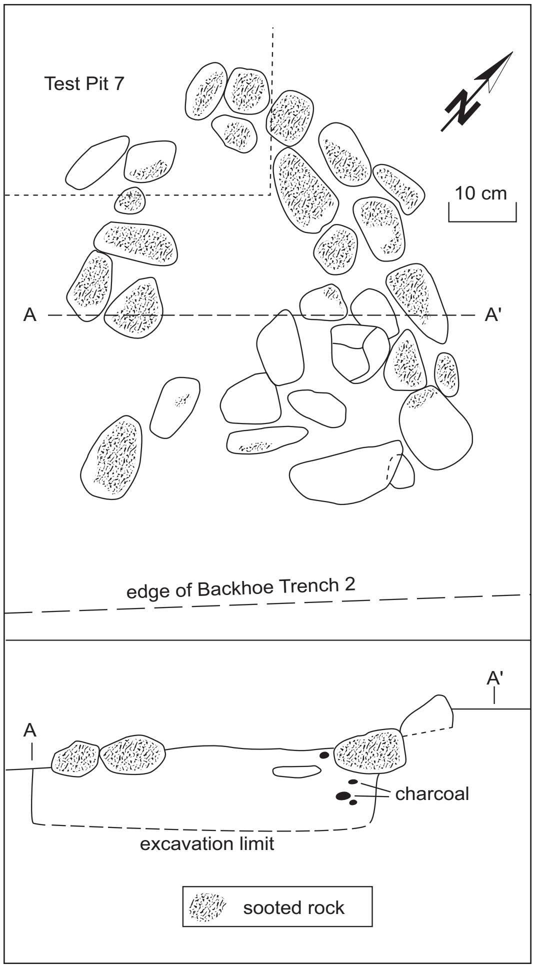

Figure 12. Plan of Feature 1.

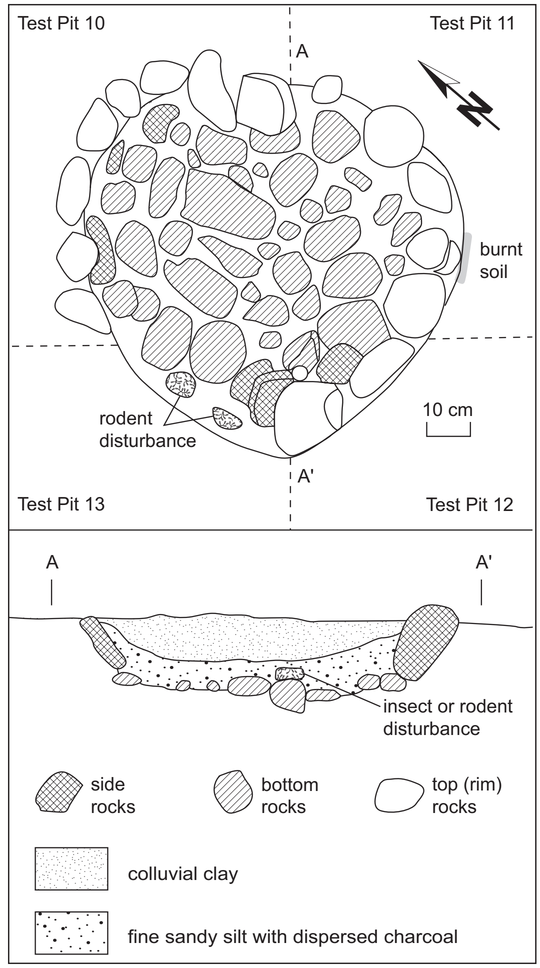

Figure 14. Plan of Feature 2.

Figure 13. View of Feature 1.

Figure 15. View of Feature 2.

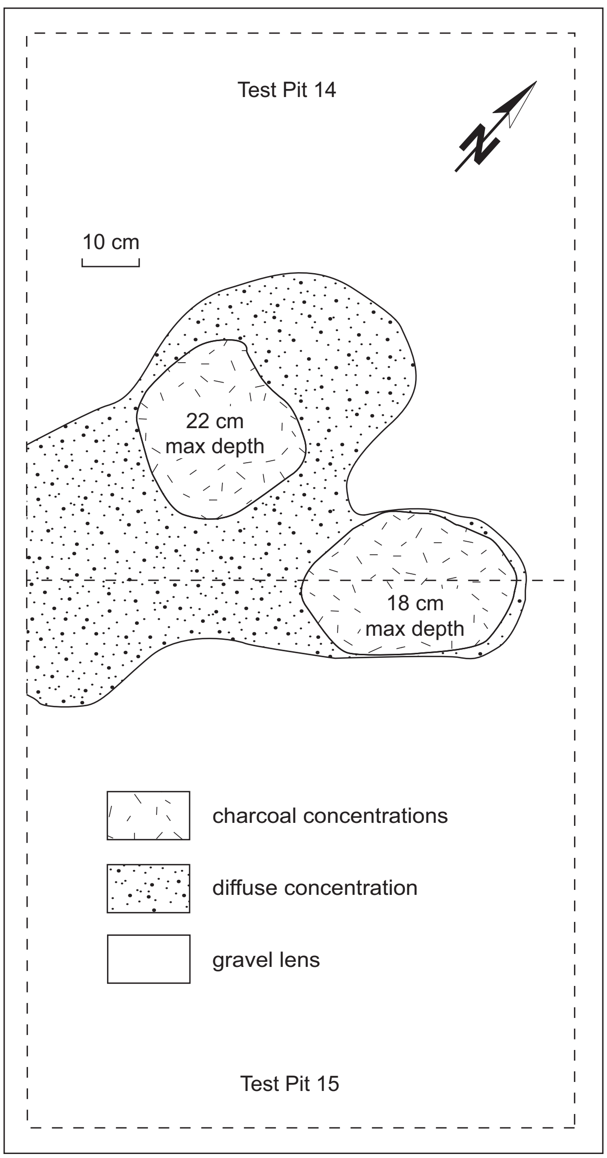

Figure 16. Plan of Feature 3.

Feature 3

Feature 3 was the charcoal stain found in Area 3A at about 60 cm below datum. It consisted of an amorphous scatter of charcoal 70 by 90 cm in size and up to 6 cm deep (Fig. 16). A gravel lens surrounds the stain and suggests a fire was built without cobbles or other indications that it was a formal feature. Fill was dark and sandy with pea-sized gravel. Charcoal chunks were present throughout but there was no sign of spalled rock or burned earth. Ceramic and lithic artifacts, and flotation samples were recovered from the stain. The flotation sample contained carbonized goosefoot, pigweed, and saltbush or greasewood charcoal.

CHAPTER 10

Artifact Analyses

Ceramic Analysis Methods, Approaches, and Categories

C. DEAN WILSON

This section discusses methods and categories employed during the analysis of 6048 sherds recovered from LA 101412. Data from this analysis form the basis for characterizations of ceramic assemblages and examinations of ceramic trends discussed elsewhere in this volume. The resulting ceramic data are used to date different contexts and examine various issues. Issues addressed during the present study include the influences of local material resources on the ceramic technology, recognition of interaction and exchange of vessels between Anasazi groups in different areas, and the determination of activities associated with various vessel forms.

Methods of Analysis

The variety of ceramic data recorded included associated provenience assignments, descriptive attributes, typological categories, counts, and weights. Recording associated field specimen numbers (FS) links ceramics to a specific provenience. Sherds from each FS exhibiting the same combination of typological and descriptive attribute codings were separated into discrete groups. These groups are assigned a specific lot number, which associates these sherds with a distinct descriptive data set. Sherds grouped into a lot are placed in the same bag, and are accompanied by a slip noting site, FS, and lot number associated which each group of sherds. The total count and weight of each lot is also recorded.

Attribute Analysis

Descriptive attributes recorded for all sherds include temper, paste profile, pigment, surface treatment, slip, vessel form, and modification. Information concerning refired paste color and decorative styles was recorded during a separate analysis of selected sherd samples. A sample of 30 sherds was also submitted for petrographic analysis.

Temper. Temper categories were determined by examining freshly broken sherd surfaces through a binocular microscope. Temper, as defined here, refers to aplastic particles intentionally added to the clay, or natural clay inclusions serving the same purpose as added temper. Temper categories reflect distinctive combinations of color, shape, size, fracture, and sheen of observed particles. Because it is often impossible to differentiate rock types based on microscopic analysis, temper categories can refer to visual characteristics rather than to specific rock and mineral classifications. Still, temper categories indicate a range of characteristics that may identify sources used within a specific area or region. Cases where the basic type or source of temper could not be determined were assigned to an Indeterminate category.

Granite with mica refers to the dominant temper type occurring in Tewa Basin gray ware sherds. This category reflects the use of combinations of local alluvial clays and crushed igneous river cobbles. Even without microscopic examination, sherds with this temper are easily recognized by the presence of numerous mica fragments visible through the vessel surface. Crushed rock fragments are relatively large and subangular to subrounded. These particles are usually white but occasionally are clear, light gray, or pink. Rock fragments sometimes contain mica or black inclusions. Gray wares with similar temper from nearby LA 103919 were subjected to petrographic analysis (Hill 2003). These samples were identified as having crushed granite that could come from either the Sangre de Cristo Mountains or from local stream cobbles or gravel deposits, weathered from Sangre de Cristo granites. Similar temper dominates local utility ware from sites in the Tewa Basin dating to most of the Anasazi occupation of this area (McNutt 1969; Wilson 2004).

Although the majority of the utility wares contain temper previously described as Granite with mica, sherds with similar temper were placed into separate categories based on the absence or dominance of mica fragments. Sherds with very similar temper but without mica were assigned to a Granite without mica category. Another category, differentiated by the presence of extremely high frequencies of mica, may reflect the intentional addition of crushed mica. Sherds displaying this combination of temper are classified as Highly micaceous. Another variety was coded as Mica schist and is distinguished by the presence of similar fragments that tend to be smaller and more abundant. This temper is associated with a very black paste and is similar to the granite schist used in the Tijeras Canyon area (Warren 1980a:156).

Fine tuff or ash (local igneous) refers to the presence of fine volcanic fragments presumably derived from local pumice, ash, or tuff deposits. This category consists of small, clear to light, or dark vitreous, angular- to rod-shaped particles with light-colored dull pumice particles. The presence of tuff or ash particles may reflect either the use of self-tempered, ash-derived clays or the intentional addition of crushed or weathered tuff or ash to the clay. Petrographic analysis indicates the use of self-tempered clays derived from volcanic ash.

Variation in particles noted in this temper has been used to define several different types of igneous tuff or ash deposits potentially indicative of different areas of origin (Warren 1979a). It was not possible to consistently make such divisions during the present study, although some attempt has been made to distinguish varieties of tuff or ash. Sand and fine tuff or ash refers to the presence of local volcanic temper with small sand particles probably representing natural clay inclusions. Similar temper with distinct black fragments was classified as Fine tuff and ash with black fragments. Sherds with tuff temper with the addition of finely crushed potsherds were assigned to a Tuff with sherd category. Large tuff fragments consist of large, poorly ground tuff fragments that appear as clusters of puffy white fragments. Sand with large tuff fragments refers to combinations of distinct sand grains and tuff fragments.

Sand refers to rounded or subrounded, well-sorted sand grains. These grains are translucent, or white to gray in color and may be frosted. This category is distinguished from sandstone temper by the presence of large even-sized quartz grains, and the absence of matrix. Some of the sand-tempered ceramics identified during the present study were most likely produced in the Cibola (or Chaco region) of the Colorado Plateau. Pastes with sand grains and high amounts of mica were assigned to a Sand with mica category, which could represent the use of local sand derived from micaceous granite. Sandstone temper exhibits similar grains along with angular matrix fragments. Grains derived from sandstone are usually smaller than those found in sand temper. The occurrence of sandstone grains with mica fragments resulted in the recognition of a Sandstone with mica category.

Andesite-diorite and sand refers to fragments from either crushed andesites or diorites along with sand grains. This category represents the predominant temper used by Anasazi potters in most of the Northern San Juan or Mesa Verde region (Wilson and Blinman 1995b). It is possible, however, that some of the sherds assigned to this category represent variations of volcanic material found in the Rio Grande region. This category is characterized primarily by angular to subangular lithic particles that are clear to milky white and sometimes reddish in color. Small, black, rod-shaped crystals are present, and may occur individually or within the larger particles. Leucocratic igneous refers to a the use of similar igneous rock without distinct crystalline structure. Tempering fragments consists of light particles only.

Basalt refers to the presence of homogenous greenish, gray, or black colored angular rock fragments representing the use of crushed basalt. Scoria refers to reddish basalt fragments.

Sherd refers to the use of crushed potsherds as temper. Crushed sherd fragments appear white, buff, gray, or orange in color. These fragments are often distinguished from crushed rock tempers by their dull nonreflective appearance. Fragments of tuff, however, may be similar in appearance. Small reflective rock particles may be included inside or outside the sherd fragments. In some cases, the presence of fairly large particles along with crushed sherd may indicate the addition of both crushed rock and sherd. In cases where both sherd and distinctive rock fragments occur together, the combination of the two materials was noted. Examples of such categories include Sherd and sand, Tuff or ash and sherd, Sherd and tuff or ash with black fragments and Crushed sherd and andesite-diorite. Unfortunately, petrographic analysis indicated that some of the sherds classified as having crushed potsherd temper actually contain tuff particles. Many of these sherds were reexamined, and in many cases could not be visually discerned from sherds tempered with crushed potsherds. Thus, it should be emphasized that some of the sherds classified here as having crushed sherd temper may actually contain tuff fragments.

Paste color. Cross-sections of ceramic paste colors reflect combinations of clay sources and firing conditions. Vessels fired in reduction atmospheres tend to exhibit dark paste profiles. Those fired in low oxidizing or neutral atmospheres are usually light gray or white. Profiles of oxidized vessels are usually reddish or yellow depending on the iron content of the clay. Variation in paste color profiles may differ in assemblages from different Anasazi regions. Paste color categories were subdivided by ware groups. Paste color attributes recorded during the present study include Dark gray to black, Light gray to white, Distinct dark core, Reddish or oxidized, and Light brown categories.

Pigment type. Pigment categories refer to the presence, surface characteristics, and color of painted decorations on all surfaces. Most pigments were divided into organic (or carbon) and mineral pigment groups based on previously described characteristics (Shepard 1963). Pigment types on unpainted sherds were simply recorded as None. Sherds with evidence of a pigment that could not be identified were assigned to an Indeterminate group, as were cases in which remnants of an organic binder was present but the original pigment type could not be determined.

Mineral pigments are made from finely ground minerals, usually iron oxides, that are applied as powdered compounds, often with an organic binder. The pigment appears as a physical layer, and exhibits surface relief. Mineral pigments obscure surface polish and irregularities. Firing atmospheres affect the color of iron-based mineral pigments. Neutral or reduction atmospheres produce black pigments, while oxidizing atmospheres result in reddish pigments. Mineral pigment categories identified during the present study include Mineral black, Mineral brown, and Mineral red.

Organic pigments refer to the use of organic or vegetal pigments only. Organic paint is absorbed into the vessel surface. Streaks and polish are often visible through the paint, and painted surfaces are often lustrous depending on the amount of surface polishing. Decorations in organic pigment may be gray, black, bluish, and occasionally orange in color. The edges of the painted designs range from sharp to fuzzy, depending on paint density. Faded organic pigments were assigned to a Diffuse organic category.

Glaze pigments contain a fluxing agent such as lead that results in a vitrified or glassy appearance. Glaze pigments are often very thick and runny. Glaze pigments fire to black, green, brown or yellow.

Slip and polish. Slip refers to the intentional application of a distinctive clay, mineral, or organic layer over a vessel surface. Such applications were used to achieve black, white, or red surface colors, usually not obtained with local paste clays and commonly employed firing methods. Categories used during the present study also denote the presence of surface polishing. Polishing implies continual rubbing with a very smooth stone to produce a compact and lustrous surface. The presence of a slipped or polished surface is often used to distinguish unpainted white ware sherds from gray wares. When treatment could not be recognized because of spalled or weathered surfaces, Missing surface category was used. Cases in which the type of slip could not be determined were described as Unknown. Unslipped but polished sherds were assigned to a Polish, no slip category.

Slipping is most commonly represented on Anasazi pottery by the use of low-iron, light-colored clays that are subsequently polished. White wares with a distinct low-iron clay slip were classified as Polished white clay slip. Those exhibiting a thin streaky slip were assigned to a Polished white wash category. Red wares with distinct high-iron slips were coded as Polished red clay slip. Micaceous slip refers to a glittery surface produced by the application of a layer of finely ground mica. Polished smudged refers to the intentional application of black carbon deposits during the firing process to the polished interior surfaces to produce a black lustrous effect.

Vessel form. Observations of sherd shape and surface manipulation provide clues concerning the form and use of associated vessels. Vessel form classification is usually dependent on sherd size, manipulation, and vessel portion. The consistent placement of sherds into form categories provides for basic functional comparisons of different sherd assemblages. It is usually possible to assign rim sherds to more specific categories than body sherds.

Indeterminate refers to cases in which vessel form is unknown. Bowl rim refers to sherds exhibiting inward curvature from the rim, indicating that they derived from bowls. Bowl body refers to body sherds with interior polishing or painted decoration, indicating that they came from bowls.

Most of the sherds identified during the present study are unpolished body sherds for which the precise vessel form could not be determined. Bowl or jar body refers to body sherds that could have originated from either of these forms. Bowl or jar rim refers to small rim sherds without enough shape to determine if they derived from either bowl or jar forms. While most unpolished gray body sherds were assigned to a Jar body category, some of these could have derived from bowls. Body sherds were assigned to this category only if they exhibited evidence of painting or polishing on the exterior surface only. Jar neck includes nonrim jar sherds with curvature, indicating that they were derived from necked jars. Cooking/storage jar rim refers to rim sherds derived from jars with relatively wide rim diameters. Such rims are often associated with vessels used for cooking or storage. This form is distinguished from other jar rim forms by a wide orifice relative to vessel size. Miniature jar refers to jar sherds from vessels too small to have been used for activities normally associated with this form. Miniature forms probably served in ritual contexts or as toys.

Ladle handle refers to elongated solid or hollow handles attached to a bowl to form a ladle. Various forms of attached and unattached handles were also recognized. Categories recorded for handles include Single coil handle, Jar body with lug handle, Jar body with handle, Indeterminate coil handle, Indeterminate strap handle, and Handle.

Modification. Modification refers to evidence of postfiring alteration, including abrasion, drilling, chipping, or spalling. Data concerning such treatments provide information about use, repair, and shaping of sherds and vessels. Modification categories combine information concerning the size, shape, and associated wear patterns of a modified sherd. Most sherds analyzed did not exhibit postfiring modifications and are coded as None. Drilled hole for repair refers to the presence of drilled holes used to mend vessels by tying vessel fragments together. Repair holes are usually located within two centimeters of an old break. Beveled edge refers to the presence of one or more abraded edges resulting from the intentional shaping of a sherd. Rounded sherd edge refers to the presence of a sherd edge rounded through beveling. Ground circular form refers to small rounded, shaped items. Sherds with evidence of abrasion from use were assigned to a Rim wear category.

Rim measurements. Larger rim sherds were also measured. Rim radius refers to the projected radius of a particular sherd determined using a circular diagram showing curvature of various radius sizes. This category conveys additional information concerning vessel function. Rim arc refers to the total amount of curvature of the sherd, and may ultimately provide information concerning relative number of vessels represented. Arc is measured using the same diagram used to determine rim radius.

Stylistic analysis. Attributes were also recorded for white ware rim sherds assigned to formal types. Attributes recorded include wall thickness 1 mm from rim, rim profile, rim decoration, degree of polish, design orientation, and design motifs.

Refired color. Refired paste color was recorded for a sample of 111 sherds. This analysis was performed on small sherd clips fired in an oxidizing atmosphere to a temperature of 950 degrees C. Refiring samples under these conditions standardizes the effects of both previous firings and the presence of organic material on paste color (Franklin 1980; Shepard 1939, 1963; Windes 1977). This provides for a general comparison of clay sources based on the influence of mineral content, particularly iron, on refired color. Refired sherd colors were recorded using Munsell Book of Color categories. Sherds firing to a particular color could have originated from a number of sources, but this technique may help to identify local clays and assist in the recognition of nonlocal ceramics.

Typological Categories

Sherds were assigned to typological categories based on combinations of traits known to have spatial, functional, or temporal significance. Type assignments result from the determination of tradition, ware group, and ceramic type.

While stylistic similarities between ceramics from separated regions may reflect widespread interaction and communication between different groups, differences in paste and temper often reflect the distinct geology of each region. Recognition of ceramic traditions involves the separation of pottery into broad groups indicating region of origin or "cultural" association, and is often used to examine exchange of vessels between groups in different regions. Sherds from LA 101412 were assigned to ceramic traditions defined for the northern Rio Grande and Colorado Plateau regions based on temper, paste, and paint characteristics.

Most of the sherds examined during the present study represent northern Rio Grande types. Ceramics exhibiting traits indicating they could have been produced at LA 101412 or nearby sites in the Tewa Basin were assigned to local northern Rio Grande or Tewa tradition types. These types dominate sites throughout the Tewa Basin, which includes much of the area presently occupied by the six modern Tewa-speaking pueblos from Tesuque Pueblo in south to San Juan Pueblo in the north. This is roughly equivalent to the area sometimes referred to as the Española Basin or Española district (Lang 1982). The Tewa Basin includes the area along the Rio Grande between Velarde and Tesuque, including the Santa Cruz, Pojoaque, Nambe, and Tesuque valleys. This area encompasses the eastern and southern portions of the physiographic feature designated the Española Basin, and is bordered by the Jemez Mountains to the west and the Sangre de Cristo Mountains to the east.

The combination of geographic boundaries and distinct geological formations contributed to the long-lived production of a distinct pottery tradition in the Tewa Basin. This tradition began with the arrival of ceramic-producing groups in the tenth century, and continues with the pottery produced by modern Tewa-speaking Puebloan groups. The distinct resources and technology used in this area allow for the recognition of types produced in other Anasazi regions. The assignment of early local pottery types to a Tewa tradition or series does not necessarily imply that the earliest Anasazi inhabitants of the Tewa Basin spoke Tewa or were even the direct ancestors of modern Tewa groups. It does, however, imply a long continuum of pottery development and resource use in this area. The typology of the local northern Rio Grande tradition includes gray wares tempered with granite and mica, and white wares exhibiting dark pastes, fine tuff and ash tempers, and design styles associated with this area of the northern Rio Grande.

Intrusive pottery from other regions in the Rio Grande and in the Colorado Plateau were identified by variation in paint type, pastes, tempers, and design styles. Earlier white wares from regions in the Colorado Plateau exhibit light-colored blocky pastes indicating the use of clay from sedimentary sources. Pottery from the Chaco or Cibola regions usually contains sand, or sherd and sand, temper. Ceramics originating in the San Juan are tempered with andesite or diorite. Later intrusive types at LA 101412 are mainly glaze ware types produced throughout the Rio Grande Valley south of Santa Fe. Production areas of glaze wares can sometimes be determined by distinctive combinations of clay and temper known to have been employed in different areas of the Rio Grande Valley (Shepard 1942; Warren 1969, 1980b).

Sherds were assigned to ware and type categories associated with various regional ceramic traditions. Ceramics were placed into gray, white, red, brown, glaze, or indeterminate ware categories based on paint type, surface color, decoration, and polish. Gray ware refers to unpainted and unpolished utility vessels usually fired in reduction or neutral firing atmospheres. This category can include sherds lacking paint but derived from painted, unpolished white ware vessels. White ware refers to painted and/or polished vessels fired in a reduction or neutral or low-oxidizing atmosphere. Red wares refer to polished and/or painted ceramics with high iron pastes that are fired in a oxidizing atmosphere. Brown wares refer to alluvial clays fired in low oxidizing atmospheres to produce brown surfaces. Brown wares are unpainted and often polished or smudged, and most appear to represent intrusive ceramics from the Mogollon Highlands to the southwest. Glaze wares refer to distinct pottery decorated with glaze paint that was produced south of Santa Fe from A.D. 1300 to 1700. Even unpainted sherds from glaze wares are easily recognized by various combinations of red and white slips, and evidence of firing in an oxidation atmosphere.

Sherds were assigned to specific type categories based on temporally sensitive manipulations, painted designs, or textured treatments. Categories employed during recent analyses include descriptive types previously defined for various regional traditions of the northern Rio Grande and Colorado Plateau (Hawley 1934; Kidder 1931; McKenna and Miles 1990; Mera 1935), as well as more recently employed descriptive types (Wilson and Blinman 1995b). Formal type categories include a geographic name followed by a ware designation (for example, Santa Fe Black-on-white). Because of the difficulty in applying previously defined types to all sherds in an assemblage, descriptive categories indicating surface treatments or decorations were also used. Examples of descriptive category names employed during this analysis include Indented Corrugated and Unpainted White.

During the present study, more type categories were used than are often employed in studies in this area. Despite the high number of categories recognized, it is easy to group comparable types used here into those defined in other studies. Implicit in these typological categories is information relevant to the examination of various issues. For example, the assignment of sherds into distinct dated types provides for the examination of temporal trends. The classification of sherds into spatially sensitive traditions allows for the examination of issues concerning production, interaction, and exchange. Ware categories may be used to examine functional trends. Ceramic typological categories recognized during the analysis of ceramics from LA 101412 are described below. Because different materials and technology were used in the production of different ware groups, typological categories for each ware group are presented separately by regional traditions.

Gray Ware Categories

Paste and temper characteristics indicate that the great majority of the gray ware sherds recovered from LA 101412 could have been locally produced. Very low frequencies of intrusive gray wares, however, were also identified. Paste and temper characteristics form the basis for distinguishing nonlocal gray ware types, as sherds belonging to all the ceramic traditions exhibit similar ranges of surface treatments and manipulations. Most gray ware types are unpolished on both surfaces, and the temper often protrudes through the surface. The great majority of gray ware sherds with various textures are derived from cooking or storage jar forms. Exterior surfaces are often dark gray or black from sooting during cooking. Gray wares belonging to various regional traditions were assigned to different type categories based on surface texture.

Northern Rio Grande gray (mica-tempered) tradition. While gray utility ware sherds dominate most sites in the Tewa Basin, only a few types have been formally defined. In previous studies, gray wares displaying a wide variety of surface treatments were often lumped into two or three types. Because of the great number of textures noted in the utility wares at LA 101412, a large number of gray ware type categories were recognized during the present study. This approach allows for the documentation of the variability associated with local gray wares.

Most utility ware sherds from LA 101412 exhibit paste characteristics similar to those from other Tewa Basin sites. These sherds are easily distinguished from nonlocal utility wares by the presence of abundant mica fragments in the paste. Microscopic examinations of gray ware sherds with these distinct mica fragments indicate the use of local mica-bearing clay sources and granite temper.

Warren (1979b) discusses the "micaceous" utility ware of the northern Rio Grande region. She defines micaceous pottery as that exhibiting visible mica flecks on the surface, and recognizes three varieties based on the probable source of the mica fragments (Warren 1979b): ceramics with a mica slip applied to the surface; ceramics made with residual clays with mica fragments; and ceramics tempered with rock containing mica.

It is unclear whether Warren would include some of the earlier gray wares containing mica into this group, as she gives a beginning date of about A.D. 1300 for micaceous utility ware. Her definition of micaceous pottery, however, seems to include gray wares associated with all temporal occupations. Examinations of local clay and temper resources in the Tewa Basin indicate that mica fragments are present in most local clays and temper sources utilized during all occupations. The addition of mica slips represents a later innovation (Warren 1979b).

The earliest "micaceous" types were described as reflecting the use of crushed local mica-bearing cobbles as temper (Warren 1979b). Examination of pottery from Developmental and early Coalition period sites indicates the continuation of similar temper beginning during the early tenth century (McNutt 1969; Mera 1935; Wiseman 1989). The geographic area dominated by micaceous gray wares expanded, and by the Classic period included much of the Rio Grande region (Mera 1935). While the temper particles in Classic period gray wares are similar to those found in earlier gray wares, there appears to have been an increase in the total frequency of mica particles. This may reflect a shift to clay sources with higher amounts of mica inclusions, or the addition of crushed mica, sometimes as a slip, to local utility wares. Still, it is important to note that despite shifts in resource use or processing, basic construction and firing technology have been fairly consistent for a millennium in the Tewa Basin. While it may be desirable to limit the term "micaceous utility wares" to Classic period types that exhibit the highest mica content, these technologies are part of a long regional tradition beginning with Developmental phase pottery. The authors feel that all local gray wares with distinctive mica flecks should be assigned to northern Rio Grande mica-tempered gray ware tradition types. This tradition includes the earlier mica-containing gray wares produced in the Tewa Basin as well as the later "micaceous" and mica-slipped gray wares found throughout the northern Rio Grande region. Because paste composition was fairly consistent, gray ware pottery produced during different periods is often defined by variation of surface texture and manipulation. Because a wide variety of treatments were employed during various periods, many of these types may occur at components associated with several temporal periods.

In general, mica inclusions in sherds from LA 101412 and nearby sites reflect the use of crushed granite and micaceous clays (Hill in prep.). Mica grains are commonly visible on the surface, and the largest particles consist of white, gray, or pink fragments. Other local tempers noted in low frequencies include fine tuff or ash, tuff or ash and sand, large tuff fragments, and crushed igneous with olivine fragments.

Paste colors in cross-sections in most of the gray wares from LA 101412 are dark gray to black. Very low frequencies of sherds vary from this trend. Surfaces colors are black, gray, brown or red. Pastes consistently fire to red or yellow-red colors when exposed to oxidation conditions. Paste textures tend to be relatively soft, porous, and silty. Sherds break and crumble easily in an uneven and blocky texture.

Sand-tempered gray wares. The presence of rounded sand particles without mica was used to distinguish sherds belonging to gray ware traditions associated with other areas of the Rio Grande, as well as a wide area of the Colorado Plateau. Sand-tempered utility wares produced during the earlier Rio Grande occupations often exhibit light pastes, which are virtually absent in the local "micaceous" utility wares. Sand or sandstone temper may occur in gray wares produced in the Pecos area. Some of the sand-tempered sherds are associated with earlier occupations of the Cibola region of the Colorado Plateau.

Gray ware type categories. A range of surface treatments and textures was noted in the gray ware sherds from LA 101412 (Fig. 17). Gray ware sherds exhibiting various paste compositions were assigned to type categories based on surface texture. The types identified reflect various surface treatments associated with Developmental, Coalition, Classic, and historic period gray wares. Surface treatments include plain, neckbanded, corrugated, and ridged exterior textures, and smudged polished surfaces.

Plain gray ware vessels with completely smoothed surfaces are common at Rio Grande sites dating to all phases. Plain gray body sherds may be derived from plain surface vessels, or from the lower portion of neckbanded or corrugated vessels. Rim sherds that probably derived from completely smoothed vessels were classified as Plain gray rim. Rim sherds that were too small to indicate the vessel surface texture were classified as

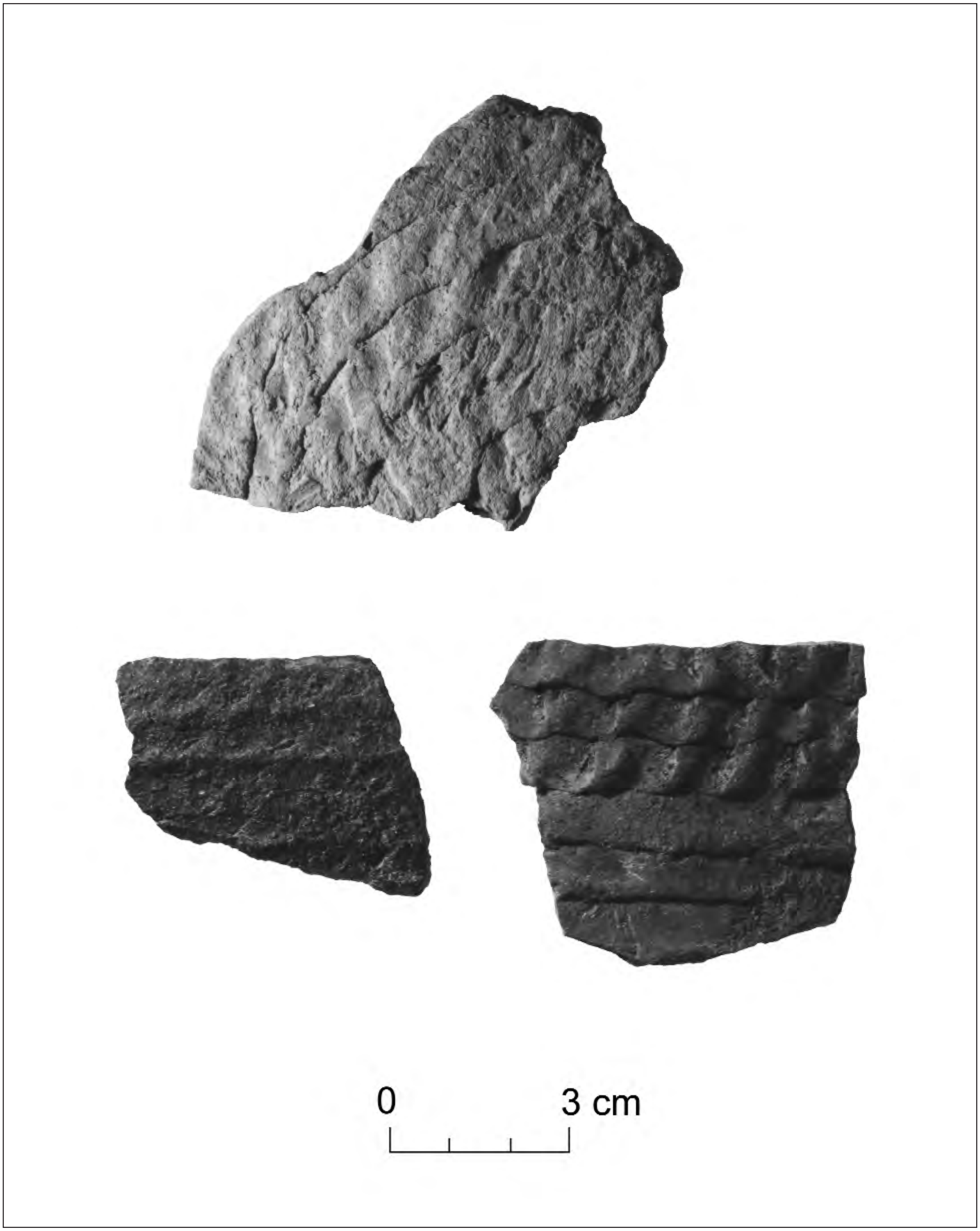

Figure 17. Gray ware ceramics from LA 101412.

Indeterminate rim. Smoothed body sherds, which could have originated from plain vessels or from smoothed portions of neckbanded or corrugated vessels, were classified as Plain body. Sherds with plain surfaces are common at sites dating to the entire occupational span of the northern Rio Grande. Their relative abundance, however, is expected to be higher during some phases than others, as discussed later. Indeterminate texture refers to cases in which the type of surface texture was unknown.

Other gray ware types are classified by distinct exterior texture treatments. Striated gray refers to plain gray sherds with small striations formed by wiping the wet surface with a fibrous tool. Basket impressed refers to textured basket impressions created by forming a vessel in a basket. Plain incised refers to plain sherds with incised decoration.

Other gray ware sherds display textures created by leaving coil junctures along the exterior of the vessel neck. Neckbanded sherds found at early sites in this region may represent a local form of Kana'a Gray, a type commonly occurring in the Colorado Plateau at Pueblo I and Early Pueblo II sites (Gladwin 1945). In the Rio Grande, such treatments are common at sites dating to the Red Mesa phase of the Developmental period. Similar wide and partially obliterated coils are found on later types such as Sapawe Micaceous Washboard, which is described below. Neckbanded sherds were divided into a series of potentially temporally sensitive types based on thickness and treatment of the unobliterated neck coils. Wide neckbanded refers to sherds with wide coils or fillets. These coils are clearly separated by distinct junctures, rest vertically to each other, and generally do not overlap. Sherds assigned to this category are very similar to those described for earlier forms of Kana'a Gray and Moccasin Gray. Rubbed or ribbed gray sherds are similar to wide neckbanded, but the junctures between the coils have been partially obliterated. The area originally occupied by these coils is still visible, and is reflected by an undulating or ribbed surface. This effect is similar to that noted for Sapawe Micaceous Washboard sherds occurring in this area at Classic phase components, and an increase of this type during the Classic period is expected.

Sherds representing banded utility ware types clearly dating after the Developmental period were limited to a few examples of Sapawe Micaceous Washboard. This type dates to the Classic period and tends to exhibit extremely micaceous pastes. Sapawe Micaceous Washboard is associated with decorated biscuit ware types (Fallon and Wening 1987), and is tempered with micaceous schist that is most likely a natural constituent in the clay (Fallon and Wening 1987). Surfaces consist of slightly obliterated coils similar to those noted in some earlier forms, but are distinguished by the addition of a highly micaceous slip. This type was probably underused during the present study, and many of the sherds assigned to Rubbed or ribbed gray may actually represent Sapawe Micaceous Washboard.

Other gray ware types are distinguished by corrugated exterior surfaces. Corrugated gray ware vessels have thin overlapping coils which are often indented. These coils usually cover the entire exterior surface, although corrugated treatments are sometimes limited to the vessel neck. In some cases, corrugated types were further distinguished by other temporally sensitive attributes such as the type and pronouncement of coiled treatment and rim eversion.

Indented corrugated includes sherds with narrow coils, regular indentations, and moderate to high contrast between coils. Similar sherds with extreme relief were classified as Exuberant corrugated. Indented corrugated sherds tend to be most common at Developmental phase and early Coalition phase sites. Plain or clapboarded corrugated refers to gray wares with similar coil treatment and relief described for Indented corrugated, but without regularly spaced indentations. This type differs from neckbanded groups by thinner coils and coiled manipulations along the vessel body. Zoned corrugated refers to alternating rows of coils described for indented and plain corrugated.

Smeared indented corrugated refers to sherds with indented corrugations that have subsequently been smeared, resulting in the partial obliteration of indentations and coil junctures. Rio Grande gray wares exhibiting these treatments have been previously classified as Tesuque Smeared (Mera 1935). In the Rio Grande region, Smeared indented represents the last form of corrugated treatment, and it dominates site assemblages dating to the late Coalition and early Classic periods.

White Ware Types

White ware sherds were assigned to various regional ceramic traditions based on paste and temper characteristics, and were then assigned to type categories based on painted design styles. White wares belonging to nonlocal traditions were mainly limited to Developmental period types produced in the Cibola or northern San Juan regions of the Colorado Plateau.

Northern Rio Grande white wares. Most of the white ware ceramics identified during the present study exhibit pastes indicative of local production in the Tewa Basin. The Tewa series, as previously described, represents a very-long-lived tradition of painted white ware pottery manufactured with local clays and tempers found along the northern Rio Grande (Fallon and

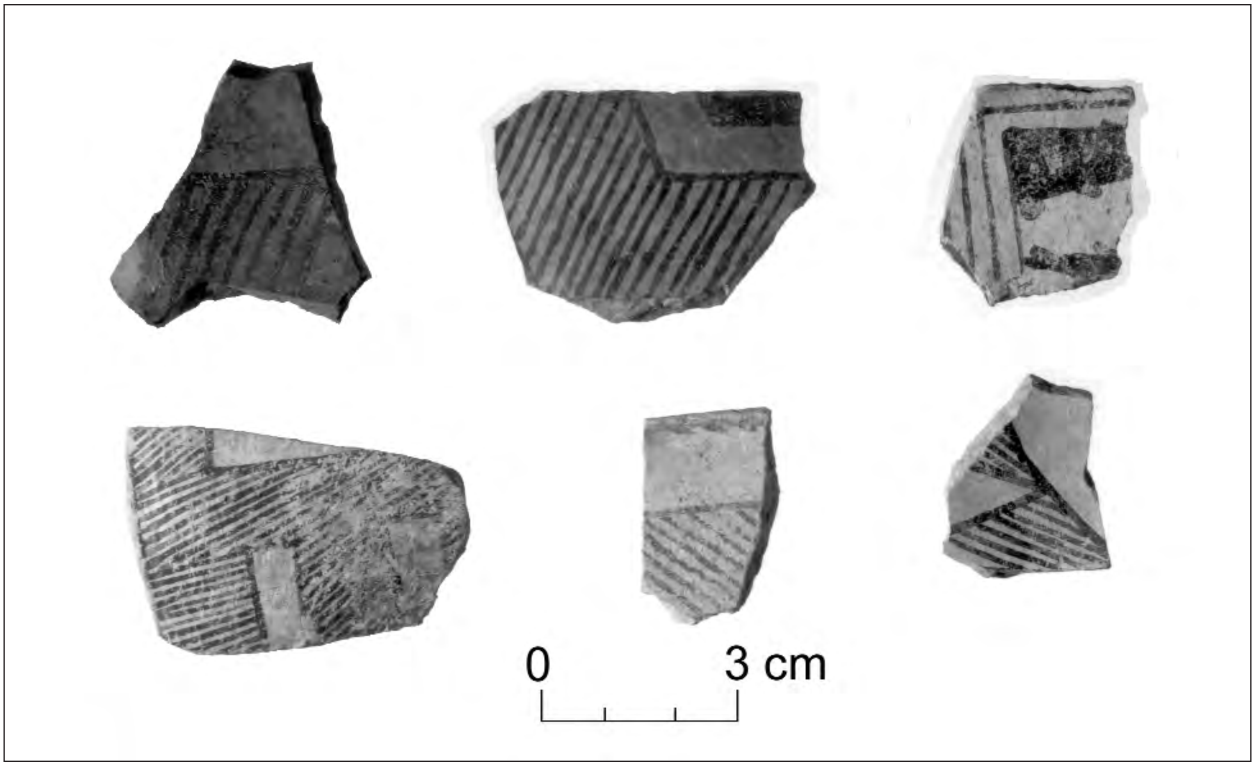

Figure 18. Developmental period ceramics from LA 101412

Wening 1987; Harlow 1973; Wendorf 1953). The earliest Developmental period types (Fig. 18) are easily differentiated from later types by the use of mineral paint and Pueblo II design styles. Pueblo II mineral-painted sherds with Rio Grande pastes are usually assigned to Kwahe'e Black-on white, the earliest type commonly defined for the Tewa series (Fallon and Wening 1987; Wendorf 1953). An important change in Tewa series pottery is the shift to decorations in organic paint, which occurred throughout much of the eastern Anasazi country. In the Rio Grande Valley this change is reflected by the introduction of Santa Fe Black-on-white, whose presence marks the beginning of the Coalition period (about A.D. 1200). The manufacture of Tewa series organic-painted white wares continued into the Classic period with the production of distinct biscuit ware types in areas north of Santa Fe. The introduction of red slips along with white slips marks the beginning of the production of Tewa polychrome types sometime during the historic period.

The geographic distribution of Tewa series types though time is similar but not identical to that noted for Rio Grande gray mica-tempered gray wares. Earlier types, such as Kwahe'e Black-on-white and Santa Fe Black-on-white were produced over most of the northern Rio Grande region. During the late Coalition and early Classic periods in the southern part of the Rio Grande region, organic-painted types were replaced by glaze-painted types, reflecting influence from regions to the west. North of Santa Fe in the Tewa Basin, biscuit wares, which continued to be decorated with organic paint, were produced instead of glaze wares.

Nonlocal decorated types from LA 101412 are limited to Pueblo II style Cibola or northern San Juan region types dating to the Developmental period. In addition, a small number of White Mountain red wares represent types produced in the Little Colorado region during the late Developmental and early Coalition periods. Glaze ware types present at LA 101412 were produced in the Rio Grande Valley and represent trade wares from areas south of Santa Fe. Glaze ware technology was derived from the Zuni and Little Colorado regions of the western Anasazi. These types were introduced and produced over wide areas in the central Rio Grande Valley by the late Coalition or early Classic periods.

Tewa series Developmental phase white ware types. A small proportion of the decorated white ware sherds from LA 101412 represents mineral-painted types dating to the Developmental period. This group includes both local Tewa series types and intrusive types from the Colorado Plateau. The earliest mineral-painted types produced in the northern Rio Grande include a local form of Red Mesa Black-on-white and Kwahe'e Black-on-white. These types are distinguished from contemporaneous pottery in other Anasazi regions by distinctive Rio Grande pastes and tempers (Honea 1965; McNutt 1969; Mera 1935; Sudar-Murphy et al. 1977; Wiseman 1989, 1995). Pastes are dark gray in color and are often vitrified. In most cases, ceramic pastes of early local Tewa white wares reflect the use of clays from volcanic ash deposits interfaced with alluvial deposits in the Tewa Basin. These clays have high iron content and vitrify at relatively low temperatures.

Temper fragments in Kwahe'e Black-on-white were originally described as finely ground sherd (Mera 1935), but more recent studies indicate the use of fine volcanic rock such as tuff (Lentz 1991). Tewa Basin types display fine volcanic rock such as tuff. The fineness of this temper contrasts with that noted for pottery from regions to the west. The great majority of Kwahe'e Black-on-white sherds recovered from LA 101412 are tempered with some variety of local fine volcanic temper. Sherds break along a even plane. Pastes are generally soft, and dark gray to brownish-gray in color.

Local Developmental period white wares usually exhibit thin streaky white slips applied over gray paste. Decorations are applied in iron oxide pigment, which is black, brown, or red. Local white wares are decorated with designs similar to those found in regions to the west. Execution, however, tends to be poorer on Kwahe'e, although well-executed examples are occasionally encountered. Rims are usually tapered and may be either unpainted or painted with a solid line.

Some studies have divided Kwahe'e into a series of geographically distinct types based on differences in temper and surface manipulation (Habicht-Mauche 1993; Honea 1965). While such divisions were not made during the present study, attributes thought to have potential spatial significance were monitored.

Local mineral-painted sherds were placed into ceramic types based on temporally sensitive styles. Painted styles were also used to place mineral-painted white wares of various traditions into similarly defined types. These categories allow for similar characterizations of similar decorated styles found in Pueblo II white wares produced in various Anasazi regions.

Unpainted white ware sherds with local pastes and temper were placed into an Unpainted Tewa white ware category. In some cases, it may be possible to distinguish unpainted white ware sherds produced during different periods based on thickness, color, and texture. These distinctions are less sensitive and reliable than those based on paint type and decoration. However, a few unpainted sherds were placed into categories reflecting these temporal associations.

Early painted sherds without distinct styles were assigned to a Mineral paint indeterminate category. Stylistic groups used to place Pueblo II white ware sherds to specific type categories are given below.

Red Mesa style (Tewa) refers to sherds with local paste and temper and distinct painted styles noted for early Pueblo II white wares. Designs are fairly complicated, and often consist of a combination of several design motifs on the same vessel or sherd. During the present study the use of the Red Mesa style was limited to sherds with distinct painted styles commonly noted in assemblages occurring throughout the Anasazi region and dating to the tenth century. Design elements associated with this type include a series of thin parallel lines, wavy or squiggle lines, pendant dots, ticked lines, rick rack, scrolls, stepped triangles, and ribbons of squiggle hatchure. A quartered or banded layout is often used, consisting of a series of geometrical opposing sections in which combinations of design elements are repeated. These sections are usually divided by a series of narrow lines. Similar pottery has been previously identified as a Rio Grande variety of Red Mesa Black-on-white (McNutt 1969; Dittert and Plog 1980).

Sherds with local pastes and designs used during the late Pueblo II period were assigned to stylistic varieties of Kwahe'e Black-on-white (Mera 1935). Kwahe'e solid designs refers to the range of solid-filled designs commonly used during the later part of the Pueblo II period. Designs are boldly executed, and often consist of a single motif. Solid motifs used in late Pueblo II period white ware pottery includes dots, opposing triangles, radiating triangles, step triangles, checkered triangles, checkered squares, and scrolls. Kwahe'e hatchured style refers to sherds exhibiting bold designs often consisting of ribbons filled with straight hatchure. This design is sometimes referred to as the Deghoszhi style, in reference to the Tusayan tradition type (Colton 1955). Hatchured designs represent one of the dominant painted styles in most regions of the Anasazi during the eleventh and early twelfth century. Sherds assigned to the hatchured style of Kwahe'e Black-on-white represent Rio Grande equivalents of the Cibola types Gallup Black-on-white or Chaco Black-on-white. Sherds exhibiting hatchure with squiggle lines were classified as Kwahe'e squiggle hatchure.

Western Pueblo II white ware types. Other sherds exhibiting Pueblo II designs in mineral paint were placed into types belonging to traditions associated with regions of the Colorado Plateau to the west. White ware pastes of pottery from regions of the Colorado Plateau are usually white to gray, and often fire to white or pink when exposed to controlled oxidizing conditions. These paste colors reflect the use of low-iron clays associated with sedimentary exposures throughout much of the

Colorado Plateau. Dark cores are often present, although paste exteriors are usually light in color. Temper fragments are usually coarser than those found in Rio Grande types, and include sand, sandstone, sherd, and crushed igneous porphyries. White ware sherds exhibiting these pastes were assigned to regional traditions of the Colorado Plateau based on different temper and pigment types, or technological characteristics (Franklin 1980; Goetz and Mills 1993).

Ceramics produced over an area covering much of northwestern New Mexico, from south of the San Juan River and north of the Mogollon Highlands, are assigned to Cibola tradition types. These types dominate white ware assemblages as far east as the Puerco Valley and as far west as eastern Arizona. Sites dating to both the early Pueblo II and late Pueblo II are common throughout most of the Cibola region. Thus, Cibola white ware types recovered from LA 101412 could have originated at sites over a large geographic area.

Sherds are assigned to Cibola white ware types based on the presence of sand or sherd temper, or both, light paste, and mineral paint. Sherds originating in regions to the west may also contain thin washy slips. Petrographic analysis from nearby LA 103919 indicates that some of the sherds assigned to Cibola white ware types, identified as having sherd and sand temper, actually contain tuff fragments. This indicates production somewhere in the Rio Grande region (Hill in prep.). The light paste and temper in these sherds differs from "local" Kwahe'e sherds, so it is unlikely that they were derived from vessels originating in the Tewa Basin. A possible source of origin may be the Jemez or Zia areas. In these areas, light-colored geological clays and tuff temper sources may overlap, and Developmental period sites are fairly common. If ceramics from these areas are represented, the initial assignment of some of these sherds to the Cibola tradition may be incorrect, but a western origin may still be indicated. Stylistic and technological similarities indicate that the technology in this areas was strongly influenced by groups from the Cibola region.

Cibola white ware sherds from LA 101412 were assigned to a series of types using the same stylistic distinctions used to differentiate local Tewa types. Unpainted sherds with Cibola pastes were assigned to an Unpainted Cibola category. Those exhibiting indeterminate designs were assigned to a Cibola indeterminate mineral category. One sherd exhibiting a squiggle design was classified as Red Mesa Black-on-white. A few sherds exhibiting very-fine-lined hatchure designs were classified as Chaco Black-on-white. Hatchured sherds with thicker lines were assigned to Gallup Black-on-white. Sherds with late Pueblo II solid or line designs were assigned to various styles of Escavada or Puerco Black-on-white (Franklin 1983; Toll and McKenna 1987; Windes 1977, 1984; Windes and McKenna 1989). One sherd with a Cibola paste exhibited organic paint, and was assigned to an Indeterminate organic paint category.

Sherds were assigned to northern San Juan tradition types based on the presence of crushed igneous rock, probably andesite or diorite (Abel 1955). The northern San Juan region includes parts of southeastern Utah, southwestern Colorado, and northwestern New Mexico. It includes most of the area drained by the tributaries of the San Juan River (Wilson and Blinman 1995b). Paste characteristics and design styles noted on the few sherds assigned to Mesa Verde types exhibit pastes, surface treatments, and painted styles similar to those noted on Cibola white ware types. The two northern San Juan sherds from LA 101412 exhibited the late Pueblo II style associated with Mancos Black-on-white (Abel 1955; Breternitz et al. 1974; Oppelt 1991; Reed 1958). One sherd was classified as Mancos hatchured style black-on white and the other as Mancos solid style black-on-white.

Coalition period white wares. The majority of the white ware sherds from LA 101412 are derived from Coalition period types. These types are easily distinguished from earlier Developmental phase types by decorations in organic rather than mineral paint. There is overlap in sherd thickness, paste, and surface characteristics in pottery produced during the two periods. Organic-painted sherds without distinct styles were assigned to an Indeterminate organic paint category and are assumed to represent Coalition phase types.

Santa Fe Black-on-white (Fig.19) represents the earliest organic-painted type produced in the Tewa Basin and is the most common decorated white ware type at LA 101412. The production of Santa Fe Black-on-white reflects a shift to the use of Pueblo III design styles in organic paint similar to those employed in other areas of the Anasazi (Lambert 1954; Lang 1982; Mera 1935; Stubbs and Stallings 1953; Sundt 1984). Vessel walls are relatively thin and straight. Pastes are often dense, hard, well-fired, and vitreous. Pastes range from light gray to blue gray, but may be brown or reddish if misfired. Decorated surfaces are usually polished and covered with a thin, streaky white slip. Undecorated surfaces are often rough and unslipped, although on bowls the slip is sometimes carried over the exterior, and appears as a short band extending below the rim. Tempering materials include fine sand or finely crushed volcanic rock temper (Bice and Sundt 1972; Habicht-Mauche 1993; Post and Lakatos 1995; Stubbs and Stalling 1953).

Painted decorations may be dark and solid, although they are often faded and translucent. Rims are usually tapered and undecorated, although flat or ticked

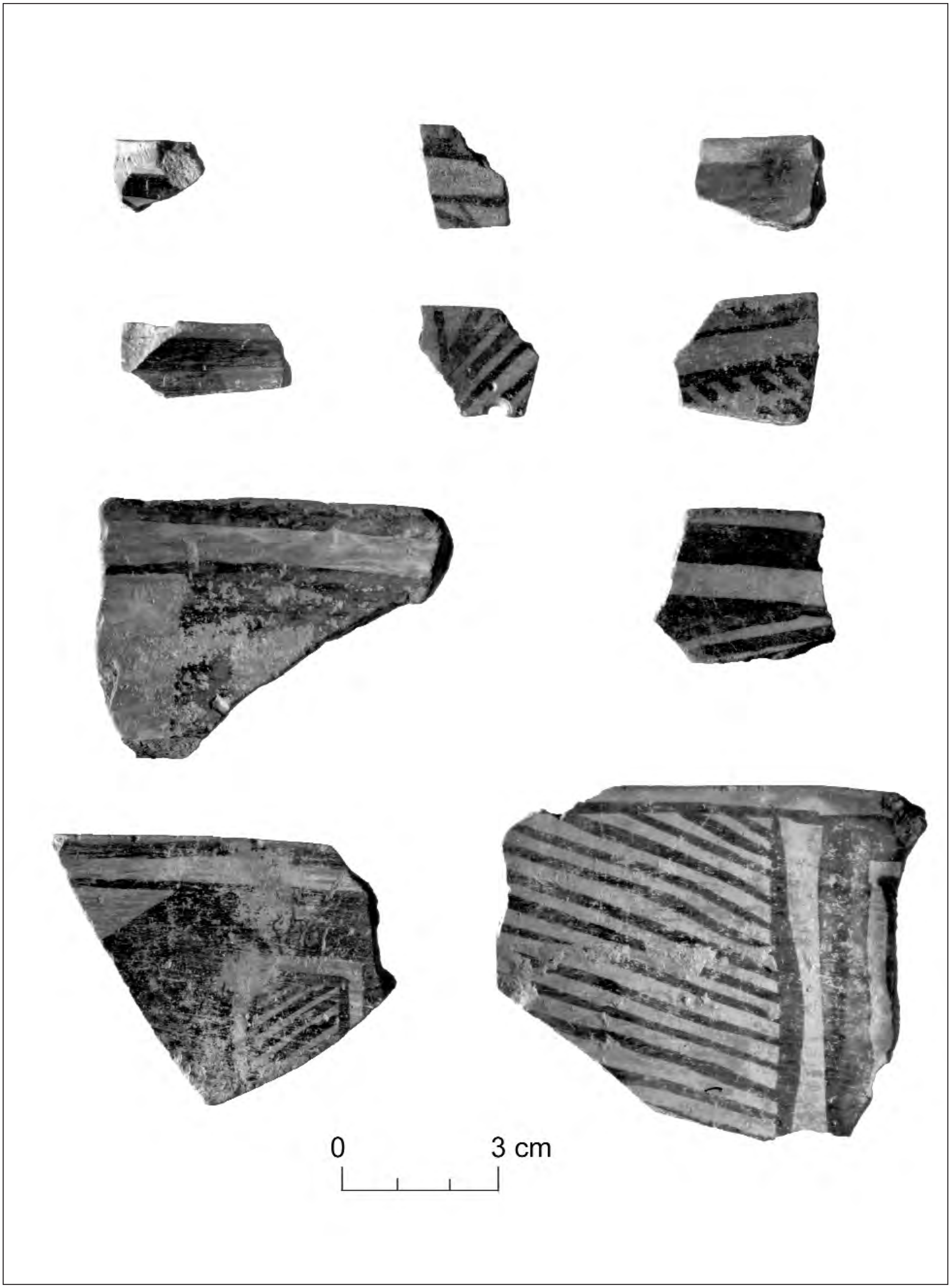

Figure 19. Santa Fe Black-on-white ceramics from LA 101412.

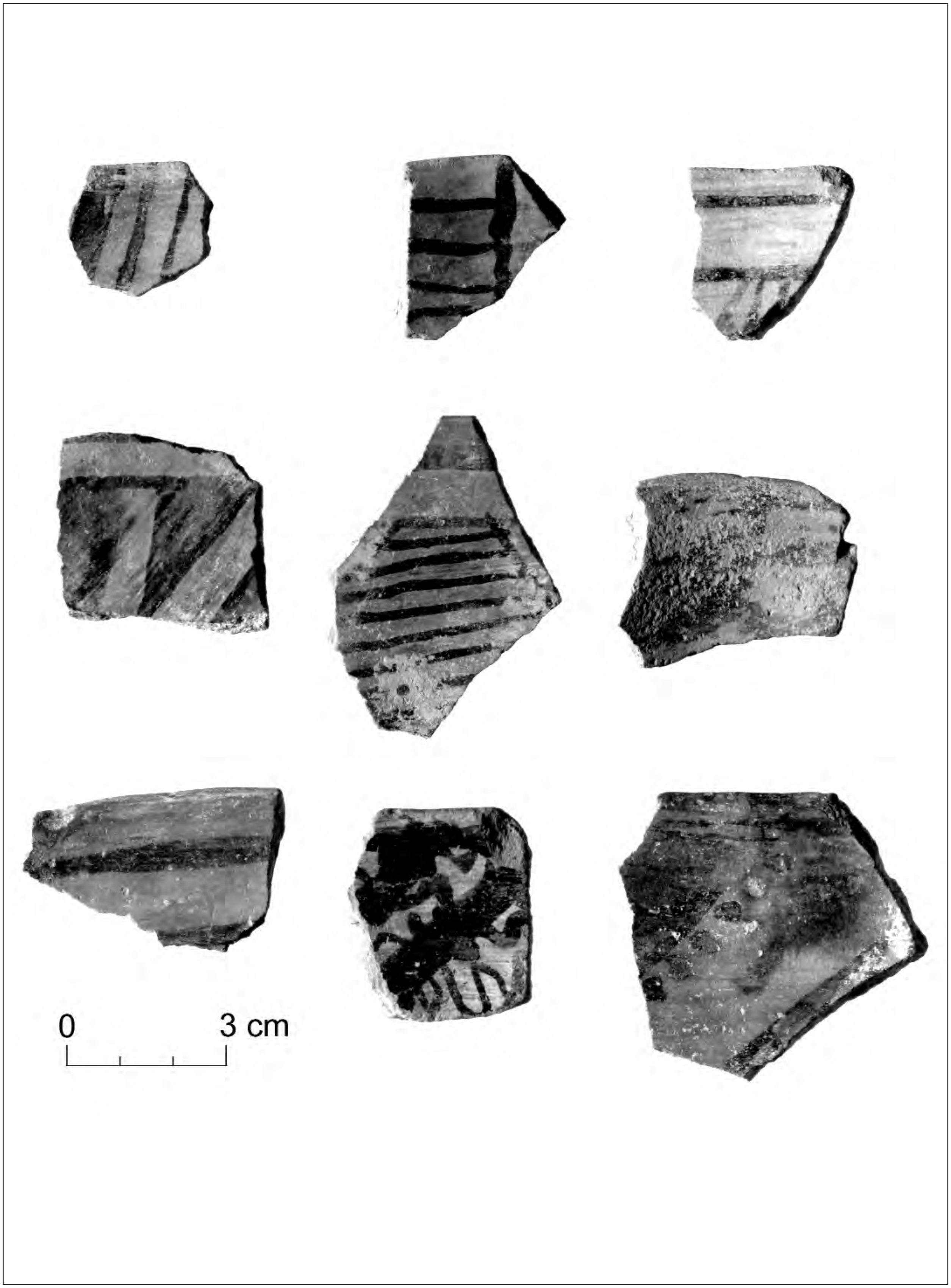

Figure 19 continued.

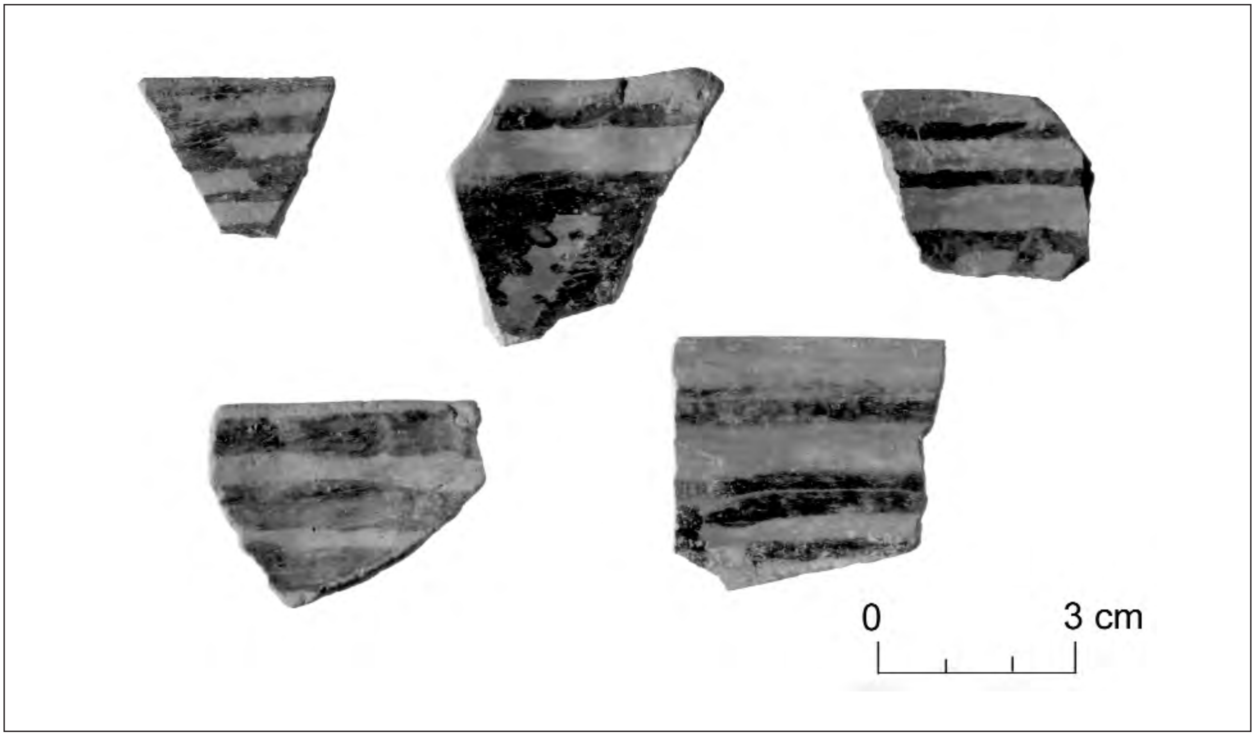

Figure 20. Wiyo Black-on-white ceramics from LA 101412.

rims, similar to those noted in contemporaneous pottery from regions on the Colorado Plateau, are present in low frequencies. Decoration consists of banded panels on bowl interiors and on the upper portions of jars. These banded panels are often framed by a single line near the rim, either slightly above or incorporated into the panel. Occasionally these designs are framed by a series of similar-sized parallel lines or a combination of a single thick and several thin lines, a design style also common on contemporaneous pottery types from regions to the west. All-over designs, also similar to those noted in Pueblo III types found to the west, are sometimes represented. Designs are composed of a variety of hatched and solid motifs including opposing triangles, stepped triangles, checkered squares triangles, rectilinear lines, chevrons, and occasional anthropomorphic designs. Painted decorations cover much of the design field, and may result in negative designs in white.

Santa Fe Black-on-white was produced throughout the northern Rio Grande region, and has the widest geographic distribution of any Tewa tradition white ware type (Habicht-Mauche 1993; Sundt 1972, 1984, 1987). The range of characteristics noted in Santa Fe Black-on-white has resulted in the definition of a series of spatially or temporally distinct varieties (Habicht-Mauche 1993; Honea 1965; Stubbs and Stallings 1953; Warren 1979a). Production of Santa Fe Black-on white is thought to have begun during the late 1100s and continued into the middle 1300s, and possibly as late as the early 1400s (Habicht-Mauche 1993; Stubbs and Stalling 1953; Sundt 1987).

Wiyo Black-on-white (Fig. 20) was originally referred to as "biscuitoid" pottery to indicate pottery with pastes and treatments transitional between Santa Fe Black-on-white and the biscuit wares (Kidder and Amsden 1931; Mera 1935; Stubbs and Stalling 1953) This type exhibits organic-painted designs similar to Santa Fe Black-on white, but has a softer paste that is tan, buff, orange, or greenish (Hibben 1937; Stubbs and Stallings 1953). Interior surfaces are usually well polished and evenly smoothed.

Wiyo Black-on-white is consistently tempered with finely crushed volcanic rock. The paste color and texture of Wiyo Black-on-white are very distinct from most varieties of Santa Fe Black-on-white and are a reflection of similarities in technology to the biscuit ware tradition that succeeds it (Habicht-Mauche 1993). Vessel walls of Wiyo Black-on-white sherds tend to be slightly thicker and more porous than those noted in Santa Fe Black-on-white.

Paints in Wiyo Black-on-white tend to be darker and denser than those noted in earlier organic types. Design styles are very similar to those described for Santa Fe Black on-white although they are sometimes described as heavier (Stubbs and Stallings 1953). Solid designs tend to be more common and lines are thicker. There is also consistent use of panel designs on Wiyo Black-on-white.

The temporal range of Wiyo Black-on-white definitely overlaps that of Santa Fe Black-on-white, and the two types are often found together in Tewa Basin assemblages. Wiyo Black-on-white may date from A.D. 1250 to 1400, but tends to be most common in assemblages dating between A.D. 1300 to 1350 (Breternitz 1966; Smiley et al. 1953; Sundt 1987), and is most common at about A.D. 1300 (Habicht-Mauche 1993). The relative frequency of Wiyo Black-on-white in Coalition phase assemblages decreases with distance from the Tewa Basin and Pajarito Plateau, and is rare at sites south of Santa Fe.

Galisteo Black-on-white is similar to Santa Fe Black-on-white but has a medium blue to pearl gray or whitish paste (Lambert 1954; Stubbs and Stallings 1953). Temper consists of coarse sherd or crushed rock. Surfaces are covered by a well-polished slip that often has fine crazing or crackling. Organic-painted designs can appear on both interior and exterior surfaces.

Designs are usually organized in paneled bands of oblique and horizontal solids, oriented from multiple or single framing lines. Motifs include triangles, keys, lines, and geometric figures. Design elements are usually solid, and hatched elements are uncommon. In some assemblages squared rims may be relatively common. Rims are sometimes ticked, but rounded and tapered rims also occur. Classic design styles on Galisteo are thought by many to derive from McElmo and Mesa Verde Black-on-white types (Mera 1935; Lang 1982), although there are definite differences in the range of styles and treatments occurring in these regional types.

Galisteo Black-on-white was one of the predominant organic-painted white wares produced in some areas during the late Coalition period (Lang 1982). Galisteo Black-on-white appears at about A.D. 1270, and by A.D. 1300 was the dominate type in some areas south of the Santa Fe drainage (Habicht-Mauche 1993). This type reached its maximum geographic extent and popularity in the middle A.D. 1300s, but is found in low frequencies in contexts dating as late as the 1400s, dominated by decorated glaze and biscuit ware types (Habicht-Mauche 1993).

White Mountain red wares. White Mountain red wares represent a specialized pottery tradition that developed in areas along west-central New Mexico and east-central Arizona (Carlson 1970). These ceramic types are consistently characterized by light pastes, sherd temper, and dark red slip with well-polished surfaces. Pigments may be applied in either a black mineral or organic paint. One sherd exhibiting these treatments did not have distinctive painted designs and was classified as Indeterminate White Mountain red ware. Another sherd exhibits surface treatment and solid designs indicative of early White Mountain red wares and was assigned to Puerco Black-on-red. These types indicate an association with the Coalition phase component at this site.

Classic phase white wares. Biscuit ware is represents the dominant decorated pottery at Classic period sites in the Tewa Basin. Biscuit ware refers to the distinctive white ware pottery technology employed in the northern Rio Grande during the Classic period (Fig. 21). Biscuit ware types are characterized by the presence of bentonite clays and vitric tuff temper (Kidder and Amsden 1931). Vessels have a soft gray to yellow paste, with finely crushed tuff or pumice. Biscuit ware is distinguished from other organic-painted Rio Grande white ware types by their woody and porous textures. Surfaces are often white, light gray, tan, or buff. Vessel walls tend to be very thick, particularly when compared with earlier decorated types. Vessels also tend to be extremely light in weight compared to their overall size, because of the porous paste texture. Bowl rims exhibit a distinct flare or eversion, and thickness may vary considerably over short distances from the rim.

Biscuit wares are decorated with sharp, clear, black organic paint. Plain bowl rims are generally ticked, and standing rims are embellished with repeating dashes or zigzag lines on the interior below the lip. Painted designs are often organized in banded patterns with panels of repeating hatched or solid geometrical elements. These include ticked edges, parallel or rectilinear lines, and stylized Awanyu motifs.

Two biscuit ware types are recognized based on the presence of painted or slipped surfaces on both vessel surfaces. Biscuit A, or Abiquiu Black-on-gray, is distinguished only in bowl forms and is defined by the presence of slipped or painted manipulations on interior surfaces only. Biscuit B, or Bandelier Black-on-gray, is distinguished from Biscuit A by yellowish pastes (Kidder and Amsden 1931) with slipping and decoration on bowl exteriors as well as interiors.

Although biscuit ware is found in an area that includes the Tewa Basin, Pajarito Plateau, and Chama Valley (Mera 1934), this area is much smaller than that in which Santa Fe Black-on-white occurs. The temporal range for Biscuit A is estimated to be from about A.D. 1375 to 1450; Biscuit B lasted from about 1400 to 1500 (Breternitz 1966; Fallon and Wening 1987; Wendorf 1953).

Unpainted sherds clearly exhibiting pastes, shapes, and thickness indicative of Biscuit wares were assigned to an Unpainted biscuit ware category.

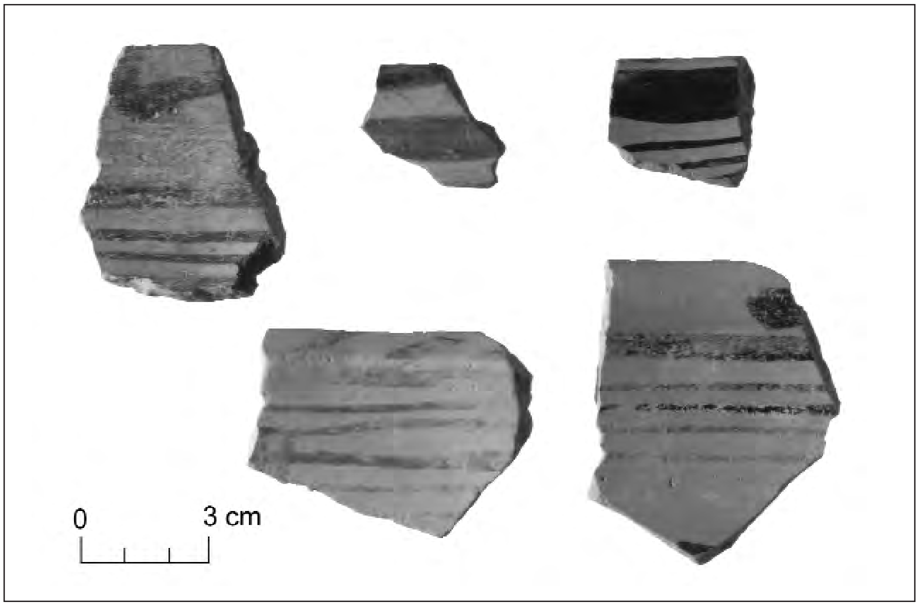

Figure 21. Biscuit ware ceramics from LA 101412.

Rio Grande glaze wares. A small number of Rio Grande glaze ware types were recovered from LA 101412. Glaze ware production was associated with the central Rio Grande Valley south of Santa Fe; thus, glaze ware sherds identified during the present study represent trade wares from areas to the south. Sherds from both painted and unpainted glaze wares are assigned to specific type categories based on combinations of rim form, slip color, and paint color combinations. Because the chronological sequence for glaze wares is based primarily on changes in rim forms (Kidder and Shepard 1936; Mera 1935), only rim sherds were assigned to formal glaze ware types. Potentially significant information may also be conveyed by variation in slip and paint color, so body sherds derived from glaze ware vessels were also assigned to a series of grouped types defined by slip and paint attributes. Type categories identified assigned to glaze body sherds include Unpainted glaze ware, Glaze-on-red, Glaze-on-white, Glaze-on-yellow, Red slip glaze, and Glaze red and white slipped.

Changes in rim form have been documented for the entire glaze ware sequence, and form the basis for the recognition of a series of temporally distinct types. The chronology proposed by Mera (1935) was employed during the present study, and involved assigning glaze ware rim sherds to temporally distinct rim groupings (designated Glaze A through F). These categories are based on variation of rim thickness, profile, shape, and degree of eversion. Rim sherds can also be assigned to more specific types based on temporally sensitive slip color, and pigment characteristics and combinations.

The only glaze ware rim forms identified during the present study represent Glaze A forms. These forms are simple and direct, proceeding straight up from the vessel wall, and terminating with rounded or flattened rim tops. Some rims are slightly inverted, but the wall thickness does not vary significantly from the vessel rim. A number of types displaying the Glaze A rim shapes are distinguished on the basis of slip color, paint combinations, and overall styles. One Glaze A form exhibiting a red slip was assigned to Agua Fria Red-on-glaze, and is thought to date from about A.D. 1340 to 1425 (Sundt 1987). Another sherd exhibiting a whitish slip was assigned to Cieneguilla Glaze-on-yellow, which dates from A.D. 1350 to 1425 (Sundt 1987).

Historic period white wares. A single sherd from LA 101412 was classified as historic Unpainted Tewa polychrome, which refers to unpainted pottery from an indeterminate Tewa polychrome series vessel. The lack of painted decorations prevents the assignment of this sherd to a specific Tewa polychrome type. Tewa polychrome series types are distinguished from those belonging to earlier Tewa types by the addition of decoration in red slip along with the white slip with black and sometimes red painted designs (Batkin 1987; Frank and Harlow 1990; Harlow 1973; Snow 1982, 1989). Tewa polychromes are tempered with fine tuff or ash; they developed out of the local Tewa series, and were produced from about A.D. 1650 into the 20th century. The single Tewa polychrome sherd at this site probably represents a contaminant from a nearby historic component.

Ceramic Analysis Results

C. DEAN WILSON AND MACY MENSEL

This section discusses data resulting from the analysis of 6048 sherds recovered during recent investigations of LA 101412. Most of the sherds were found in slope wash from a nearby and long-occupied village (LA 61). Many of the stratigraphic units excavated by OAS contain mixtures of ceramic types associated with most of the major periods of the northern Rio Grande. Basic sequences of accumulation and mixture of materials were documented for each stratigraphic unit by examining distributions of dated ceramic types. Issues examined include influences of material resources on the local ceramic technology, recognition of interaction and exchange of vessels between Anasazi groups in different areas, and the identification of activities associated with various vessel forms.

In order to obtain data necessary to examine these issues, proveniences, descriptive attributes, typological categories, counts, and weights were recorded. Descriptive attributes and typological categories are described in the ceramic methodology section in this volume. Discussion related to the examination of various ceramic trends and patterns follows.

Dating of Contexts and Components

The dating of sites in the northern Rio Grande is relatively poor, although tree-ring samples and ceramic cross-dating provide the basis for dating the long occupation of this region (Breternitz 1966; Robinson et al. 1973; Smiley et al. 1953; Wendorf 1954; Wiseman 1989, 1995). Several basic temporal periods can be distinguished based on ceramic distributions: the late Developmental (A.D. 900 to 1200), Coalition (1200 to 1350), Classic (1350 to 1550), and historic (1550 to present) periods as previously defined for the northern Rio Grande (Wendorf and Reed 1955).

Developmental period components are distinguish from later occupations by the presence of mineral-painted white ware types. These include local Kwahe'e Black-on-white as well as intrusive types from the Colorado Plateau to the west. Gray utility wares associated with this period include neckbanded, plain, and corrugated types. While the Developmental period occupation spans a very long duration, only the later part of this occupation (A.D. 900 to 1200) is well-represented in the Tewa Basin (Wilson 2004).

Two separate late Developmental phases have been identified in the Tewa Basin: Red Mesa and Kwahe'e (McNutt 1969). The Red Mesa phase dates tentatively between A.D. 900 and 1050 and is characterized by white wares with manipulations and styles described for Red Mesa Black-on-white (Gladwin 1945; McKenna 1984; Toll and McKenna 1993; Windes 1977, 1984). Most of the white wares from tenth century components represent intrusive types from the Colorado Plateau, although very low frequencies of sherds exhibit the Red Mesa Black-on-while style with pastes and temper indicative of local production. Gray wares from Red Mesa phase assemblages are dominated by plain gray and neckbanded types. Corrugated types may be present, but are very rare. The Kwahe'e phase dates tentatively between A.D. 1050 and 1200, and is characterized by white wares exhibiting hatchured and solid styles generally defined for late Pueblo II types. While paste and temper distributions indicate a dramatic increase in the local production of white wares, nonlocal white wares from the Colorado Plateau are still relatively common. Corrugated gray ware sherds are consistently present, although they are often outnumbered by plain gray ware sherds. Neckbanded and incised gray ware sherds are present in low frequencies.

Coalition period components are easily distinguished from those dating to the earlier Developmental period by the dominance of white wares decorated in organic paint. The majority of white wares dating to the earlier part of the Coalition period are from Santa Fe Black-on-white, which represents the dominant white ware type on sites dating from A.D. 1200 to 1275, although it is common until at least A.D. 1350, if not later. In the Tewa Basin, Wiyo Black-on-white is common at sites dating to the later Coalition period (A.D. 1300 to 1350), and sometimes outnumbers Santa Fe Black-on-white at late Coalition sites. The relatively high frequency of utility pottery at Coalition period sites in this area may include a mixture of treatments due to the shift from the sharply indented to smeared corrugated treatments in pottery produced during the Developmental period to the smeared corrugated produced during later periods. Intrusive White Mountain Red trade wares often occur in very low frequencies at Coalition period sites. Early glaze ware types may also occur in very low frequencies in late Coalition contexts in the Tewa Basin.

Classic period assemblages north of Santa Fe are easily recognized by the dominance of distinct biscuit ware types. Biscuit A, identified by painted or slipped decorations on bowl interiors surfaces only, is dominant earlier than Biscuit B, identified by painted on slipped decorations on both sides of bowl surfaces (Kidder 1931; Wendorf 1953). Difficulties in the distinguishing biscuit ware types may result from the common weathering of surfaces obliterating evidence of slip or painted decorations (Wendorf 1953). Utility wares associated with Classic period occupations tend to be highly micaceous, and can exhibit smoothed, smeared corrugated, or ridged surfaces, and correspond to the type Sapawe Micaceous Washboard as sometimes described.

Ceramic assemblages associated with historic occupations of the Northern Tewa in this area are identified by the occurrence of Tewa polychrome decorated wares and Tewa plain, polished and smudged utility wares. Only a single historic sherd was identified during the present study.

While many of the units excavated at LA 101412 represent mixed deposits eroded from contexts upslope and dating to various periods, it is possible to examine basic trends during the occupation, and the integrity of stratigraphic units through associated ceramic distributions. Thus, distributions of types from various proveniences identified in the field were examined. Appendix 1 gives and summarizes the type distributions for each provenience and stratigraphic unit.

In order to more efficiently examine temporally related distributions associated with the range of white ware and gray ware types recognized during this study, types were further assigned to a series of temporal groups. Earlier mineral painted types such as Kwahe'e Black-on-white and Pueblo II types from the Cibola and Mesa Verde regions were assigned to a Developmental period white ware group. Santa Fe Black-on-white, Wiyo Black-on-white and Galisteo Black-on-white were all put into a Coalition period group. Biscuit A and Biscuit B were placed into a Classic period group, and the single Tewa polychrome was assigned to a historic period group. Appendix 1 summarizes the distribution of these white ware groups by provenience.

Because of the long temporal span associated with the production of gray wares types exhibiting a variety of texture treatments, it was not possible to assign them to groups associated with a specific dating period. Instead, gray ware types were assigned to a number of texture groups thought to be more common during different periods. Gray ware exhibiting plain, neckbanded, corrugated. smeared corrugated, rubbed-ribbed, and indeterminate textures were assigned to different texture groups. Table 2 summarizes the distributions of these gray ware textures by provenience.

Based on distributions of various ceramic types and groups, proveniences were assigned to a dating group (see Appendix 2). Most of the surface and subsurface contexts reflect movement of sherds from upslope and date to several distinct components. Contexts exhibiting ceramic types and groups indicating a mixture of material include: General Site; Backhoe Trenches 1, 2, 3, 4, and 5; Areas 1, 2, and 3; and the upper levels of test pits. Although Coalition period types tend to dominate most of these proveniences, they also contain significant frequencies of decorated types associated with the Developmental and Classic periods. Gray ware distributions also indicate the mixture of ceramics. All contexts are dominated by plain gray wares. Smeared corrugated types are usually the second most dominant wares from the trenches, and are associated with slightly lower amounts of corrugated pottery. Rubbed-ribbed utility wares are also consistently present.

The dominance of Coalition period white wares in most mixed provenience assemblages indicates that most of the material recovered from the site originated from Coalition period components. Ceramic distributions associated with other contexts enabled the documentation of certain temporal trends at this site.

The ceramics from most stratigraphic units in Test Pits 8 and 9 indicate a high degree of mixing, but over half the painted sherds from the upper unit are Biscuit A. Although the presence of some Coalition period types indicates mixture or contamination from earlier occupations, the ceramic distribution seems to indicate an early Classic period component. This designation is also supported by the presence of early glaze ware (Glaze A red and yellow) sherds. Gray wares include a relatively high frequency of smeared corrugated sherds.

The lower units of Test Pit 8 have relatively high frequencies of biscuit ware types, along with higher frequencies of other Coalition period types. Biscuit wares gradually decline in lower stratigraphic units, although all units from this test pit contain a mixture of Classic and Coalition period ceramics.

Ceramic distributions from stratigraphic levels in Test Pits 3-6 show an absence of Classic period white ware types, although both Developmental and Coalition period types are present. The uppermost layer is dominated by Coalition period white wares (mostly Santa Fe Black-on-white). For example, 97.3 percent of the distinct white ware types are Coalition period types. In the next layer down, 70.5 percent of the distinct white ware sherds belong to Coalition period types, and the remainder are Developmental period types.

In contrast, the next lowest layers of Test Pits 3-6 contain more Developmental period types exhibiting late Pueblo II ceramic styles. Unfortunately, no white wares were recovered from the lowest layer of this area. Gray wares from all units in Test Pits 3-6 are dominated by plain utility wares. Indented corrugated sherds are the next most common utility ware group, and consistently outnumber smeared corrugated sherds. This trend and the general absence of Wiyo Black-on-white may indicate a sequence of deposition spanning from the late Developmental to the early Coalition periods.

Both stratigraphic units from Test Pits 14 and 15 are dominated by Coalition period white wares, particularly

Santa Fe Black-on-white. Both proveniences contain a higher frequency of smeared corrugated than indented corrugated sherds.

The uppermost stratum from Test Pit 16 contains only Coalition period white wares, but this may simply reflect the small sample size. The next two strata have types from most periods, indicating mixed deposits. Distributions associated with the lower deposits include mostly Coalition period types with low frequencies of Developmental period types. With one exception, the frequency of smeared corrugated sherds is higher in the upper units.

Very few sherds were recovered from Test Pits 10-13, but the five units show a long sequence of accumulation. The uppermost deposits contain a mixture of white ware types associated with the Developmental, Coalition, and Classic periods. The next layer down contains only Coalition period white ware types, primarily Santa Fe Black-on-white. Samples recovered from this layer yielded radiocarbon dates at about A.D. 1220. The next lowest layer contains a mixture of Developmental and Coalition white wares, and the layer under it only contains Developmental period white wares. The lowest layer did not contain any white ware sherds. Gray ware distributions indicate a similar temporal sequence. The uppermost layer contains equal amounts of corrugated and smeared corrugated textures, whereas corrugated sherds significantly outnumber smeared corrugated in the lower layers.

Examination of trends associated with the small number of sherds recovered from Test Pit 7 also indicates that the material was derived mostly from earlier

Table 2. Gray ware textures by provenience.

	Gray Ware Textures						Total	
	Plain Gray	Neckbanded	Corrugated	Smeared Corrugated	Sapawi/ Rubbed-Ribbed	Indeterminate	n	%
General site	28	-	4	13	4	-	49	1.0%
Backhoe Trenches								
Backhoe Trench 1	115	-	1	1	-	-	117	2.4%
Backhoe Trench 2	134	2	45	53	11	-	245	5.1%
Backhoe Trench 3	119	-	23	32	3	-	177	3.7%
Backhoe Trench 4	200	1	35	37	1	-	274	5.7%
Backhoe Trench 5	201	1	44	60	7	-	313	6.5%
Test Pits								
Test Pit 3-6 A	203	2	90	28	9	1	333	6.9%
Test Pit 3-6 B	243	1	81	38	5	-	368	7.6%
Test Pit 3-6 C	97	-	20	9	1	-	127	2.6%
Test Pit 3-6 D	26	-	4	-	1	1	32	0.7%
Test Pit 7 A	31	1	10	1	2	-	45	0.9%
Test Pit 7 B	47	-	2	1	3	1	54	1.1%
Test Pit 7 C	5	-	-	-	-	-	5	0.1%
Test Pit 8 and 9 A	231	-	10	30	4	-	275	5.7%
Test Pit 8 and 9 B	478	-	36	91	7	2	614	12.7%
Test Pit 8 and 9 C	103	-	9	21	-	-	133	2.8%
Test Pit 8 and 9 D	91	-	11	38	1	-	141	2.9%
Test Pit 8 and 9 E	181	8	60	63	3	2	317	6.6%
Test Pit 10-13 A	41	1	12	11	5	-	70	1.5%
Test Pit 10-13 B	16	-	7	1	1	-	25	0.5%
Test Pit 10-13 C	22	2	3	-	1	-	28	0.6%
Test Pit 10-13 D	13	-	1	-	1	-	15	0.3%
Test Pit 10-13 F2	4	-	4	-	-	-	8	0.2%
Test Pit 13 and 15 A	88	1	21	62	5	-	177	3.7%
Test Pit 14 and 15 B	94	1	18	44	1	-	158	3.3%
Test Pit 16 A	9	-	-	1	-	-	10	0.2%
Test Pit 16 B	76	-	13	23	1	-	113	2.3%
Test Pit 16 C	40	-	4	4	-	-	48	1.0%
Test Pit 16 D	86	-	33	15	6	-	140	2.9%
Test Pit 16 E	35	-	3	9	-	-	47	1.0%
Areas								
Area 1	62	-	29	52	8	-	151	3.1%
Area 2	5	-	6	4	-	-	15	0.3%
Area 3	110	1	48	34	3	-	196	4.1%
Total textures	3234	22	687	776	94	7	4820	100.0%
Percent total textures	67.1%	0.5%	14.3%	16.1%	2.0%	0.1%	100.0%	-

components. All of the white ware types in the two upper layer of fill are Developmental period types; one sherd exhibits the earlier Red Mesa style, and the others later Pueblo II styles. A problem, however, results from the presence of a single sherd assigned to the Coalition period. This sherd was classified as being in the Indeterminate Organic category, and could represent an early form of organic-painted sherds. Corrugated indented is more common than smeared corrugated sherds in these contexts. Thus, it is possible that the entire sequence in Test Pit 7 is from the Developmental period. A radiocarbon sample from the base of this unit dates at about A.D. 910.

The examination of the ceramics resulted in placement of 15 proveniences (84.2 percent of all sherds) into the mixed provenience group, 7 proveniences (2.3 percent of all sherds) into the Developmental provenience group, 1 provenience (0.5 percent of all sherds) into the Developmental or Coalition provenience group, 6 proveniences (6.5 percent of all sherds) into the Coalition provenience group, and 1 (6.4 percent of all sherds) into the Classic provenience group.

The ceramics indicate that most of the contexts excavated at LA 101412 are mixed, although some display less mixing. Both types of contexts ultimately reflect deposits from a deep stratigraphic sequence that reflects the long depositional sequence at this site. Changes in the nature of mixture of dated types also provides clues to the nature of this sequence. Ceramic assemblages from the lower contexts are often associated with small assemblages dominated by types from a single period. These probably reflect material associated with the features dating to the Developmental and Coalition periods. The upper deposits reflect the more rapid accumulation of ceramic material from LA 61, beginning in the Coalition period and continuing for at least 300 years. When all proveniences are considered, there is strong evidence for continual utilization of the general area from the Developmental through the Coalition to the Classic periods.

Examination of Ceramic Trends

Although the mixed nature of the deposits at LA 101412 limits specific dating interpretations, the recovery of significant amounts of pottery belonging to types associated with three distinct periods allows us to examine several long-term trends in the Pojoaque area. The remainder of this discussion focuses on patterns in vessel production, exchange, and use by comparing distributions of temporally sensitive ceramic types recovered from this site.

Identification of Ceramic Resource Availability and Use

The production and exchange of ceramic vessels are closely related phenomena. Discussions of pottery production and exchange at LA 101412 focus first on factors relating to the influence of resource availability on local ceramic production. These examinations provide the basis for the identification of locally produced pottery, as well as an understanding of the potential reasons for the production of a distinctive pottery tradition in the northern Rio Grande. Such criteria are also used to recognize nonlocal ceramics, and to document changing patterns in ceramic exchange.

As part of these investigations, local raw materials for ceramic production were collected, characterized, and compared to materials noted in the pottery found at LA 101412. These comparisons allow the distinction of locally produced pottery from that manufactured in other Anasazi regions. Ethnographic data compiled by Arnold (1985) indicate that potters not relying on modern transportation seldom go more than three kilometers to collect temper, and five kilometers for clay. Thus, characterizing sources occurring within these distances from a site provides a basis for identifying locally produced ceramics.

Properties noted in nearby clay and temper sources were compared with those identified in the local pottery. Examination with a binocular microscope and petrographic analysis provided the basis for temper comparisons. The main technique for clay comparison involves firing clays and sherds to similar atmospheres and temperatures, which enables a common comparison based on the influence of mineral content on paste color.

Geology and ceramic raw materials. The distinct geology of the Española Basin, whose boundaries largely overlap archaeologically based definitions of the Tewa Basin, provides the basis for identifying locally produced pottery. The Española Basin is part of the Rio Grande rift or depression, which follows the Rio Grande Valley from southern Colorado to southern New Mexico (Kelley 1979). Regional uplifts during the late Eocene and Oligocene caused widespread erosion of the region. On the east, the margin of a subdued version of the Laramide Sangre de Cristo uplift lies 8 to 16 km west of its present position. This material is the source of much of the Neocene Santa Fe group sediments.

During the Miocene and early Pliocene, older sedimentary and crystalline sources were augmented by volcanic eruptions in the Jemez, Brazos and Sangre de Cristo areas. Accumulation of sediments continued as this basin subsided and the Sangre de Cristo source area slowly tilted. Erosion of upturned beds and elevated scarps was relatively rapid, and pedimentation spread widely.

The Santa Fe group comprises the middle and upper Pliocene deposits resulting from these episodes. The Santa Fe group is divided into two formations—the lower Tesuque formation, and the upper Chamito formation (Galusha and Blick 1971). In some areas, the total thickness of the Santa Fe group is at least 1,372 m. The sediments of this group include alluvial-fan and eolian deposits consisting of gravels, loosely consolidated sandstones, siltstones, volcanic ash, bentonite, tuffaceous deposits, conglomerate sandstones, intraformation breccias, concretions of various kinds, and clay. Interbedded volcanic flows are few and small in extent.

Deposits of the Tesuque formation can be divided into five members: Nambe, Skull Ridge, Pojoaque, Chama-El Rito, and Ojo Caliente. All members are lithologically distinct, but may have been deposited at about the same time.

Representative samples of potential ceramic materials were collected from various sources in the Pojoaque area. All clay sources located appeared to be associated with the Santa Fe formation. It was not possible to consistently distinguish members of this formation, but two basic types of sources for clay sources are represented. Characterization of local clays indicates that the great majority of the pottery from both LA 101412 and surrounding areas of the Tewa Basic could have been produced locally.

Appendix 3 describes the clays collected in the Pojoaque area. Most of the clays were silty and derived from alluvial fans or flood plain deposits associated with members of the Santa Fe group. Various members are represented by numerous brownish, tan, pink, or reddish-brown bands. Clays collected from local alluvial sources contain numerous flecks of mica as well as small silt-size white angular fragments of weathered granite. All these clays are high in iron content and fire red when oxidized. Gray wares from local sites dating to various periods indicate the use of local high-iron alluvial sources with varying mica content. High-quality micaceous clays identical in appearance with pastes noted in the local gray ware are common in the upper formations of the terraces along LA 101412. Refiring tests showed that local alluvial clay and most gray wares fired to the same red colors in oxidizing atmospheres; both also had coarse, silty textures. Temper materials reflect the use of local cobbles derived from granitic sources in the Sangre de Cristo mountains. The presence of finer schist inclusions and the increase in amount of mica in many of the Classic period utility wares may indicate a shift to self-tempered clays derived from highly micaceous schist sources. These clays are available in the local area, and their use may reflect a shift in preference of locally available sources.

The other type of ceramic clay occurring in Santa Fe formation deposits consists of thinner, white, light gray to green layers of volcanic ash interbedded with the thicker layers of alluvial clay. While such deposits are often not suitable as pottery clay, weathering sometimes results in fine high-quality bentonitic clays. Unlike the alluvial clays, these do not have mica inclusions. They do contain fine ash and tuff inclusions that are very similar to particles noted in Tewa tradition white wares. This indicates the use of self-tempered, ash-derived clays. These ash-derived clays often fire to reddish colors when exposed to an oxidation atmosphere, and to black or dark gray colors when fired in a neutral or reduction atmosphere. The dark pastes and fine textures noted in local clays are very similar to those noted in early Tewa tradition pottery. Types associated with all temporal periods fire to similar yellow-red colors. Fine tuff or ash was noted in white ware pastes associated with all occupational periods represented, although biscuit ware usually exhibited finer and more dense fragments. It is likely that biscuit ware pastes reflect the addition of fine volcanic ash that results in the porous, woody texture noted in these sherds.

Pottery production and exchange. Regional distributions of stylistic traits and raw materials provide clues to the production and movement of ceramic vessels, and flow of information on appropriate manufacturing and decorative techniques. Examination of all these phenomena is important in documenting the participation of Tewa Basin groups in larger regional exchange or interaction networks of the Northern Anasazi. The presence of nonlocal ceramics may reflect several factors, including seasonal movement, long-distance migration, informal reciprocal exchange between kin-related groups, and formalized trade between distinct groups. Because of the widespread use of certain ceramic styles throughout the eastern Anasazi country (Toll and McKenna 1993), nonlocal vessels must be identified by the presence of the distinct tempering and clay sources not available or used in the Tewa Basin.

Models for the participation of Developmental period groups in the Tewa Basin in regional systems often focus on the role of groups in the Chaco (or Cibola) region of the Anasazi. Models involving the earliest influences include migration or colonization episodes postulated to have begun during the tenth century (McNutt 1969; Wilson 2004). Other models involve the subsequent participation of groups from the Tewa Basin in the Chaco regional network during the eleventh or early twelfth centuries (Lekson 1991; Riley 1995; Wiseman and Olinger 1991). These influences could result in stylistic similarities between Tewa Basin and Cibola pottery as well as the presence of Cibola trade wares at Developmental sites in the Tewa Basin.

Another model of panregional interaction and influence for the Tewa Basin involves the proposed mass migration of Pueblo III groups from the Four Corners or northern San Juan region into the northern Rio Grande (Cordell 1978, 1989, 1995; Lipe 1994). Such episodes are often postulated to explain the abandonment of areas in the northern San Juan, but are more commonly accepted by archaeologists working in the Four Corners area than those in northern Rio Grande region (Cameron 1995). Northern Rio Grande trends used to invoke such theories include the appearance of large villages during the Coalition period, the introduction of organic-painted pottery, and the appearance of Mesa Verde Black-on-white painted design styles on northern Rio Grande pottery. However, the assumed strong similarities in architectural and ceramic traditions between regions in the Colorado Plateau and northern Rio Grande have not been adequately demonstrated. If mass migration from the northern San Juan to the Tewa Basin did occur during this time, a high frequency of intrusive Mesa Verde Black-on-white pottery and strong influence on the local ceramic technology would be expected. So far, extremely little evidence of intrusive Mesa Verde pottery or strong stylistic influence from this region has been documented in northern Rio Grande Coalition period assemblages.

Classic period groups in the Tewa Basin are expected to have interacted with the increasing populations in other areas of the Rio Grande region, although this could also involve interaction with more distant pueblos to the west, Pecos Pueblo to the east, and the Tiwa pueblos to the north. Habicht-Mauche (1993) notes fundamental changes in the structure and scale of northern Rio Grande society during the Classic period, which is postulated to have included the establishment of regional tribal networks. These transformations are reflected in the emergence of regional ceramic technologies and styles, and in the structure of ceramic production and exchange throughout the Rio Grande. Participation of Classic populations in larger networks oriented towards areas of the Rio Grande to the south should result in the presence of glaze ware pottery and possibly other nonlocal types.

Documentation of nonlocal gray utility and decorated white ware ceramics from various temporal components at LA 101412 provides an opportunity to examine various models involving exchange and interaction between groups in this area and other Anasazi regions. Tables 3 through 10 give the distributions of temper for wares assigned to a phase (Appendix 2), by ware, and by ware and provenience group (Appendix 2).

Although the majority of gray wares associated with various occupational periods are tempered with local materials, temper characteristics appear to change (Table 5). The great majority (91.3 percent) of gray ware sherds from Developmental period contexts are tempered with a combination of granite and mica particles. This frequency declines slightly during the Coalition period (83.8 percent), and then declines dramatically during the Classic period, when this temper is only present in 44.7 percent of the gray wares. In contrast, there is an apparent increase through time in the frequency of gray wares with mica schist, or sandstone and mica temper.

Petrographic analysis of utility wares from various occupations indicated that all those examined contain plutonic rock (granite) similar to materials outcropping in the southern Sangre de Cristo Mountains (Appendix 4). Granite and other plutonic rocks would also have been readily available near LA 101412 as cobbles and on pediment surfaces common in the surrounding valleys (Galusha and Blick 1971; Kelley 1979; Miller et al. 1963). Temper fragments tend to be relatively large, and it is likely that large-sized temper was used in the utility wares to reduce thermal shock during cooking cycles. In all cases, temper appears to have been additive to the gray ware pastes. The sherds with extremely micaceous pastes associated with later Classic phase occupations appear to represent the use of clays that were probably derived from outcrops dominated by weathered mica, most likely in the southern Sangre de Cristo Mountains. Thus, petrographic analysis indicates the long-term use of similar ceramic sources in the manufacture of gray ware vessels.

Patterns of production and exchange of white wares during different periods were examined by monitoring changes in ceramic types produced in various regions. Temporal changes were examined through a comparison of sherds from dated contexts (Table 6) as well as dated ceramic styles. These examinations indicate that the majority of sherds associated with all periods could have been locally produced, although there is evidence of shifts in the intensity and direction of exchange (Tables 11 through 15).

Developmental period white wares found at LA 101412 originated from a number of different Anasazi regions. Most local Developmental period pottery types exhibit painted styles similar to contemporaneous pottery from the Cibola and northern San Juan regions (Wilson 2004). Similarities include the common occurrence of thin, solidly painted rims, and similar hatchured and solidly painted designs. These similarities confirm the strong connection between the earliest pottery from the Tewa Basin and that from early Pueblo II sites in regions of the Colorado Plateau; this connection is also supported by the presence of nonlocal pottery from these areas. This may indicate trends ultimately resulting from small migration episodes from the Colorado Plateau to northern Rio Grande during the early tenth century. The persistence of nonlocal white wares at

Developmental phase contexts dating to the tenth, eleventh, and twelfth centuries may further reflect continual exchange with kin groups in the San Juan Basin.

In addition, high frequencies of sherds with low-iron pastes and nonlocal tempers indicate that a large proportion of pottery associated with this period originated in other regions of the Southwest. For example, 2.7 percent of Developmental white ware types (Appendix 2) represent northern San Juan types, and 36 percent represent Cibola types. Similar trends are indicated by the distribution of sherds from proveniences dated to the Developmental period. The trend noted for the Developmental component at LA 101412 is similar to that noted for other sites in the Tewa Basin (McNutt 1969; Stubbs 1954; Wilson 2004; Wiseman 1995), and probably reflects both the migration of populations from the Colorado Plateau, and to a lesser extent influences associated with the Chacoan network.

Petrographic analysis of two Kwahe'e Black-on-white sherds, assumed to represent the locally produced Developmental phase decorated pottery, indicates the use of different, although related, sources (Appendix 4). These sources appear to represent the use of self-tempered clays with fine plutonic rock fragments. It is likely that they were produced in the southern Sangre de Cristos and associated valleys.

In contrast to the Developmental phase components, none of the white ware types associated with the Coalition phase components appear to have been produced in the Colorado Plateau. Mesa Verde Black-on-white is absent, and Pueblo III pottery from the Colorado Plateau is limited to extremely small numbers of White Mountain Red Ware sherds. Comparisons of Santa Fe Black-on-white from LA 101412 and other sites in the area and Mesa Verde Black-on-white from the Colorado Plateau indicate greater geographic differences in style and technology than generally acknowledged (Abel 1955; Mera 1935). For example, Santa Fe Black-on-white sherds tend to be relatively thin, tapered, and exhibit few ticked painted decorations (Tables 16 through 19). These differ significantly from contemporaneous Mesa Verde sherds from the northern

Table 3. Temper types by phase.

Temper	Phase					Total	
	Unknown	Developmental	Coalition	Classic	Historic	n	Percent of Site
Self-tempered	21	3	6	-	-	30	0.5%
Indeterminate	11	-	2	2	-	15	0.2%
Sand	36	8	-	2	-	46	0.8%
Mica/quartz/feldspar	3339	-	3	4	-	3346	55.3%
Sherd	23	13	3	1	-	40	0.7%
Sherd and sand	14	18	2	-	-	34	0.6%
Fine local igneous	328	26	447	123	-	924	15.3%
Tuff and sherd	3	1	-	1	-	5	0.1%
Fine igneous, other	-	-	1	-	-	1	< 0.1%
Sandstone	3	4	2	-	-	9	0.1%
Mica/quartz	-	-	1	-	-	1	< 0.1%
Fine local igneous and sand	81	3	42	15	-	141	2.3%
Large tuff fragments	213	-	7	2	-	222	3.7%
Leucocratic quartz	14	-	-	-	-	14	0.2%
Andesite diorite with sherd	-	3	-	-	-	3	< 0.1%
Andesite diorite with sand	-	1	-	-	-	1	< 0.1%
Local materials with olivine	-	-	1	1	-	2	< 0.1%
Gray cystalline basalt	-	-	-	1	-	1	< 0.1%
Highly micaceous	12	-	-	-	-	12	0.2%
Sand and mica	319	-	-	-	-	319	5.3%
Ash/vitric tuff	1	-	7	16	-	24	0.4%
Sherd, sand, and igneous	4	-	1	-	-	5	0.1%
Sherd and fine local igneous	15	8	7	1	1	32	0.5%
Sandstone and mica	104	-	-	-	-	104	1.7%
Local self-tempered with black inclusions	-	1	1	-	-	2	< 0.1%
Albuquerque area mica schist	686	-	-	-	-	686	11.3%
Scoria	3	-	-	4	-	7	0.1%
Large tuff fragments with sand	-	-	-	2	-	2	< 0.1%
Fine local igneous with black inclusions	6	-	7	-	-	13	0.2%
Fine local igneous with mica	2	-	6	-	-	8	0.1%
Sherd with black inclusions	-	-	-	1	-	1	< 0.1%
Total	5238	89	546	176	1	6050	100.0%
Percent of site	86.6%	1.5%	9.0%	2.9%	< 0.1%	100.0%	-

San Juan where white wares are thicker, more commonly exhibit flat and ticked rims, and are more polished (Wilson 2004). In addition, examination of white ware paste and temper characteristics indicates similar dark pastes and fine local volcanic temper in almost all sherds examined. Thus, ceramic distributions indicate almost no exchange of white wares during the Coalition period, and tend to contradict models of mass migration of groups from the Colorado Plateau to the Tewa Basin. Instead, Santa Fe Black-on-white appears to have developed locally out of earlier types such as Kwahe'e, with minor influences from regions to the west. Ceramic evidence thus indicates that the Tewa Basin and other areas of the northern Rio Grande were becoming more and more isolated from Anasazi groups in the Colorado Plateau during the Coalition period.

Petrographic analysis of selected Santa Fe Black-on-white sherds revealed that all contained calcium-cement-supported sandstone as well as fine plutonic rock fragments (Appendix 4). The Tesuque Valley and Sangre de Cristos contain such sandstone along with clays with similar plutonic rock fragments. All of the Wiyo Black-on-white sherds subjected to petrographic analysis were tempered with glassy pumice (Appendix 4). It is likely that they were produced from different clay bodies but similar geological sources.

Ceramic distributions associated with the Classic period indicate very little interaction between groups in the Tewa Basin and those in regions outside the northern Rio Grande. Classic period white wares represented local biscuit ware types. Design styles and rim forms are very distinct from those noted at earlier components at LA 101412 (see Tables 16 through 19), but similar to those described for other Classic period sites north of Santa Fe (Fallon and Wening 1987; Kidder 1931; Wendorf 1953). Nonlocal decorated types dating to the Classic period are limited to a small number of glaze wares. The wide range of tempering materials present in glaze wares indicates vessels originating in a number of different areas of the middle Rio Grande Valley.

All biscuit ware sherds examined petrographically were tempered with crushed glassy pumice similar to that noted for Wiyo Black-on-white sherds (Appendix 4). Sources of this temper and clay are available locally in volcanic deposits.

Table 4. Temper types by ware.

	Ware						Total	
Temper	Gray	White	Red	Glaze	Historic Decorated	Other	n	Percent of Site
Self-tempered	10	19	-	-	-	1	30	0.5%
Indeterminate	3	8	2	2	-	-	15	0.2%
Sand	29	14	1	2	-	-	46	0.8%
Mica/quartz/feldspar	3306	40	-	-	-	-	3346	55.3%
Sherd	1	33	6	-	-	-	40	0.7%
Sherd and sand	1	32	1	-	-	-	34	0.6%
Fine local igneous	90	832	1	1	-	-	924	15.3%
Tuff and sherd	-	5	-	-	-	-	5	0.1%
Fine igneous, other	-	1	-	-	-	-	1	< 0.1%
Sandstone	3	6	-	-	-	-	9	0.1%
Mica/quartz	-	1	-	-	-	-	1	< 0.1%
Fine local igneous and sand	43	98	-	-	-	-	141	2.3%
Large tuff fragments	205	17	-	-	-	-	222	3.7%
Leucocratic quartz	14	-	-	-	-	-	14	0.2%
Andesite diorite with sherd	-	3	-	-	-	-	3	< 0.1%
Andesite diorite with sand	-	1	-	-	-	-	1	< 0.1%
Local materials with olivine	-	1	-	1	-	-	2	< 0.1%
Gray cystalline basalt	-	-	-	1	-	-	1	< 0.1%
Highly micaceous	12	-	-	-	-	-	12	0.2%
Sand and mica	315	4	-	-	-	-	319	5.3%
Ash/vitric tuff	-	24	-	-	-	-	24	0.4%
Sherd, sand, and igneous	-	3	2	-	-	-	5	0.1%
Sherd and fine local igneous	-	29	1	1	1	-	32	0.5%
Sandstone and mica	100	4	-	-	-	-	104	1.7%
Local self-tempered with black inclusions	-	2	-	-	-	-	2	< 0.1%
Albuquerque area mica schist	686	-	-	-	-	-	686	11.3%
Scoria	-	-	3	4	-	-	7	0.1%
Large tuff fragments with sand	-	-	-	2	-	-	2	< 0.1%
Fine local igneous with black inclusions	1	12	-	-	-	-	13	0.2%
Fine local igneous with mica	1	7	-	-	-	-	8	0.1%
Sherd with black inclusions	-	-	-	1	-	-	1	< 0.1%
Total	4820	1196	17	15	1	1	6050	100.0%
Percent of site	79.7%	19.8%	0.3%	0.2%	< 0.1%	< 0.1%	100.0%	-

Table 5. Gray ware temper types by provenience group.

Temper	Provenience Group: Mixed	Developmental	Coalition/ Developmental	Coalition	Classic	Total: n	Percent of Gray Ware
Self-tempered	8	-	-	2	-	10	0.2%
Indeterminate	1	-	-	1	1	3	0.1%
Sand	27	-	-	1	1	29	0.6%
Mica/quartz/feldspar	2763	116	25	279	123	3306	68.6%
Sherd	1	-	-	-	-	1	< 0.1%
Sherd and sand	1	-	-	-	-	1	< 0.1%
Fine local igneous	89	1	-	-	-	90	1.9%
Sandstone	1	1	-	1	-	3	0.1%
Fine local igneous and sand	35	2	3	3	-	43	0.9%
Leucocratic quartz	193	-	-	4	8	205	< 0.1%
Large tuff fragments	14	-	-	-	-	14	0.3%
Highly micaceous	12	-	-	-	-	12	0.2%
Sand and mica	259	5	-	28	23	315	6.5%
Sandstone and mica	78	2	-	6	14	100	2.1%
Albuquerque area mica schist	574	-	-	7	105	686	14.2%
Fine local igneous with black inclusions	1	-	-	-	-	1	< 0.1%
Fine local igneous with mica	-	-	-	1	-	1	< 0.1%
Total	4057	127	28	333	275	4820	100.0%
Percent of gray ware	84.2%	2.6%	0.6%	6.9%	5.7%	100.0%	-
Percent of site	67.1%	2.1%	0.5%	5.5%	4.5%	79.7%	-

Table 6. White ware temper types by provenience group.

Temper	Provenience Group: Mixed	Developmental	Coalition/ Developmental	Coalition	Classic	Total: n	Percent of White Ware
Self-tempered	19	-	-	-	-	19	1.6%
Indeterminate	8	-	-	-	-	8	0.7%
Sand	12	-	-	2	-	14	1.2%
Mica/quartz/feldspar	35	3	-	2	-	40	3.3%
Sherd	28	2	2	1	-	33	2.8%
Sherd and sand	27	1	1	3	-	32	2.7%
Fine local igneous	701	3	1	40	87	832	69.6%
Tuff and sherd	5	-	-	-	-	5	0.4%
Fine igneous, other	1	-	-	-	-	1	0.1%
Sandstone	5	-	-	1	-	6	0.5%
Mica/quartz	1	-	-	-	-	1	0.1%
Fine local igneous and sand	77	1	-	5	15	98	8.2%
Large tuff fragments	17	-	-	-	-	17	1.4%
Andesite diorite with sherd	3	-	-	-	-	3	0.3%
Andesite diorite with sand	1	-	-	-	-	1	0.1%
Local materials with olivine	1	-	-	-	-	1	0.1%
Sand and mica	3	-	-	1	-	4	0.3%
Ash/vitric tuff	24	-	-	-	-	24	2.0%
Sherd, sand and igneous	3	-	-	-	-	3	0.3%
Sherd and fine local igneous	20	2	1	5	1	29	2.4%
Sandstone and mica	3	-	-	-	1	4	0.3%
Local self-tempered with black inclusions	2	-	-	-	-	2	0.2%
Fine local igneous with black inclusions	12	-	-	-	-	12	1.0%
Fine local igneous with mica	6	-	-	1	-	7	0.6%
Total	1014	12	5	61	104	1196	100.0%
Percent of white ware	84.8%	1.0%	0.4%	5.1%	8.7%	100.0%	-
Percent of site	16.8%	0.2%	0.1%	1.0%	1.7%	19.8%	-

Table 7. Red ware temper types by provenience group.

	Provenience Group			Total	
Temper	Mixed	Coalition	Classic	n	Percent of Redware
Indeterminate	2	-	-	2	11.8%
Sand	1	-	-	1	5.9%
Sherd	4	1	1	6	35.3%
Sherd and sand	-	-	1	1	5.9%
Sherd, sand and igneous	2	-	-	2	11.8%
Fine local igneous	-	-	1	1	5.9%
Sherd and fine local igneous	1	-	-	1	5.9%
Scoria	2	-	1	3	17.6%
Total	12	1	4	17	100.0%
Percent of redware	70.6%	5.9%	23.5%	100.0%	-

Table 8. Glaze ware temper types by provenience group.

	Provenience Group		Total	
Temper	Mixed	Classic	n	Percent of Glazeware
Indeterminate	2		2	13.3%
Sand	1	1	2	13.3%
Fine local igneous		1	1	6.7%
Local materials with olivine	1		1	6.7%
Gray crystalline basalt	1		1	6.7%
Sherd and fine local igneous	1		1	6.7%
Scoria	2	2	4	26.7%
Large tuff fragments with sand	1	1	2	13.3%
Sherd with black inclusions	1		1	6.7%
Total	10	5	15	100.0%
Percent of glazeware	66.7%	33.3%	100.0%	-

Table 9. Historic decorated ceramic temper types by provenience group.

	Provenience Group	
Temper	Mixed	Total
Sherd and fine local igneous	1	1
Total	1	1

Table 10. Other ceramic temper types by provenience group.

	Provenience Group	
Temper	Mixed	Total
Self-tempered	1	1
Total	1	1

Table 11. Ware group by tradition for mixed proveniences.

Ware Group	Tradition				Total	
	Indeterminate	San Juan/ Mesa Verde	Cibolan/ Chaco	Northern Rio Grande	n	Percent of Mixed Proveniences
Prehistoric gray ware	-	-	-	4057	4057	79.6%
Prehistoric white ware	-	3	27	984	1014	19.9%
Prehistoric redware	-	-	2	10	12	0.2%
Prehistoric glazeware	-	-	-	10	10	0.2%
Historic decorated	-	-	-	1	1	< 0.1%
Other	1	-	-	-	-	< 0.1%
Total	1	3	29	5062	5095	100.0%
Percent of mixed proveniences	< 0.1%	0.1%	0.6%	99.4%	100.0%	-
Percent of site	< 0.1%	< 0.1%	0.5%	83.7%	84.2%	-

Table 12. Ware group by tradition for Classic proveniences.

Ware Group	Tradition		Total	
	Cibolan/ Chaco	Northern Rio Grande	n	Percent of Classic Proveniences
Prehistoric gray ware	-	275	275	70.9%
Prehistoric white ware	-	104	104	26.8%
Prehistoric redware	1	3	4	1.0%
Prehistoric glazeware	-	5	5	1.3%
Total	1	387	388	100.0%
Percent of Classic proveniences	0.3%	99.7%	100.0%	-
Percent of site	< 0.1%	6.4%	6.4%	-

Table 13. Ware group by tradition for Coalition proveniences.

Ware Group	Tradition	Total	
	Northern Rio Grande	n	Percent of Coalition Proveniences
Prehistoric gray ware	333	333	84.3%
Prehistoric white ware	61	61	15.4%
Prehistoric redware	1	1	0.3%
Total	395	395	100.0%
Percent of Coalition proveniences	100.0%	100.0%	-
Percent of site	6.5%	6.5%	-

Table 14. Ware group by tradition for Coalition/Developmental proveniences.

Ware Group	Tradition: Cibolan/ Chaco	Tradition: Northern Rio Grande	Total: n	Total: Percent of Coalition/ Developmentsl Proveniences
Prehistoric gray ware	-	28	28	84.8%
Prehistoric white ware	2	3	5	15.2%
Total	2	31	33	100.0%
Percent of Coal./Dev. proveniences	6.1%	93.9%	100.0%	-
Percent of site	< 0.1%	0.5%	0.5%	-

Table 15. Ware group by tradition for Developmental proveniences.

Ware Group	Tradition: Cibolan/ Chaco	Tradition: Northern Rio Grande	Total: n	Total: Percent of Developmental Proveniences
Prehistoric gray ware	-	127	127	91.4%
Prehistoric white ware	2	10	12	8.6%
Total	2	137	139	100.0%
Percent of Developmental proveniences	1.4%	98.6%	100.0%	-
Percent of site	< 0.1%	2.3%	2.3%	-

Table 16. Rim thickness by ceramic type.

	Rim Thickness (mm)							Total	
Ceramic Type	2.0	4.0	5.0	6.0	7.0	8.0	16.0	n	Percent of Sample
Santa Fe Black-on-white	1	12	27	14	1	-	1	56	62.2%
Wiyo Black-on-white	-	5	7	-	-	-	-	12	13.3%
Biscuit A	-	1	3	8	5	1	-	18	20.0%
Biscuit B	-	1	2	1	-	-	-	4	4.4%
Total	1	19	39	23	6	1	1	90	100.0%
Percent of stylistic sample	1.1%	21.1%	43.3%	25.6%	6.7%	1.1%	1.1%	100.0%	-

Table 17. Rim decoration by ceramic type.

	Ceramic Type				Total	
Rim Decoration	Santa Fe Black-on-white	Wiyo Black-on-white	Biscuit A	Biscuit B	n	Percent of Sample
Indeterminate	3	1	3	-	7	7.8%
Undecorated	52	11	3	2	68	75.6%
Solid	1	-	1	-	2	2.2%
Ticked dots or squares	-	-	4	2	6	6.7%
Single zigzags	-	-	2	-	2	2.2%
Diagonal lines	-	-	3	-	3	3.3%
Single line on portion	-	-	2	-	2	2.2%
Total	56	12	18	4	90	100.0%
Percent of sample	62.2%	13.3%	20.0%	4.4%	100.0%	-

Table 18. Motif type by ceramic type.

Motif Type	Ceramic Type: Santa Fe Black-on-white	Wiyo Black-on-white	Biscuit A	Biscuit B	Total: n	Percent of Sample
Indeterminate	6	-	2	1	9	10.0%
Other lines	1	-	-	-	1	1.1%
Thin parallel lines	4	1	-	-	5	5.6%
Thick parallel lines		-	2	-	2	2.2%
Thin rectilinear lines	1	-	-	-	1	1.1%
Single thin line	1	-	-	-	1	1.1%
Single thick line	37	10	13	3	63	70.0%
Triangles	1	-	-	-	1	1.1%
Right triangles	2	-	-	-	2	2.2%
Rectilinear ribbon	2	-	1	-	3	3.3%
Triangular ribbon	1	-	-	-	1	1.1%
Parallel lines with opposing triangles alternating on lines	-	1	-	-	1	1.1%
Total	56	12	18	4	90	100.0%
Percent of stylistic sample	62.2%	13.3%	20.0%	4.4%	100.0%	-

Table 19. Motif type by provenience group.

Motif Type	Provenience Group: Mixed	Classic	Coalition	Total: n	Percent of Sample
Indeterminate	8	1	-	9	10.0%
Other lines	1	-	-	1	1.1%
Thin parallel lines	4	-	1	5	5.6%
Thick parallel lines	1	1	-	2	2.2%
Thin rectilinear lines	1	-	-	1	1.1%
Single thin line	1	-	-	1	1.1%
Single thick line	58	1	4	63	70.0%
Triangles	1	-	-	1	1.1%
Right triangles	2	-	-	2	2.2%
Rectilinear ribbon	3	-	-	3	3.3%
Triangular ribbon	1	-	-	1	1.1%
Parallel lines with opposing triangles alternating on lines	1	-	-	1	1.1%
Total	82	3	5	90	100.0%
Percent of stylistic sample	91.1%	3.3%	5.6%	100.0%	-

Thus, an examination of paste, temper and other characteristics associated with the pottery recovered from LA 101412 indicates several trends concerning the production and exchange of pottery. Gray ware vessels appear to have been produced locally during all periods. Nonlocal types that may have been produced in the Colorado Plateau are relatively common in Developmental period and rare to absent in later assemblages, indicating a decline in the long-distant exchange of pottery through time. There is some evidence, however, for exchange of decorated pottery such as glazed types from other areas within the Rio Grande region.

The utility wares from this site exhibit similar pastes and tempers, which appear to have been ultimately derived from the Sangre de Cristos and are common in the surrounding valleys. The presence of pastes with higher concentrations of mica during the Classic period could represent a minor shift in the clay resources utilized. Although white wares appear to exhibit high proportions of pastes with volcanic inclusions, petrographic analysis indicates the use of distinct sources in the production of white wares during the three periods represented. This may represent shifts in the use of different locally available source materials more suitable to the technologies associated with different periods, rather than shifts in exchange. Determining the significance of the trends noted, however, still requires more data.

Functional trends. The recovery of ceramics at a particular archaeological context ultimately reflects the use and breakage of vessels used for specific activities. Attributes relating to vessel shape, size, material resources, surface manipulation, technological attributes, and wear patterns reflect the intended or actual uses of ceramic vessels. Vessel function is reflected by ceramic ware groups and vessel form. Examinations of ware and vessel form distributions provide information concerning activities for which ceramic vessels may have been used.

Functional trends associated with changes in ware distributions must be based on distributions of the small number of sherds from dated proveniences. Examinations of ware distributions (Table 20) indicate an increase in decorated wares through time. For example, white ware sherds make up 8.6 percent of the total sherds for Developmental period assemblages, 15.4 percent for Coalition period assemblages, and 26.8 percent of the total for those associated with the Classic period.

Functional changes are also reflected by vessel form distributions. Table 21 illustrates vessel forms associated with the ware groups, and Table 22 illustrates vessel forms from dated wares (Appendix 2). Although a variety of forms are represented by white wares, the majority of decorated types dating to all periods are bowls. In contrast, the great majority of gray ware sherds are derived from wide-mouth cooking and storage jars. Thus, there appears to have been an increase in the total frequency of bowls through time.

Another trend of potential functional significance concerns evidence of surface treatments on gray wares (Table 23). The majority of sherds associated with each provenience group have plain gray exteriors, although the frequencies of gray ware sherds exhibiting other surface textures is highest for the Coalition period. This trend mostly reflects the corrugated sherds, which increase in the Coalition period deposits, then decrease in those from the Classic period.

Similar trends in the frequency and decoration of gray wares have been noted in other areas of the Anasazi, such as the Colorado Plateau, but data from LA 101412 and surrounding sites indicate strong differences in the timing and degree of change in the Tewa Basin. For example, while the increase in white wares noted from the Developmental to Coalition periods at LA 101412 has also been noted at sites in the Pueblo II to Pueblo III periods in other areas, the differences in total frequencies of white wares at given periods is dramatic. For example, white ware sherds often represent less than 10 percent of the total ceramics from LA 101412 and other sites in the Tewa Basin (Wilson 2004), but usually include at least a third of the total sherds from contemporaneous Pueblo II sites on the Colorado Plateau. White wares represent less than 20 percent of the pottery from Tewa Basin sites, but they often represent over half the sherds from contemporaneous Pueblo III sites on the Colorado Plateau (Wilson and Blinman 1995a).

In addition, corrugated forms from LA 101412 are similar to those noted at sites on the Colorado Plateau, but they occur in much lower frequencies. Furthermore, the change in white ware frequency from the Coalition to Classic period is the opposite of that noted at Paa-ko east of Albuquerque, where a decline in the total frequency of white wares has been noted (Lambert 1954).

Differences in frequency and decoration of gray wares could ultimately reflect factors relating to greater mobility in groups of the Tewa Basin and other areas of the northern Rio Grande, particularly during the Developmental period. Because pottery vessels provide evidence of food preparation as well as of storage activities that contribute to evening out spatial and temporal heterogeneity in subsistence resources, it is not surprising that changes in mobility or sedentism would be reflected in the characteristics and distribution of the pottery produced (Mills 1989). Pottery provides technological alternatives to full-scale mobility (Mills 1989). One model for understanding potential changes in ceramic production and manufacture involves the distinction between maintainable and reliable systems

(Bleed 1986; Mills 1989). Maintainable systems sacrifice durability for other factors such as modularity and portability, whereas reliable systems are designed for increased durability. The expected characteristics of containers resulting from maintainable systems include ease of manufacture and repair, little time spent on manufacture and use, lack of backup systems, portability, intended utilization for a limited number of tasks, and reflect simple and easily transferred construction and firing techniques. Containers resulting from reliable productions systems tend to be abundant and sturdy, involve more specialized forms, are resistant to failure during a specific task, and may require more specialized manufacturing and firing techniques that are relatively time consuming. Mills (1989) notes widespread trends concerning the shift from maintainable to reliable pro-

Table 20. Ware group by provenience group.

	Provenience Group					Total	
Ware Group	Mixed	Developmental	Coalition/ Developmental	Coalition	Classic	n	Percent of Site
Prehistoric gray ware	4057	127	28	333	275	4820	79.7%
Prehistoric white ware	1014	12	5	61	104	1196	19.8%
Prehistoric redware	12	-	-	1	4	17	0.3%
Prehistoric glazeware	10	-	-	-	5	15	0.2%
Historic decorated	1	-	-	-	-	1	< 0.1%
Other	1	-	-	-	-	1	< 0.1%
Total	5095	139	33	395	388	6050	100.0%
Percent of site	84.2%	2.3%	0.5%	6.5%	6.4%	100.0%	-

Table 21. Vessel form by ware group.

	Ware Group						Total	
Ware Group	Prehistoric Gray Ware	Prehistoric White Ware	Prehistoric Redware	Prehistoric Glazeware	Historic Decorated	Other	n	Percent of Site
Indeterminate	4	1	-	-	-	1	6	0.1%
Bowl rim	3	138	2	2	-	-	145	2.4%
Bowl body	17	965	13	13	1		1009	16.7%
Jar neck	5	-	-	-	-	-	5	0.1%
Storage jar rim	162	6	-	-	-	-	168	2.8%
Jar body	4609	70	2	-	-	-	4681	77.4%
Jar body lug handle	1	-	-	-	-	-	1	< 0.1%
Jar body with handle	1	1	-	-	-	-	2	< 0.1%
Indeterminate coil handle	1	1	-	-	-	-	2	< 0.1%
Strap handle	1	-	-	-	-	-	1	< 0.1%
Ladle handle	-	1	-	-	-	-	1	< 0.1%
Miniature jar	1	-	-	-	-	-	1	< 0.1%
Bowl or jar body	8	6	-	-	-	-	14	0.2%
Miniature bowl rim	-	3	-	-	-	-	3	< 0.1%
Bowl or jar rim	4	2	-	-	-	-	6	0.1%
Vessel Base	-	1	-	-	-	-	1	< 0.1%
Indeterminate vessel rim	2	-	-	-	-	-	2	< 0.1%
Single coil handle	1	1	-	-	-	-	2	< 0.1%
Total	4820	1196	17	15	1	1	6050	100.0%
Percent of site	79.7%	19.8%	0.3%	0.2%	< 0.1%	< 0.1%	100.0%	-

duction systems in the Anasazi from the Basketmaker III to Pueblo II in the Colorado Plateau.

The dispersal of populations in the northern Rio Grande during the Developmental or early Pueblo II may have resulted in patterns of mobility and dispersion similar to those utilized in most of the Colorado Plateau during the Basketmaker III period. Although a larger community may have been oriented around a great kiva at the Pojoaque Grant site (Wiseman 1995), most Developmental populations resided at very small dispersed sites. Populations begin to group into larger villages during the Coalition period. It is interesting to note that distributions and shifts in white and gray ware frequencies and decorations in the Tewa Basin resemble trends noted during the Basketmaker III to Pueblo I periods. Thus, ceramic trends in both regions may ultimately

Table 22. Vessel form by phase.

	Phase					Total	
Ware Group	Unknown	Developmental	Coalition	Classic	Historic	n	Percent of Site
Indeterminate	6	-	-	-	-	6	0.1%
Bowl rim	19	15	83	28	-	145	2.4%
Bowl body	376	49	437	146	1	1009	16.7%
Jar neck	5	-	-	-	-	5	0.1%
Storage jar rim	165	1	2	-	-	168	2.8%
Jar body	4637	22	20	2	-	4681	77.4%
Jar body lug handle	1	-	-	-	-	1	< 0.1%
Jar body with handle	1	1	-	-	-	2	< 0.1%
Indeterminate coil handle	2	-	-	-	-	2	< 0.1%
Strap handle	1	-	-	-	-	1	< 0.1%
Ladle handle	-	-	1	-	-	1	< 0.1%
Miniature jar	1	-	-	-	-	1	< 0.1%
Bowl or jar body	14	-	-	-	-	14	0.2%
Miniature bowl rim	1	-	2	-	-	3	< 0.1%
Bowl or jar rim	5	-	1	-	-	6	0.1%
Vessel Base	1	-	-	-	-	1	< 0.1%
Indeterminate vessel rim	2	-	-	-	-	2	< 0.1%
Single coil handle	1	1				2	< 0.1%
Total	5238	89	546	176	1	6050	100.0%
Percent of site	86.6%	1.5%	9.0%	2.9%	< 0.1%	100.0%	-

Table 23. Gray ware textures by provenience group.

	Provenience Group					Total	
Texture Type	Mixed	Developmental	Coalition/ Developmental	Coalition	Classic	n	Percent of Gray Ware
Plain gray	2681	97	22	203	231	3234	67.1%
Neckbanded	18	-	2	2	-	22	0.5%
Corrugated	564	20	3	90	10	687	14.3%
Smeared Corrugated	709	9	-	28	30	776	16.1%
Sapawi Rubbed-Ribbed	79	1	1	9	4	94	2.0%
Indeterminate	6	-	-	1	-	7	0.1%
Total	4057	127	28	333	275	4820	100.0%
Percent of gray ware	84.2%	2.6%	0.6%	6.9%	5.7%	100.0%	-
Percent of site	67.1%	2.1%	0.5%	5.5%	4.5%	79.7%	-

reflect factors relating to the agglomeration of populations from small dispersed settlements into larger villages.

Functional differences in Tewa Basin ceramic assemblages may reflect greater mobility associated with the initial movement of populations to the northern Rio Grande during the Developmental period. Increased mobility may have required a shift back to earlier-employed maintainable vessel production systems. A maintainable system may have required greater amounts of utility ware jars for transport and temporary storage. The shift into larger villages mainly as a result of local population growth and population reorganization would have required more reliable technologies, reflected by the increase in white wares and corrugated exteriors. This contrasts with previous explanations that describe initial divergences in gray wares in terms of cultural isolation or boundaries.

Lithic Artifacts

A total of 301 lithic artifacts were recovered during the testing phase of this project. Dividing the artifacts into Developmental and mixed Developmental/Coalition assemblages, Moore concluded that the site occupants had greater access to exotic materials (obsidian) in the Developmental period (Developmental, 20.3 percent; mixed Developmental/Coalition, 11.2 percent), probably reflecting greater mobility during this period. He also found more thermal alteration and platform modification in the earlier assemblage, suggesting that there could have been a change in reduction technology over time (1994:32-33). The primary objectives outlined in the data recovery plan concern material selection and reduction technology through time (Moore 1994:33). Material selection is monitored though material type, texture, and cortex type; variables monitored to determine reduction technology are thermal enhancement, artifact morphology, platform type, portion, and size. Lithic analysis can also provide information on site function, the range of activities that took place, and mobility, and on exchange and interaction with other groups (1994:50-51).

Methodology

Methods followed those outlined in *Standardized Lithic Artifact Analysis: Attributes and Variable Code Lists* (OAS 1994). Each artifact was examined using a binocular microscope, and variables were coded for computer analysis using SPSS/PC 4.0. Attributes recorded include the field specimen number, material type, material quality, artifact morphology, artifact function, the percent of dorsal cortex (to the nearest 10 percent), platform type, platform lipping, cortex type, distal termination, thermal alteration, wear patterns, measurement of the edge angle on informal tools (degrees), and the length, width, and thickness (mm).

The lithic artifacts are divided into chronological units based on the results of the ceramic analysis. Test pits and layers considered to be Developmental include the lower levels of Test Pits 3-6, all of Test Pit 7, and the lower levels of Test Pits 10-13. Coalition deposits were found in the upper fill of Test Pits 3-6, 14, and 15, and in the lower level of Test Pit 16. The only unmixed Classic period deposits were in the upper fill of Test Pits 8 and 9. The remainder of the sample is considered mixed. Some variation in the assemblages is expected based on differences in deposition for the periods. Much of the Developmental material was deposited in situ over a number of years, with only minor washing from LA 61. The Coalition deposits contain some in situ materials but much has washed into the area. Virtually all of the Classic materials were probably washed in, because they occur high in the fill without associated features.

Material Selection

In the OAS analytic format, most materials are only grossly identified, but a few more refined types from known sources are also recognized. The Pedernal chert classification is usually reserved for chert outcropping in the vicinity of Cerro Pedernal; this analysis, however, did not distinguish Pedernal chert from similar cherts found in the gravel deposits at the site. Thus, whereas some chert is actually Pedernal, the local material is well represented. Moore (1994:29) identified 63.8 percent of the testing sample as Pedernal chert. In this analysis, Pedernal-like chert ranged from a low of 68.5 percent in Developmental deposits to a high of 81.5 percent in the Classic deposits (Table 24). Unsourced obsidian predominates but obsidian from near Polvadera Peak and some resembling the Jemez obsidian from Obsidian Ridge were also recovered. Small amounts of the obsidian and the Pedernal-like chert (Table 25) have water-worn cortex, which suggests that they were transported by water. No other type of cortex was recorded. The tumbled Pedernal-like chert may have been collected from along the Rio Grande, about 8 km to the west of the site. The virtual absence of many of the other materials deposited by the ancestral Rio Grande may indicate that much of the Pedernal-like chert was from the more local gravels. At Los Alamos Canyon, near San Ildefonso, the Rio Grande gravels contain not only Pedernal chert but other cherts, quartzite, basalt, rhyolite, undifferentiated igneous rocks, and silicified wood (Moore 2001).

Massive quartz (white) cobbles are abundant in the gravel at the site; basalt, limestone, sandstone, and other cherts occur in gravel found to the north and south of the site. Paleozoic beds exposed at nearby Nambe Falls contain mudstone, siltstone, sandstone, conglomerates, and limestone (Sutherland 1963:32). Quaternary gravel deposits to the north contain large amounts of massive quartzite (Manley 1979:231), as do Santa Cruz gravel deposits upstream from LA 101412 (Kelley 1979:282; Manley 1979:235). Ortiz pediment remnants outcrop just north and west of the site (Kelley 1979:282). Gravel at the site is mostly Precambrian Embudo granite (Montgomery 1963:8), with lesser amounts of quartz, schist, and chert. This suggests that, with the exception of obsidian, lithic materials are essentially local. Because obsidian does not occur in the Rio Grande gravels in this vicinity, it had to be procured either close to the source or downstream where it occurs in the Rio Grande gravels (Moore 2001).

The main trend in material selection is the decreasing amount of obsidian. Overall, obsidian decreases from 18.5 percent of the Developmental assemblage, to 10.5 percent of the Coalition assemblage, and 7.5 percent of the Classic assemblage. Although obsidian decreases generally, proportions of Polvadera obsidian increase (Developmental, 0.9 percent; Coalition, 1.5 percent; Classic, 5.6 percent). The only obsidian identified as Jemez obsidian is from Developmental deposits. This decrease in exotic material is a good indication that residents of the area were becoming less mobile, or that trade networks were shifting away from that area. Massive quartz shows a pattern similar to that of obsidian; proportionately more is found in the Developmental period deposits, after which it decreases steadily.

Table 24. Lithic material by time period.

	Developmental		Coalition		Classic		Mixed		Total	
Material Type	n	%	n	%	n	%	n	%	n	%
Chert	-	-	1	0.3%	1	1.9%	1	0.2%	3	0.3%
Pedernal-like	74	68.5%	266	79.6%	44	81.5%	446	78.1%	830	77.8%
Obsidian	18	16.7%	30	9.0%	1	1.9%	56	9.8%	105	9.8%
Jemez obsidian	1	0.9%	-	-	-	-	-	-	1	0.1%
Polvadera obsidian	1	0.9%	5	1.5%	3	5.6%	17	3.0%	26	2.4%
Basalt	3	2.8%	8	2.4%	1	1.9%	13	2.3%	25	2.3%
Limestone	-	-	-	-	1	1.9%	-	-	1	0.1%
Sandstone	-	-	3	0.9%	2	3.7%	4	0.7%	9	0.8%
Quartzite	1	0.9%	7	2.1%	-	-	-	-	8	0.7%
Massive quartz	10	9.3%	14	4.2%	1	1.9%	33	5.8%	58	5.4%
Crystalline quartz	-	-	-	-	-	-	1	0.2%	1	0.1%
Total	108	10.1%	334	31.3%	54	5.1%	571	53.5%	1067	100.0%

Table 25. Percent of waterworn cortex by time period.

Material	Developmental	Coalition	Classic	Mixed
Pedernal-like chert	14.9	15.4	13.6	17.9
Obsidian	5.5	10.0	-	8.9
Polvadera obsidian	100.0	20.0	-	5.9
Basalt	33.3	37.5	-	23.0
Sandstone	-	66.7	-	25.0
Quartzite	-	14.3	-	-
Massive quartz	20.0	14.3	100.0	42.4
All materials	14.8	15.9	13.0	18.2

Table 26. Material quality by time period.

Material quality	Developmental	Coalition	Classic	Mixed	Total
Pedernal-like chert (n)	74	266	44	446	830
fine-grained (%)	91.8	82.3	81.8	81.8	82.9
fine-grained, flawed (%)	6.8	16.2	13.6	15.5	14.8
medium-grained (%)	1.4	1.5	4.5	2.7	2.3
Obsidian (n)	20	35	4	73	132
glassy (%)	70.0	85.7	100.0	95.9	89.4
glassy, flawed (%)	30.0	14.3	-	4.1	10.6
All materials (n)	108	334	54	571	1067
glassy (%)	18.6	10.8	1.8	12.8	12.3
fine-grained (%)	80.5	87.8	94.4	85.1	85.8
medium/coarse-grained (%)	0.9	1.5	3.7	2.1	1.9

Results of Chi-square tests on counts for Developmental, Coalition, and Classic assemblages

All material: glassy, fine, medium; X^2 = 11.8423, df = 4, p = .0186.

Pedernal-like chert: glassy, fine, medium; X^2 = 2.0657, df = 4, p = .3560.

flawed, not flawed; X^2 = 3.3412, df = 2, p = .1881.

Changes in material (Pedernal-like chert and obsidian) are statistically significant: X^2=6.9353, df=2, p=.0312.

Material texture (Table 26), a measure of grain size applied within material types, is more often glassy in the earlier sample, mainly reflecting the greater use of obsidian. Medium- or coarse-grained materials (sandstone, quartzite, and quartz) increase steadily in proportion, as do fine-grained materials (cherts, basalt, limestone). The quality of the Pedernal-like chert declines over time: less of the Developmental Pedernal-like chert was fine-grained and flawed, or medium- to coarse-grained (p=.3560). However, this could also reflect artifact size because smaller pieces are less likely to display flaws. Flakes of flawed Pedernal-like chert are slightly larger on average than those recorded as not flawed (flawed length=21.7 mm, width=15.1 mm, thickness=6.8 mm, n=125; not-flawed length=18.3 mm, width=12.4 mm, thickness=4.4 mm, n=238). This contrasts with the obsidian where glassy and flawed obsidian decreases, indicating either a change in obsidian source or that any obsidian was considered for use early on. Again, flake size for flawed material is slightly larger (length=14.8 mm, width=9.71 mm, thickness=2.7 mm, n=14) than for material without flaws (length=13.21 mm, width=8.8 mm, thickness=2.5 mm, n=133).

Heat treatment to improve flaking characteristics was rare (Table 27) even though studies have shown that it may have been necessary to heat treat Pedernal chert in order to produce small formal tools requiring soft hammer or pressure flaking (Schutt 1989:25). Most of the thermal alteration is crazing which results from accidental exposure or mistakes in treatment. The single incidence of luster and color change was in the Coalition period deposits, but this hardly suggests systematic attempts to overcome the lesser-quality material in use during that period. This contrasts markedly with finds at sites closer to the source. Much of the Pedernal chert from sites at Abiquiu Lake shows evidence of heat treatment (Schutt 1989:25).

Dorsal cortex (Table 28) is relatively rare overall. Obsidian has the least; sandstone, basalt, and massive quartz have cortex considerably more often and attest to the frequent use of tumbled cobbles. Proportions of flakes without cortex change little over time regardless of material (all materials X^2=.5867, df=2, p=.7458; Pedernal-like chert X^2=.5271, df=2, p=.7683; obsidian X^2=.5742, df=2, p=.7933). Early-stage reduction (flakes with more than 50 percent dorsal cortex) are only slightly more common in the Coalition deposits. Percentages are remarkably close for Pedernal-like chert. Other

Table 27. Thermal alteration of Pedernal-like chert (percent of flakes altered).

	Developmental		Coalition		Mixed	
	n	%	n	%	n	%
Crazed	1	1.3	16	6.0	14	3.1
Crazed/pot lid	-	-	-	-	1	0.2
Pot lid	-	-	1	0.4	-	-
Color change	-	-	-	-	4	1.0
Luster and color	-	-	1	0.4	-	-

materials have such small sample sizes that they are difficult to compare. In general, the finer-grained and glassy materials have less cortex, which indicates that they were reduced to a greater extent than materials with coarser grains, such as quartzite and quartz.

Reduction Technology

Most of the lithic artifacts are debitage, predominately core flakes (Table 29). Flakes are debitage exhibiting one or more of the following: definable dorsal and ventral surfaces: a bulb of percussion, and a striking platform. Angular debris lacks these. Cores have two or more negative scars originating from one or more surfaces. Formal tools are debitage intentionally altered to produce specific shapes or edge angles (Moore 1994:25).

Even though less of the material is flawed in the early period assemblage, angular debris is more common, but not significantly so (X^2=1.80, df=2, p=.4016). A characteristic of an expedient core-flake reduction strategy is a lot of angular debris showing evidence of hard-hammer percussion, which results in large amounts of shatter. Angular debris was much more common in the testing sample (35.5 percent of the assemblage) (Moore 1994:28) than in the excavation sample where it ranges from 10.0 to 19.6 percent (perhaps suggesting interanalyst differences). Pedernal-like chert produced much of the angular debris (Table 30) and increasing amounts of the flakes. Like other sites in the Santa Fe area (Wiseman 1990:347), obsidian was favored for bifaces and projectile points: only 8.4 percent of the angular debris and 12.5 percent of the flakes are obsidian, whereas 46.2 percent of the bifaces are obsidian. Pedernal-like chert comprises far less of the bifaces than angular debris and core flakes. These two patterns suggest that obsidian was selected for manufacturing tools, and Pedernal-like chert for activities that do not require

Table 28. Percent cortex by material.

Material percent dorsal cortex	Developmental	Coalition	Classic	Mixed	Total
Pedernal-like chert (n)	74	266	44	446	830
0%	87.8	84.6	86.4	81.4	83.3
10-40%	-	1.2	-	0.6	0.7
50-100%	12.2	14.2	13.6	17.9	16.0
Obsidian (n)	18	30	1	56	105
0%	94.4	90.0	100.0	91.1	91.4
100%	5.6	10.0	-	8.9	8.6
Polvadera obsidian (n)	1	5	3	17	26
0%	-	80.0	100.0	94.1	88.9
50-100%	100.0	20.0	-	5.9	11.1
Basalt (n)	3	8	1	13	25
0%	66.7	62.5	100.0	69.2	68.0
30-40%	-	12.5	-	-	4.0
100%	33.3	25.0	-	30.8	28.0
Sandstone (n)	-	3	2	4	9
0%	-	-	100.0	75.0	55.6
100%	-	100.0	-	25.0	44.4
Quartzite (n)	1	7	-	-	8
0%	100.0	85.7	-	-	87.5
100%	-	14.3	-	-	12.5
Massive quartz (n)	10	14	1	33	58
0%	70.0	85.7	-	51.5	62.1
50-100%	30.0	14.3	100.0	48.4	37.8
All materials (n)	108	334	54	571	1067
0%	86.1	83.8	87.0	80.7	82.6
10-40%	-	1.2	1.9	0.4	0.7
50-100%	13.9	15.0	11.2	18.7	16.9

Undifferentiated chert, Jemez obsidian, limestone, and crystalline quartz all have no cortex.

a formal tool. This is somewhat supported by the edge-angle measurements. Only the Coalition sample has wear on both Pedernal-like chert and obsidian debitage (n=3 each), and the obsidian has a slightly finer angle (mean=54, SD=11.5, versus 48, SD=19.1) with both suggesting scraping rather than cutting uses.

More flakes are complete in the Developmental assemblage, but not by much (Table 31) (all materials X^2=1.8505, df=1, *p*=.3640; Pedernal-like chert X^2=3.8096, df=2, *p*=.1489; obsidian X^2=4.7791, df=2, *p*=.0917). All of the bifaces are broken, usually resulting in medial or distal portions. Platforms varied slightly through time. Probably the most significant aspect of platforms is that prepared (abraded) platforms are rare and decrease in proportion from 2.4 percent of the Developmental assemblage to 1.1 percent of the

Table 29. Artifact type by time period.

	Developmental		Coalition		Classic		Mixed		Total	
Material Type	n	%	n	%	n	%	n	%	n	%
Angular debris	21	19.4%	58	17.4%	6	11.1%	57	10.0%	142	13.3%
Core flake	85	78.7%	271	81.1%	47	87.0%	506	88.6%	909	85.2%
Biface flake	-	-	1	0.3%	-	-	-	-	1	0.1%
Birectional core	-	-	-	-	-	-	1	0.2%	1	0.1%
Multidirectional core	1	0.9%	-	-	-	-	-	-	1	0.1%
Early-stage biface	1	0.9%	2	0.6%	-	-	-	-	3	0.3%
Middle-stage biface	-	-	-	-	-	-	1	0.2%	1	0.1%
Late-stage biface	-	-	2	0.6%	1	1.9%	6	1.1%	9	0.8%
Total	108	10.1%	334	31.3%	54	5.1%	571	53.5%	1067	100.0%

Table 30. Material type for selected artifact types by time period.

Artifact type material	Developmental	Coalition	Classic	Mixed	Total
Angular debris (n)	21	58	6	57	142
chert (%)	-	1.7	16.7	1.8	2.1
Perdernal-like chert (%)	76.2	89.7	83.3	82.5	84.5
obsidian (%)	19.0	5.2	-	7.0	7.7
Polvadera obsidian (%)	-	1.7	-	-	0.7
basalt (%)	-	-	-	1.8	0.7
quartzite (%)	-	1.7	-	-	0.7
massive quartz (%)	4.8	-	-	7.0	3.5
Core flake (n)	85	271	47	506	909
Perdernal-like chert (%)	67.1	78.2	83.0	78.3	77.4
obsidian (%)	16.5	9.2	2.1	9.7	9.8
Jemez obsidian (%)	1.2	-	-	-	0.1
Polvadera obsidian (%)	1.2	1.5	4.3	3.2	2.6
basalt (%)	2.4	3.0	2.1	2.2	2.4
limestone (%)	-	-	2.1	-	0.1
sandstone (%)	-	1.1	4.3	0.8	1.0
quartzite (%)	1.2	2.2	-	-	0.8
massive quartz (%)	10.6	4.8	2.1	5.7	5.7
crystalline quartz (%)	-	-	-	0.2	0.1
Biface (n)	1	4	1	7	13
Perdernal-like chert (%)	100.0	50.0	-	28.6	38.5
obsidian (%)	-	25.0	-	42.9	30.8
Polvadera obsidian (%)	-	-	100.0	14.3	15.4
basalt (%)	-	-	-	14.3	7.7
massive quartz (%)	-	25.0	-	-	7.7

Table 31. Portion, platform, distal termination, and function and wear by artifact type and period.

Artifact type attribute	Developmental	Coalition	Classic	Mixed	Total
Portion					
flake (n)	85	272	47	506	910
complete (%)	30.6	30.1	25.5	27.1	28.2
proximal (%)	34.1	36.8	53.2	49.4	44.4
medial (%)	20.0	18.4	19.1	14.8	16.6
distal (%)	8.2	9.9	2.1	7.1	7.8
lateral (%)	7.1	4.4	-	1.6	2.8
collapsed platform (%)	-	0.4	-	-	0.1
biface (n)	1	4	1	7	13
proximal (%)	-	25.0	-	16.7	15.4
medial (%)	-	50.0	-	16.7	30.8
distal (%)	100.0	25.0	100.0	50.0	46.1
lateral (%)	-	-	-	16.7	7.7
Platform type					
core flake (n)	84	270	47	501	902
cortical (%)	10.7	8.1	6.4	8.0	8.2
cortical abraded (%)	2.4	-	-	-	0.2
single-faceted (%)	11.9	15.6	23.4	26.1	21.5
single-faceted abraded (%)	-	0.7	-	-	0.1
multifaceted (%)	34.5	33.0	40.4	33.9	34.0
abraded (%)	-	0.4	-	-	0.2
collapsed (%)	13.1	14.8	8.5	9.8	11.5
crushed (%)	-	-	-	0.2	0.1
absent (%)	13.1	14.1	10.6	11.4	12.3
broken in manufacture (%)	14.3	13.3	10.6	10.6	11.8
biface flake (n)	-	1	-	-	1
retouched (%)	-	100.0	-	-	100.0
Distal termination					
core flake (n)	84	270	47	505	906
feather (%)	25.0	18.1	21.3	20.2	20.1
hinge (%)	8.3	14.8	8.5	10.7	11.6
step (%)	1.2	2.2	-	0.6	1.1
snap fracture (%)	29.8	21.1	25.5	22.6	23.1
axial fracture (%)	1.2	0.7	-	-	0.3
plunging fracture (%)	4.8	8.1	2.1	7.7	7.3
broken in manufacture (%)	28.6	33.0	42.6	38.2	35.8
axial (%)	1.2	1.9	-	-	0.7
biface flake (n)	-	1	-	-	1
obscured by wear (%)	-	100.0	-	-	100.0
Wear pattern/function					
core flake (n)	2	6	-	6	14
unidirectional use (%)	50.0	-	-	16.7	14.3
bidirectional use (%)	-	16.7	-	16.7	14.3
unidirectional retouch (%)	50.0	66.7	-	33.3	50.0
bidirectional retouch (%)	-	-	-	33.3	14.3
abrasion (%)	-	16.7	-	-	7.1
biface flake (n)	-	1	-	-	1
unidirectional use (%)	-	100.0	-	-	100.0
core (n)	1	-	-	1	2
bidirectional use (scraper/graver) (%)	-	-	-	100.0	100.0
utilized core (%)	100.0	-	-	-	
biface (n)	1	4	1	7	13
unidirectional retouch (%)	-	50.0	-	-	15.4
bidirectional retouch (%)	100.0	50.0	100.0	100.0	84.6

Coalition assemblage. None of those in the Classic assemblage are prepared (all time periods X^2=5.3068, df=2, p=.0704; Developmental versus Coalition X^2=3.7891, df=1, p=.0516). Multifaceted platforms are the most common platform type in all time periods and indicate extensive reduction of cores. Only the biface flake has a retouched platform. Distal termination (Table 32) is most often a snap fracture, followed by feather termination. Fair numbers in all time groups were broken in manufacture (X^2=2.7221, df=2, p=.2564). When broken down by material, the results show the same differences as observed in material qual-

Table 32. Core flake distal termination by material.

Material termination	Developmental	Coalition	Classic	Mixed	Total
Pedernal (n)	56	209	39	395	699
feather (%)	23.2	21.1	23.1	22.3	22.0
hinge (%)	8.9	14.8	5.1	11.4	11.9
step (%)	1.8	2.9	-	0.3	1.1
snap (%)	33.9	20.6	28.2	22.5	23.2
plunging (%)	3.6	6.7	2.6	7.8	6.9
broken in manufacture (%)	26.8	31.1	41.0	35.9	33.9
axial (%)	1.8	2.4	-	-	0.9
Obsidian (n)	14	25	1	49	89
feather (%)	7.1	12.0	-	6.1	7.9
hinge (%)	7.1	16.0	-	6.1	9.0
step (%)	-	-	-	4.1	2.2
snap (%)	28.6	12.0	-	20.4	19.1
axial (%)	7.1	4.0	-	-	2.2
plunging (%)	14.3	16.0	-	10.2	12.4
broken in manufacture (%)	35.7	40.0	100.0	53.1	47.2
Jemez obsidian (n)	1	-	-	-	1
broken in manufacture (%)	100.0	-	-	-	100.0
Polvadera obsidian (n)	1	4	2	16	23
feather (%)	-	-	-	18.8	12.5
hinge (%)	-	25.0	-	-	4.2
snap (%)	-	-	50.0	31.3	29.2
plunging (%)	-	25.0	-	12.5	12.5
broken in manufacture (%)	100.0	50.0	50.0	37.5	41.7
Basalt (n)	2	8	1	11	22
feather (%)	-	12.5	-	9.1	9.1
hinge (%)	-	-	100.0	18.2	13.6
snap (%)	-	37.5	-	18.2	22.7
plunging (%)	-	-	-	9.1	4.5
broken in manufacture (%)	100.0	50.0	-	45.5	50.0
Limestone (n)	-	-	1	-	1
hinge (%)	-	-	100.0	-	100.0
Sandstone (n)	-	3	2	4	9
feather (%)	-	-	-	50.0	22.2
hinge (%)	-	33.3	-	25.0	22.2
broken in manufacture (%)	-	66.7	100.0	25.0	55.6
Quartzite (n)	1	6	-	-	7
feather (%)	100.0	-	-	-	14.3
hinge (%)	-	16.7	-	-	14.3
snap (%)	-	50.0	-	-	42.9
plunging (%)	-	33.3	-	-	28.6
Massive quartz (n)	9	13	1	29	52
feather (%)	66.7	7.7	100.0	17.2	25.0
hinge (%)	11.1	15.4	-	10.3	11.5
snap (%)	22.2	38.5	-	27.6	28.8
plunging (%)	-	7.7	-	-	1.9
broken in manufacture (%)	-	30.8	-	44.8	32.7
Crystalline quartz (n)	1	-	-	-	1
broken in manufacture (%)	100.0	-	-	-	100.0

ity. Fewer flakes were broken in manufacture in the earlier deposits when material quality was better. Because flakes broken in manufacture are thinner on average for Developmental period flakes (mean=2.79 mm, SD=2.26 mm, n=24) than for the Coalition (mean=4.92 mm, SD=4.11 mm, n=90) or Classic (mean=3.90 mm, SD=2.71 mm, n=20) periods, this could be due to selection of better material or to greater skill overall.

Size (Table 33) of both angular debris and complete core flakes appears to vary little over time, but this could be due to small sample sizes in all but the Coalition sample. Pedernal-like chert flakes are uniformly larger and thicker than those of obsidian, probably reflecting the size and properties of the parent material.

Slightly more early-stage core reduction is represented in the Developmental assemblage. This is seen in the proportion of flakes with large amounts of cortex (see Table 26), the ratio of cortical to noncortical flakes (Table 34), and the ratio of angular debris to flakes (Table 35). Differences are small, indicating that Developmental and Coalition early-stage core reduction was quite similar. More late-stage core reduction, seen in the proportion of flakes with no cor-

Table 33. Mean size of angular debris and complete core flakes.

	Developmental			Coalition			Classic		
	L	W	T	L	W	T	L	W	T
Angular									
Pedernal (n)	16	16	16	52	52	52	5	5	5
mean	16.4	11.7	5.1	15.6	9.9	4.1	19.4	12.4	4.4
SD	6.1	6.3	4.5	8.2	4.7	3.5	2.9	4.3	1.7
obsidian (n)	4	4	4	4	4	4	0	0	0
mean	12.5	8.7	3.5	15.5	9.5	3.5	-	-	-
SD	4.9	3.8	1.7	6.2	4.2	2.4	-	-	-
Core flake (n)									
Pedernal (n)	13	13	13	73	73	73	9	9	9
mean	19.8	14.0	7.3	18.3	12.5	4.3	17.6	10.4	2.8
SD	5.8	4.9	5.3	7.9	6.4	3.2	4.1	4.7	1.4
obsidian (n)	5	5	5	3	3	3	0	0	0
mean	9.6	7.4	2.4	13.3	6.3	1.7	-	-	-
SD	2.7	2.7	2.2	2.1	0.6	0.6	-	-	-

L = length, W = width, T = thickness; all measurements in millimeters.

Table 34. Ratio of cortical to noncortical flakes.

Material	Developmental	Coalition	Classic	Mixed
Chert	-	0:1.0	0:1.0	0:1.0
Pedernal-like chert	1:7.2	1:5.5	1:6.3	1:4.4
Obsidian	1:17.0	1:9.0	0:1.0	1:10.2
Jemez obsidian	0:1.0	-	-	-
Polvadera obsidian	1:0	1:4.0	0:3.0	1:16.0
Basalt	1:2.0	1:1.7	0:1.0	1:2.2
Limestone	-	-	0:1.0	1:3.0
Sandstone	-	1:0.3	0:2.0	-
Quartzite	0:1.0	1:6.0	0:1.0	-
Massive quartz	1:2.3	1:6.0	-	1:1.1
Crystalline quartz	-	-	-	0:1.0
All materials	1:6.2	1:5.2	1:6.7	1:4.2

Table 35. Ratio of flakes to angular debris.

Material	Developmental	Coalition	Classic	Mixed
Chert	-	0:1	0:1	0:1
Pedernal-like chert	3.6:1	4.1:1	7.8:1	8.4:1
Obsidian	3.5:1	8.7:1	1:0	12.2:1
Jemez obsidian	1:0	-	-	-
Polvadera obsidian	1:0	4:1	2:0	16:1
Basalt	2:0	8:0	1:0	11:1
Limestone	-	-	1:0	4:0
Sandstone	-	3:0	2:0	-
Quartzite	1:0	6:1	-	-
Massive quartz	9:1	13:0	1:0	7.2:1
Crystalline quartz	-	-	-	1:0
All materials	4:1	4.7:1	7.8:1	8.9:1
Testing sample	1.4:1	1.9:1	-	-

tex and the ratio of cortical to noncortical flakes, is found in the Developmental assemblage. Both obsidian and Pedernal-like chert have higher ratios in the Developmental than the Coalition and Classic assemblages, suggesting more flakes per core. This is consistent with the nature of the samples, in that only the Developmental assemblage represents a fair amount of in-situ deposition. Fairly high ratios of flakes to angular debris (Table 35) seem to suggest either a good amount of tool manufacture or more systematic core reduction. However, it is possible that the soil matrix, which contained large amounts of gravel, influenced the recovery of angular debris. Flakes, which are more easily distinguished from broken gravel, may have been invariably collected while angular debris was not.

Activities Represented

Few tools were found. Functionally, these include an early-stage biface from the Developmental deposits; two early-stage bifaces, a late-stage biface, and a projectile point fragment from Coalition deposits; and a late-stage biface from Coalition deposits. Mixed deposits contained a core/scraper-graver, a middle-stage biface, two late-stage bifaces, and four projectile point fragments. This relative abundance of bifaces and projectile points but few other forms suggests an emphasis on activities associated with bifaces. Whereas most of the biface breaks are nondiagnostic, one from a Coalition period deposit is a point tip with a haft snap, suggesting it may have returned in an animal carcass. Two others were broken in manufacture, one from a Coalition deposit and one from a mixed deposit.

As in most assemblages, there is little expedient use recorded on the flakes and cores (see Table 31). In addition, tumbling in colluvial deposits may well have obscured some wear. Materials selected for use at the site are predominantly fine-grained material used primarily for cutting and scraping activities; medium- to coarse-grained materials suited to tasks requiring more durable edges are uncommon. This, in and of itself, may indicate that the tasks carried out at LA 101412 primarily involved cutting and scraping.

Chronological Trends

The only statistically verifiable trends noted in this assemblage relate to material use. Increases in Pedernal-like chert and Polvadera obsidian, along with decreases in obsidian in general, seem to indicate a shift from selection of better quality material that took more effort to acquire, to lesser quality material available at the site and in the Rio Grande lag gravel. This trend is also seen within the Developmental period at nearby LA 103919 (Lentz 2004).

No significant differences were found in the proportion of flakes to angular debris, proportion of complete flakes, proportion of flakes with no cortex, or the number broken in manufacture, indicating that reduction technology changed little over the time span reflected in the site deposits. Throughout, the reduction technology reflects production of expedient tools and task-specific bifaces.

Regional Comparisons

Just north of LA 101412, dense deposits of lithic and ceramic artifacts were found when two burials were excavated from LA 61 within the U.S. 285 right-of-way. Ceramics recovered have dates ranging from Developmental through the late seventeenth century, with most dating to the late Coalition and early Classic periods. Lithic artifacts from the limited excavations numbered 767 flakes and pieces of angular debris, 11 projectile point fragments, 4 biface fragments, a spokeshave, 10 cores, and 2 pieces of ground stone (Anschuetz 1986a:32).

Only 166 pieces of the debitage were analyzed (Anschuetz 1986a:33-38). Materials were recorded somewhat differently but the combined total of chert, Pedernal chert, and chalcedony (86.7 percent) most resembles the LA 101412 Classic deposit total for Pedernal-like chert and chert at 83.4 percent. Obsidian is rare—only 2.4 percent obsidian and 3.0 Polvadera obsidian, also closest to the Classic deposits at LA 101412. Very small amounts of quartzite, basalt, and massive quartz were also recovered. The cortical to noncortical ratio for all materials at LA 61 is 1:4.7, less than that for these Classic deposits but more than in the mixed deposits. Similarly, the ratio of flakes to angular debris (3.2:1) is lower than found in our excavations but greater than that reported by Moore (1994:29) (1.67:1). For LA 61, the platforms are described as mainly faceted, but the proportions are much greater (61.1 percent compared to a range of 32.8 to 40.4 percent), suggesting that, in Anschuetz's analysis, faceted includes both single and multifaceted platforms. Overall, the assemblages are similar enough to conclude that at least part of the LA 101412 assemblage could have come from the north at LA 61.

Data from other sites in the vicinity are sparse. At LA 103919 (Lentz 2004), northeast of LA 101412, early and late Developmental lithic assemblages show a decrease in obsidian (44.5 to 21.8 percent), whereas Pedernal chert and undifferentiated chalcedony increase dramatically through time. In that assemblage, angular debris is sparse, to the extent that analytic differences are suspected (0.6 percent of the assemblage of 5435 artifacts), making other kinds of comparisons difficult.

The KP site (Wiseman 1989) was analyzed quite differently than more recent analyses and provides little basis for comparison. LA 50837, to the west on N.M. 4, an artifact scatter dating to the late Coalition to middle Classic periods, produced very little chipped stone. Materials were largely chert/Pedernal chert/chalcedony (46.8 percent) with more quartzite than was found at LA 101412 (27.6 percent), and little obsidian (4.2 percent) (Anschuetz 1986b:24)

What most of these sites have in common is the use of local materials from nearby gravel deposits and an expedient reduction technology. Choice of better quality materials may characterize the early period but the data base is still too incomplete to decipher regional patterning.

Ground Stone

Ground stone was sparse: only three pieces were recovered even though numerous cobbles were examined for evidence of use. One piece, from Backhoe Trench 3, is a medial fragment of a unifacially ground piece of tabular pink igneous rock. One side is pecked and ground flat, the other is irregular with wear resembling the floor wear on a metate or anvil. This piece is 2.4 cm thick; broken length and width are 7.1 cm and 5.5 cm, respectively. Because the surface is pecked, it is probably a piece of a unifacial mano or a portion of a metate.

The second piece, from Backhoe Trench 1, is a partial metamorphic cobble with polish wear on one face. The wear is spotty with unworn low spots, indicating slight wear, probably on a flat surface. Fine striae are unidirectional and the edges are rounded, indicating it was complete as used. It measures 7.3 cm by 7.6 cm by 1.9 cm, is unmodified, and was probably an expedient grinding tool.

The third piece was found in the upper fill of Test Pit 8. It is a thin tabular piece of igneous rock that is worn flat on both sides. The wear covers much of the surfaces with low or pecked areas not yet worn. Except for recent excavation damage, no striae are evident. One edge has a couple of flakes removed, possibly from shaping. Otherwise, it is irregular in shape and measures 7.3 cm by 4.6 cm by 0.9 cm. It probably represents another expedient but fairly utilized tool.

Little can be concluded from the small ground stone assemblage. None of the pieces were in context.

Fauna

Methods

Identification and recording of the faunal remains from LA 101412 used a modified version of the OAS faunal recording format. Variables include field specimen number (FS), lot number, a feature code, number of items, an indication when identification was uncertain, the taxon, whether the element was part of an articulation, the body part (element) represented, element side, element completeness, portion of the element represented, the age of the animal, criteria for aging, environmental alteration and degree, animal alteration and location, burning degree and location, rounding, processing type and location, and whether the element is a tool, ornament or manufacturing debris.

Taxonomic identifications were made as specific as possible using the OAS comparative collection. When an element could not be identified to species or even family, a range of indeterminate categories identified the size of the animal involved and whether it was mammal, bird, other, or could not be determined. Each specimen (piece of bone) was counted only once even if it was broken into a number of pieces by the archaeologists. If the break occurred prehistorically, the pieces were counted separately with a notation in the articulation variable.

Analytic Results

Very little fauna was recovered: 28 pieces of bone (including two pieces from the testing phase), and one egg-shell fragment. Only seven of these were recovered from Developmental period deposits, and nine from the Coalition period. No single provenience produced more than a few bones (Table 36).

The assemblage consists mostly of unidentifiable fragments from larger-sized animals (72.4 percent). However, taxa range in size from small rodents (a rib and an incisor) to bighorn sheep (a distal metacarpal). Jackrabbits, probably the back-tailed jackrabbit (*Lepus californicus*), are found throughout the state but tend to concentrate where rain results in lush vegetation (Findley et al. 1975:93). Jackrabbits are relatively rare in an assemblage from LA 103919, a Developmental period site to the northeast of this site, but cottontails and jackrabbits occur in almost equal frequencies at the Tesuque By-Pass site to the southeast (Jelinek 1969:127). Bighorn sheep once occupied most New Mexico mountain ranges and were common along the crest of the Sangre de Cristo Mountains (Bailey 1971:16). Deer and pronghorn, but no bighorn sheep, were found at LA 103919 and at the Tesuque By-Pass site.

Most of the bone is highly fragmented (89.7 percent), represented by less than 25 percent of the specimen. The exceptions are a rodent rib and bird radius that are between 25 and 50 percent complete, and an artiodactyl sesamoid that is more than 75 percent complete. Much is also pitted (27.6 percent) from soil conditions, or checked (27.6 percent) from exposure or shallow burial.

All animals were mature individuals. A good portion are burned—half of the medium to large and 42 percent of the large mammal bone is heavily burned (black) (n=4); two fragments are calcined. The only other potential evidence of processing is an impact break on the bighorn sheep metacarpal.

The bighorn sheep was found deep in Test Pit 6 in a Developmental period deposit. The rodent is also from Developmental deposits. None of the bone found in Coalition period deposits was identifiable beyond the general size of the animal. Such a small sample (much of which washed into the area) from deposits ranging over several hundred years sheds little light on subsistence practices. The bighorn sheep would have required some travel to procure but the rabbit, rodent, and possibly the bird were probably present in the immediate area.

Table 36. Fauna by provenience.

Taxon	Test Pit 2	Test Pits 5 and 6	Test Pit 7	Test Pits 8 and 9	Test Pits 10 and 13	Test Pit 16	Feature 3	Area 1	Backhoe Trench 4	Backhoe Trench 5
Small to medium mammal	-	-	-	-	-	1	-	-	-	-
Medium to large mammal	2	2	2	1	1	-	1	-	-	-
Large mammal	-	3	1	1	1	1	2	-	2	1
Small rodent	-	-	2	-	-	-	-	-	-	-
Lepus (jackrabbit)	-	-	-	-	1	-	-	-	-	-
Medium artiodactyl	-	-	-	1	-	-	-	-	-	-
Ovis canadensis (bighorn sheep)	-	1	-	-	-	-	-	-	-	-
Large bird	-	-	-	-	-	-	-	1	-	-
Egg shell	1	-	-	-	-	-	-	-	-	-
Total	3	6	5	3	3	2	3	1	2	1

Macrobotanical Materials

MOLLIE S. TOLL

Introduction and Methods

Botanical materials from several isolated features at the Pojoaque interchange are reviewed here. Flotation samples include three from fire pits (Features 1 and 2) and three from stains (Feature 3, and an unnumbered stain in Test Pit 8).

At 1700 m, LA 101412 is at the lower elevational range of Great Basin Conifer Woodland, with deeper soils and more juniper than piñon, relative to the slightly higher elevation ranges where juniper-piñon woodland achieves its fullest expression (Brown 1994:52). Understory and downslope contact flora include grassland and desert scrub species; saltbush and the several weedy annuals recovered in this flotation assemblage are components of both groups.

The six soil samples collected during excavation were processed at the Museum of New Mexico's Office of Archeological Studies by the simplified bucket version of flotation (see Bohrer and Adams 1977). Sample volume was measured with a large graduated cylinder (volumes ranged from 1.0 to 1.5 liters of soil; the mean was 1.3 liters). Each sample was immersed in a bucket of water, and a 30- to 40-second interval allowed for settling out of heavy particles. The solution was then poured through a fine screen (about 0.35 mm mesh) lined with a square of chiffon fabric to catch organic materials floating or in suspension. After drying, each sample was sorted with a series of nested geological screens (4.0, 2.0, 1.0, 0.5 mm mesh), and reviewed under a binocular microscope at 7-45×. Samples were sorted entirely, and seed totals reported in Table 37 represent frequency of seeds per liter of original soil sample.

From the four flotation samples with sufficient charcoal, a sample of 20 pieces of charcoal was identified (10 from the 4-mm screen, 10 from the 2-mm screen). A fifth provenience, FS 235 from the stain in Test Pit 8, had very little charcoal, but was examined briefly (all six pieces in the 4-mm screen) to determine if this feature continued the wood-use pattern viewed in

Table 37. Flotation results.

	Feature 1 (Fire Pit)		Feature 2 (Fire Pit)	Feature 3 (Stain)		Stain
	Upper Fill FS 183	Lower Fill FS 182	Lower Fill FS 206	Test Pit 14 FS 207	Test Pit 15 FS 208	Test Pit 8 FS 235
Cultural (carbonized)						
Weedy annuals						
Amaranthus (pigweed)	-	-	-	11.7	5.0	-
Chenopodium (goosefoot)	-	-	-	0.8	-	1.0
Portulaca (purslane)	-	-	-	-	-	2.0
Perennials						
Atriplex (saltbush)	-	-	-	-	-	1.0
Juniperus (juniper)	-	-	-	+ male cone + scale leaf	+ scale leaf	-
Cultigens						
Zea mays (corn)	-	-	-	-	-	+ cupules
Unknown 9127	-	-	-	1.7	-	-
Unknown 9161	-	-	-	4.2	-	-
Unidentifiable	-	-	-	-	+ nonreproductive part	-
Probably intrusive (not carbonized)						
Weedy annuals						
Chenopodium (goosefoot)	23.3	-	0.8	-	0.9	-
Euphorbia (spurge)	1.3	0.7	0.8	-	-	1
Physalis (groundcherry)	-	-	-	-	0.9	-
Portulaca (purslane)	12	-	0.8	-	-	-
Unidentifiable	-	0.7	0.8	-	-	-

Values are estimated quantity of seeds or fruits per liter of soil in the original flotation sample.
Relative abundance of nonreproductive parts is indicated (+ = 1-10 items).

Table 38. Species composition of charcoal in flotation samples.

	Feature 1 (Fire Pit)		Feature 2 (Fire Pit)	Feature 3 (Stain)
	Upper Fill FS 183	Lower Fill FS 182	Lower Fill FS 206	Test Pit 14 FS 207
Atriplex-Sarcobatus (saltbush-greasewood)	n=20; 0.77 g	n=20; 0.95 g	n=20; 1.46 g	n=20; 0.70 g

the other burn features. Each charcoal fragment was snapped to expose a fresh transverse section, and identified at 45×. Low-power, incident-light identification of wood specimens does not often allow species- or even genus-level precision, but can provide reliable information useful in distinguishing broad patterns of utilization of a major resource class.

Results

Botanical materials from the fire pits were all unburned seeds from widespread species with promiscuous seed dispersal patterns (Table 37). These include *Euphorbia* (spurge) which has very little economic utility (summarized in Toll 1993:432), and two taxa, *Chenopodium* and *Portulaca* (goosefoot and purslane) which occur in nearly every Anasazi flotation assemblage (Toll 1983; Winter 1993) as well as most historic period accounts of ethnobotanical utilization (e.g., Castetter 1935). It is highly likely that all seeds in these fire pits are intrusive (higher frequency of goosefoot in upper fill of Feature 1 supports this). All wood from Feature 1 (both upper and lower fill) and Feature 2 is saltbush or greasewood, or both (Table 38).

Interestingly, the stains that have more direct remains of cultural plant-related activities. Carbonized goosefoot and pigweed are in Feature 3, and goosefoot, purslane, and corn in the Test Pit 8 stain. Wood from both stains was again entirely saltbush-greasewood. Presumably, the saltbush fruit in Test Pit 8 is a correlate of fuel use. The same derivation is expected for juniper twig parts (scale leaves, male cone) in Feature 3, given that juniper grows at the site, and the widespread popularity of this fuel source at Developmental to Classic period sites of the upper Rio Grande valley (Toll 1995:Table 16).

Summary

Flotation remains from six burned feature samples document several elements of the subsistence regime. Corn debris, for instance, certifies the role of farming; several economic annuals (goosefoot, pigweed, purslane) evidence the contribution of wild-plant gathering; and saltbush charcoal and a fruit distinguish selection of a local shrub for fuel. From this small sample size, however, it is not possible to make sound statements about the relative role or importance of these elements in subsistence, nor is it possible to discern new details about changes within this broad time range.

Other Materials

Two ornaments were found at LA 101412: a small white disc bead and an obsidian object. The white bead was found on the surface of what was to become Test Pit 7. It is probably shell, judging from the polished shiny appearance and what appear to be growth lines rather than banding (Merrin 1995:11); it is 3.9 mm in diameter with a hole approximately 2.2 mm in diameter, and a thickness that varies from 0.8 to 1.1 mm. White disc beads are relatively common in the Rio Grande area, mostly in Coalition period sites. Shell disc beads are rare in Developmental and Classic period sites (Merrin 1995:25-26).

The second object is a small (length 2.1 cm, maximum width 1.2 cm, constriction width 0.86 cm, thickness 6.5 cm) object shaped like an ax (Fig. 22). One end is pointed and the other rounded, and it is notched as if for hafting. The initial shaping was by flaking but much of the object has wear that resembles fine grinding, but this could result from being carried in a bag or from tumbling. Fine scratches occur in some of the depressions that have no grinding. The obsidian is dark black and only slightly translucent with clear banding.

Figure 22. Obsidian ornament from LA 101412

CHAPTER 11

Conclusions

Even though LA 101412 did not produce the expected structures or habitation-related features, this site provides insights into the settlement and adaptations in the Pojoaque-Tesuque area. The test pits, scrapes, and backhoe trenches revealed a large dark gray stain about 12 m by 16 m. The upper surface of what came to be referred to as the Pojoaque paleosol dips down from northeast to southwest about 60 cm over a 15-m stretch, is more or less flat in Area 3 but is 30 cm lower in Area 1 only about 3.0 m to the north. Feature 1, which lies at about the same level but beyond the paleosol, provides an approximate end date for its formation, A.D. 910. The rim of Feature 2 is about 40 cm above the paleosol and is dated at A.D. 1220. It can be deduced from these two dates that about 40 cm of deposition occurred in the 300 years between when the two features were used. Up to a meter of mostly colluvial fill accumulated between the paleosol and present ground surface.

When the features were built and used, they were at the edge of the Rio Tesuque floodplain, an area probably used for agriculture. The main site in the area, LA 61, was on the terrace above the fields but may have been distant enough that those who tended the fields built fires and carried out an array of tasks. Lithic tools associated with the lower deposits indicate that scraping and cutting activities took place, probably around the features. The fire pits themselves contain no food remains but show that locally available brush was used for fuel. Corn in one of the stains shows that consumption took place, which is also suggested by the presence of sherds from both bowls and cooking or storage jars. Burned and unburned bone in the lower deposits indicate animal processing and preparation.

Less is known about the later Coalition, Classic, and historic use of the area, when colluvial channels cut and filled the area with sand, gravel, cobbles, and cultural material from LA 61. Modern modification of the landscape, and the lack of specific spatial information concerning the occupation of LA 61, make it difficult to determine the sequence of events.

Interestingly, alluviation at sites further up the Rio Tesuque was investigated by John P. Miller and Fred Wendorf over forty years ago. Since 1880 it had been observed that many alluvial valleys that had once been arable floodplains with stable channels were becoming incised by deep arroyos. Consensus was that the rapid erosion was caused by poor land management, especially overgrazing and deforestation, in conjunction with increased human settlement. Examination of exposed stratigraphic profiles, however, revealed several earlier periods of erosion and deposition, unrelated to agriculture and human activities, suggesting a natural sequence of events (Miller and Wendorf 1958:177). The Tesuque Valley has two alluvial terraces: a more extensive high terrace, and a lower terrace that occupies a narrow strip along the present channel (Miller and Wendorf 1958:180). Most of the known archaeological sites are situated on the high terrace or nearby hills, and floodwater farming was practiced on the floodplain. In some areas, alluviation occurred on the high terrace, further obscuring evidence of occupation between A.D. 950 and 1200 (Miller and Wendorf 1958:184). Channel trenching began sometime after 1200 to 1250, depositing the low-terrace fill. At some point, this fill stopped then resumed again about 1880 with accelerated erosion (Miller and Wendorf 1958:187).

The findings at LA 101412 more or less agree with this interpretation. Being located at the edge of the low terrace, the area was suited for floodwater farming during the Developmental and parts of the Coalition. The paleosol indicates that stable conditions persisted through the early 900s and ended before 1220, because Feature 2 was built into active colluvial fill. The absence of features dating to later periods could indicate that colluviation made conditions even less ideal for farming in this particular area. Active erosion, paired with a short growing season, unpredictable first and last frosts, and often insufficient and seasonal rainfall, undoubtedly made agriculture an even more risky undertaking. Historically, residents of Pojoaque Pueblo focused their agricultural activities on the Pojoaque Valley north of LA 61 (Ellis 1979), and it is possible that, once the Rio Tesuque became entrenched between A.D. 1200 and 1250, conditions favored use of that area.

Ceramics found at LA 101412 indicate that the Developmental period population had strong ties with the Colorado Plateau region, and some occupants may well have originated in that area. Floodwater farming techniques developed on the Plateau would have been readily adapted to the Tesuque Valley. Vessel forms and exotic lithic materials both suggest a relatively mobile but agriculture-based population. Coalition and Classic period ceramics suggest that these populations grew out of those already in the area, and that they had decreasing interaction with other regions. If true, the substantial increases in the number and size of habitation sites during the Coalition period demonstrate that the local population was able to overcome and flourish under conditions that caused the entrenching and alluviation, although some of the perceived increase may be due to the more substantial site types and the cessation of high-terrace alluviation.

REFERENCES CITED

Abel, Leland J.
1955 *Pottery Types of the Southwest: Wares 5A, 10A, 10B, 12A, San Juan Red Ware, Mesa Verde Gray and White Ware, San Juan White Ware*. Museum of Northern Arizona Ceramic Series No. 3, Flagstaff.

Anderson, Dana, and Yvonne Oakes
1980 The World View of Agriculture. In *Tijeras Canyon: Analyses of the Past*, edited by L. S. Cordell, pp. 12-40. Maxwell Museum of Anthropology and University of New Mexico Press, Albuquerque.

Anschuetz, Kurt F.
1986a *Archaeological Excavation of Two Human Burials Within the U.S. 285 Right-of-Way at Pojoaque Pueblo, Santa Fe County, New Mexico*. Laboratory of Anthropology Notes No. 353. Museum of New Mexico, Santa Fe.

1986b *Archaeological Test Excavations at LA 50387, An Anasazi Special-Use Site Along State Road 4, West of the Pojoaque Pueblo Reservation, Santa Fe County, New Mexico*. Laboratory of Anthropology Notes No. 354. Museum of New Mexico, Santa Fe.

Arnold, Dean E.
1985 *Ceramic Theory and Cultural Process*. Cambridge University Press, Cambridge.

Bailey, Vernon
1971 *Mammals of the Southwestern United States (With Special Reference to New Mexico)*. Dover Publications, New York.

Batkin, Jonathan
1987 *Pottery of the Pueblos of New Mexico, 1700 to 1900*. Colorado Springs Fine Arts Center, Colorado Springs.

Bice, Richard A., and William M. Sundt
1972 Ceramics. In *Prieta Vista: A Small Pueblo III Ruin in North Central New Mexico*. Albuquerque Archaeological Society, Albuquerque.

Biella, Jan V., and Richard C. Chapman
1979 *Archeological Investigations in Cochiti Reservoir, New Mexico*, vol. 4, *Adaptive Change in the Northern Rio Grande Area*. Office of Contract Archeology, University of New Mexico, Albuquerque.

Bleed, Peter
1986 The Optimal Design of Hunting Weapons: Maintainability or Reliability. *American Antiquity* 51:737-747.

Bohrer, Vorsila L., and Karen R. Adams
1977 *Ethnobotanical Techniques and Approaches at the Salmon Ruin, New Mexico*. San Juan Valley Archaeological Project, Technical Series 2; Contributions in Anthropology 8(1). Eastern New Mexico University, Portales.

Breternitz, David A.
1966 *An Appraisal of Tree-Ring Dated Pottery in the Southwest*. Anthropological Papers of the University of Arizona 10. University of Arizona Press, Tucson.

Breternitz, David A., Arthur H. Rohn, Jr., and Elizabeth A. Morris
1974 *Prehistoric Ceramics of the Mesa Verde Region*. Museum of Northern Arizona Ceramic Series No. 5. Flagstaff.

Brown, David E. (editor)
1994 *Biotic Communities: Southwestern United States and Northwestern Mexico*. University of Utah Press, Salt Lake City.

Bullard, William Rotch, Jr.
1962 *The Cerro Colorado Site and Pithouse Architecture in the Southwestern United States Prior to A.D. 900*. Papers of the Peabody Museum of Archaeology and Ethnology 44(2). Harvard University, Cambridge.

Buol, S.W., F.D. Hole, and R.J. McCracken
1989 *Soil Genesis and Classification*, 3rd edition. University of Iowa Press, Iowa City.

Cameron, Catherine M.
1995 Migration and Movement of Southwestern Peoples. *Journal of Anthropological Research* 14(2):104-119.

Carlson, Roy L.
1970 *White Mountain Redware; A Pottery Tradition of East-Central Arizona and West-Central New Mexico*. Anthropological Papers of the University of Arizona No. 19. University of Arizona Press, Tucson.

Carroll, Charles H.
1984 Norton-Tesuque 115 KV Transmission Project Cultural Resources Technical Report. Manuscript on file, Public Service Company of New Mexico, Albuquerque.

Castetter, E. F.
1935 *Uncultivated Native Plants Used as Sources of Food*. Ethnobiological Studies of the American Southwest 1, University of New Mexico Bulletin, Biological Series 4(1). Albuquerque.

Chang, J. H.
1959 An Evaluation of the 1948 Thornthwaite Classification. *Annals of the Association of American Geographers* 49:24-30.

Chavez, Fray Angelico
1979 Genizaros. In *Handbook of North American Indians*, vol. 9, edited by A. Ortiz, pp. 198-200. Smithsonian Institution, Washington, D.C.

Chronic, Halka
1987 *Roadside Geology of New Mexico*. Mountain Press Publishing Company, Missoula.

Colton, Harold S.
1955 *Pottery Types of the Southwest*. Museum of Northern Arizona No. 3A. Flagstaff.

Cordell, Linda S.
1979 *Cultural Resources Overview: Middle Rio Grande Valley, New Mexico*. Government Printing Office, Washington, D.C.

1989 Northern and Central Rio Grande. In *Dynamics of Southwest Prehistory*, edited by Linda S. Cordell and George J. Gumerman, pp. 293-335. Smithsonian Institution Press, Washington, D.C.

1995 Tracing Migration Pathways from the Receiving End. *Journal of Anthropological Research* 14(2):203-211.

Dittert, Alfred E., and Fred Plog
1980 *Generations in Clay: Pueblo Pottery of the American Southwest*. Northland Press, Flagstaff.

Doebley, J. F.
1981 Plant Remains Recovered by Flotation for Trash at Salmon Ruin, New Mexico. *The Kiva* 46:169-187.

Dozier, Edward P.
1970 *The Pueblo Indians of North America*. Holt, Rinehart, and Winston, Inc., New York.

Eggan, Fred
1979 Pueblos: Introduction. In *Handbook of North American Indians*, vol. 9, edited by A. Ortiz, pp. 224-235. Smithsonian Institution, Washington, D.C.

Ellis, Florence Hawley
1979 Summary of Pojoaque Pueblo History and Water Use. Manuscript on file, Laboratory of Anthropology, Museum of New Mexico, Santa Fe.

Fallon, Denise, and Karen Wening
1987 *Howari: Excavation at a Northern Rio Grade Biscuit Ware Site*. Laboratory of Anthropology Notes No. 261b. Museum of New Mexico, Santa Fe.

Fenneman, Nevin M.
1931 *Physiography of the Western United States*. McGraw-Hill, Inc., New York.

Findley, James S., Arthur H. Harris, Done E. Wilson, and Clyde Jones
1975 *Mammals of New Mexico*. University of New Mexico Press, Albuquerque.

Folks, James J.
1975 *Soil Survey of Santa Fe Area, New Mexico*.

United States Department of Agriculture, Soil Conservation Service, Forest Service, United States Department of Interior, Bureau of Indian Affairs, and the New Mexico Agricultural Experiment Station, Washington, D.C.

Frank, Larry and Francis H. Harlow
1990 *Historic Pottery of the Pueblo Indians 1600-1880*. Schiffer Publishing, Ltd., West Chester.

Franklin, Hayward H.
1980 Ceramic Chronology and Culture Change at Salmon Ruin. In *Investigations at the Salmon Site: the Structure of Chacoan Society in the Northern Southwest*, vol. 2, edited by Cynthia Irwin Williams and Phil H. Shelley, pp. 35-205. Report to Funding Agencies, Eastern New Mexico University, Portales.

1983 Preliminary Ceramic Analysis In *Economy and Interaction Along the Lower Chaco River*, edited by Patrick H. and Joseph C. Winter, pp 291-307. Office of Contract Archeology and Maxwell Museum of Anthropology, Albuquerque.

Frisbie, T. R.
1967 The Excavation and Interpretation of the Artificial Leg Basketmaker to Pueblo I Sites Near Corrales, New Mexico. Master's thesis, University of New Mexico, Albuquerque.

Gabin, Vickie L., and Lee E. Lesperance
1977 *New Mexico Climatological Data: Precipitation, Temperature, Evaporation, and Wind, Monthly and Annual Means, 1850-1975*. W. K. Summers, Socorro.

Galusha, Ted, and John C. Blick
1971 Stratigraphy of the Santa Fe Group, New Mexico. *Bulletin of the American Museum of Natural History* (144)1. New York.

Gasser, R. E.
1982 *The Coronado Project Archaeological Investigations: The Specialist's Volume: Biocultural Analyses*. Research Paper 23, Coronado Series 4. Museum of Northern Arizona, Flagstaff.

Gilman, Patricia A.
1983 Changing Architectural Forms in the American Southwest. Ph.D. dissertation, University of New Mexico. University Microfilms, Ann Arbor.

Gladwin, Harold S.
1945 *The Chaco Branch: Excavations at White Mound and in the Red Mesa Valley*. Medallion Papers 33, Gila Pueblo, Globe.

Goetz, Christine E., and Barbara J. Mills
1993 Classification Criteria for Wares and Types. In *Interpretation of Ceramic Artifacts*, edited by Barbara J. Mills, Christine E. Goetz, and Maria Nieves Zedeño. *Across the Colorado Plateau: Archaeological Studies for the Transwestern Pipeline Expansion Project*, vol. 16. Office of Contract Archeology and Maxwell Museum of Anthropology, University of New Mexico, Albuquerque.

Habicht-Mauche, Judith A.
1993 *The Pottery from Arroyo Hondo Pueblo, New Mexico; Tribalization and Trade in the Northern Rio Grande*. Arroyo Hondo Archaeological Series No. 8. School of American Research Press, Santa Fe.

Hack, John T.
1942 *The Changing Environmental of the Hopi Indians of Arizona*. Papers of the Peabody Museum of American Archaeology and Ethnology 35(1).

Hammond, George P., and Agapito Rey
1953 Oñate and the Colonization of New Mexico. In *Don Juan de Oñate: Colonizer of New Mexico, 1595-1628*, by George P. Hammond and Agapito Rey, pp. 1-15. University of New Mexico Press, Albuquerque. Reprinted 1971 in *New Mexico Past and Present: A Historical Reader*, edited by R. N. Ellis, pp. 17-29. University of New Mexico Press, Albuquerque.

1966 The Rediscovery of New Mexico, 1580-1594. *Coronado Cuarto Centennial Publications, 1540-1940*, vol. 3. University of New Mexico Press, Albuquerque.

Harlow, Francis H.
1973 *Matte Paint Pottery of the Tewa, Keres, and Zuni Pueblos*. Museum of New Mexico Press, Santa Fe.

Hawley, Florence
1934 *The Significance of the Dated Prehistory of Chetro Ketl, Chaco Canyon, New Mexico*. University of New Mexico Bulletin, Monograph No. 1. Albuquerque.

Hewett, Edgar Lee
1953 *Pajarito Plateau and Its Ancient People*, revised by Bertha P. Dutton. School of American Research, Santa Fe; University of New Mexico Press, Albuquerque.

Hibben, Frank C,
1937 *Excavation of the Riana Ruin and Chama Valley Survey*. University of New Mexico Anthropological Series, Bulletin 300 (2)1. Albuquerque.

Hill, David V.
in prep. Nambe Petrographic Report. In *Excavations at LA 103919, a Developmental Period Site Along NM 503 Near Nambé Pueblo, Santa Fe County, New Mexico*. Archaeology Notes 199. Office of Archaeological Studies, Museum of New Mexico, Santa Fe.

Hill, James N., and Nicholas Trierweiler
1986 *Prehistoric Responses to Food Stress on the Pajarito Plateau, New Mexico: Technical Report and Results of the Pajarito Archaeological Research Project 1977-1985*. University of California, Los Angeles.

Hodge, Frederick W.
1910 Pojoaque. In *Handbook of American Indians North of Mexico*, vol. 2. Bureau of American Ethnology Bulletin 30. Smithsonian Institution, Washington, D.C.

Honea, Kenneth H.
1965 Material Culture Ceramics. In *The Cochiti Dam: Archaeological Salvage Project*, part 1, *Report on the 1963 Season*, edited by Charles H. Lange, pp. 111-169. Museum of New Mexico Research Series No. 6. Museum of New Mexico Press, Santa Fe.

Jelinek, Arthur J.
1969 Identification of Mammalian Fauna. In *Early Puebloan Occupation at Tesuque By-Pass and Within the Upper Rio Grande Valley*, by Charles H. McNutt, pp. 127-133. Anthropological Papers of the University of Michigan 40. Ann Arbor.

Jenkins, Myra E., and Albert H. Schroeder
1974 *A Brief History of New Mexico*. University of New Mexico Press, Albuquerque.

Kelley, Vincent C.
1979 Geomorphology of the Española Basin. In *New Mexico Geological Society Guidebook: Santa Fe County* (30th Field Conference), pp. 281-288. University of New Mexico, Albuquerque.

Kidder, Alfred V.
1927 Southwestern Archaeological Conference. *Science* 66:480-491.

1931 *The Pottery of Pecos*, vol. 1, *The Dull-Paint Wares*. Papers of the Southwestern Expedition, No. 5. Yale University Press, New Haven.

Kidder, Alfred V., and Anna O. Shepard
1936 *The Pottery of Pecos*, vol. 2, *The Glaze-Paint, Culinary and Other Wares*. Papers of the Southwest Expedition No. 7. Yale University Press, New Haven.

Lambert, Marjorie F.
n.d. Field Notes on Pojoaque, 1942, 1959, 1970.

1954 *Paa-ko*. School of American Research Monographs 19. Santa Fe.

Lang, Richard W.
1982 Transformation in White Ware Pottery of the Rio Grande. In *Southwestern Ceramics: A Comparative Review*, edited by Albert Schroeder, pp. 153-200. The Arizona Archaeologist No. 15, Phoenix.

Lange, Charles H., and Carroll L. Riley
1970 *The Southwestern Journals of Adolph F. Bandelier, 1880-1882*. University of New Mexico Press, Albuquerque.

Lekson, Stephen H.
1991 Settlement Patterns and the Chaco Region. In *Chaco and Hohokam; Prehistoric Regional Systems in the Southwest*, edited by Patricia L. Crown and W. James Judge, pp. 31-56. School of American Research Press, Santa Fe.

Lentz, Stephen C.
1978 *A Program of Archaeological Testing for Three Locations near Pojoaque Pueblo, New Mexico*. Office of Contract Archeology, University of New Mexico, Albuquerque.

1991 *Kwahe'e Black-on-white and Taos Black-on-white: The H.P. Mera Type Sites*. Pottery Southwest 18(3).

Lentz, Stephen C., Timothy D. Maxwell, James L. Moore, and C. Dean
1994 *Results of a Limited Testing Program for the Pojoaque Interchange at US 84/285, and a Data Recovery Plan for LA 101412, Santa Fe County, New Mexico*. Archaeology Notes 150. Office of Archaeological Studies, Museum of New Mexico, Santa Fe.

Lentz, Stephen C.
2004 *Excavations at LA 103919, a Developmental Period Site Along NM 503 Near Nambé Pueblo, Santa Fe County, New Mexico*. Archaeology Notes 199. Office of Archaeological Studies, Museum of New Mexico, Santa Fe.

Leonard, Robert D.
1989 Resource Specialization, Population Growth, and Agricultural Production in the American Southwest. *American Antiquity* 54(3):491-503.

Lipe, William D.
1994 The depopulation of the northern San Juan: conditions in the turbulent 1200s. Paper presented at the 4th Southwest Symposium, Arizona State University, Tempe.

Lucas, Mary Beth
1984 Norton-Tesuque 115 KV Transmission Project Earth Resources Technical Report. Manuscript on file, Public Service Company of New Mexico, Albuquerque.

McKenna, Peter J.
1984 *The Architectural and Material Culture of 29SJ 1360, Chaco Canyon, New Mexico*. Reports of the Chaco Center No. 7. Division of Cultural Research, National Park Service, Albuquerque.

McKenna, Peter J., and Judith Miles
1990 Ceramic Manual for the Bandelier Archaeological Survey. Manuscript on file, Bandelier National Monument, National Park Service, New Mexico.

McKenna, Peter J., and Robert P. Powers
1986 Preliminary Report on the 1985 Test Survey of Bandelier National Monument, New Mexico. Prepared for the National Park Service, Southwest Region, Santa Fe.

McNutt, Charles H.
1969 *Early Puebloan Occupation at Tesuque By-Pass and Within the Upper Rio Grande Valley*. Anthropological Papers of the University of Michigan 40. Ann Arbor.

Manley, Kim
1979 Tertiary and Quaternary Stratigraphy of the Northeast Plateau, Española Basin, New Mexico. In *New Mexico Geological Society Guidebook: Santa Fe County* (30th Field Conference), pp. 231-236. University of New Mexico, Albuquerque.

Marshall, Michael P.
1993 *A Cultural Resource Survey for the Pojoaque-Interchange Highway 285 Improvement Project*. Cibola Research Consultants, Albuquerque.

Maxwell, Timothy D.
1994 Proposed Data Recovery Plan. In *Results of a Limited Testing Program for the Pojoaque Interchange at US 84/285, and a Data Recovery Plan for LA 101412, Santa Fe County, New Mexico*, by Stephen C. Lentz, Timothy D. Maxwell, James L. Moore, and C. Dean Wilson, pp. 36-53. Archaeology Notes 150. Office of Archaeological Studies, Museum of New Mexico, Santa Fe.

Mera, H. P.
1934 *A Survey of the Biscuit Ware Area in Northern New Mexico*. Laboratory of Anthropology Technical Series Bulletin No. 8. Museum of New Mexico, Santa Fe.

1935 *Ceramic Clues to the Prehistory of North Central New Mexico*. Laboratory of Anthropology Technical Series Bulletin No. 8. Museum of New Mexico, Santa Fe.

Merrin, Hope
1995 *Small White Disc Beads of the Northern Rio Grande Region, New Mexico*. Archaeology Notes 100, Office of Archaeological Studies, Museum of New Mexico, Santa Fe.

Miller, John P., Arthur Montgomery, and Patrick Sutherland
1963 *Geology of the Southern Part of the Southern Sangre de Cristo Mountains, New Mexico*. Bureau of Mines and Mineral Resources, Memoir 11. Socorro, New Mexico.

Miller, John P., and Fred Wendorf
1958 Alluvial Chronology of the Tesuque Valley,

New Mexico. *The Journal of Geology* 66(2):177-194.

Mills, Barbara J.
1989 The organization of ceramic production in household economies. Paper presented at a Symposium in Honor of Lewis R. Binford, University of New Mexico, Albuquerque.

Montgomery, Arthur
1963 Precambrian Rocks. In *Geology of Part of the Southern Sangre de Cristo Mountains, New Mexico*, edited by John P. Miller, Arthur Montgomery, and Patrick K. Sutherland, pp. 7-21. Bureau of Mines and Mineral Resources Memoir 11. Socorro, New Mexico.

Moore, James L.
1994 Chipped Stone Artifact Analysis. In *Results of a Limited Testing Program for the Pojoaque Interchange at US 84/285, and a Data Recovery Plan for LA 101412, Santa Fe County, New Mexico*, by Stephen C. Lentz, Timothy D. Maxwell, James L. Moore, and C. Dean Wilson, pp. 25-34. Archaeology Notes 150. Office of Archaeological Studies, Museum of New Mexico, Santa Fe.

2001 *Prehistoric and Historic Occupation of Los Alamos and Guaje Canyons: Data Recovery at Three Sites Near the Pueblo of San Ildefonso*. Archaeology Notes 244. Office of Archaeological Studies, Museum of New Mexico, Santa Fe.

Nelson, Nels C.
1914 *Pueblo Ruins of the Galisteo Basin, New Mexico*. Anthropological Papers of the American Museum of Natural History 15(1). New York.

1916 Chronology of the Tano Ruins, New Mexico. *American Anthropologist* 18(2):159-180.

New Mexico Geological Society
1982 New Mexico Highway Geologic Map. New Mexico Geological Society, Socorro.

OAS (Office of Archaeological Studies)
1994 *Standardized Lithic Artifact Analysis: Attributes and Variable Code Lists*. Archaeology Notes 24c. Office of Archaeological Studies, Museum of New Mexico, Santa Fe.

Oppelt, Norman T.
1991 *Earth, Water and Fire, The Prehistoric Pottery of Mesa Verde*. Johnson Books, Boulder.

Peckham, Stewart
1984 The Anasazi Culture of the Rio Grande Rift. In *New Mexico Geological Society Guidebook: Rio Grande Rift, Northern New Mexico* (35th Field Conference), pp. 275-281. University of New Mexico, Albuquerque.

Pilz, Wayne B.
1984 *Norton-Tesuque 115 KV Transmission Project Biotic Resources Technical Report*. Manuscript on file, Public Service Company of New Mexico, Albuquerque.

Plog, Fred T.
1974 *The Study of Prehistoric Change*. Academic Press, New York.

Post, Stephen S., and Steven A. Lakatos
1995 Santa Fe Black-on-white Pottery, Firing Features of the Northern Rio Grande Valley. In *Of Pots and Rocks: Papers in Honor of A. Helene Warren*, edited by Meliha S. Duran and David T. Kirkpatrick, pp. 141-155. Archaeological Society of New Mexico, Rio Rancho.

Reed, Erik K.
1958 *Excavation in Mancos Canyon, Colorado*. University of Utah Anthropological Papers No. 35. Salt Lake City.

Reinhart, Theodore R.
1967 The Rio Rancho Phase: A Preliminary Report in Early Basketmaker Culture in the Middle Rio Grande Valley, New Mexico. *American Antiquity* 32:458-470.

Retallack, G.J.
1990 *Soils of the Past*. Harper Collins Academic, London.

Reynolds, S. E.
1956a *Climatological Summary, New Mexico: Temperature 1850-1954; Frost 1850-1954; and Evaporation 1850-1954*. Technical Report 5, New Mexico Office of the State Engineer. Santa Fe.

1956b *Climatological Summary, New Mexico: Precipitation 1849-1954*. Technical Report 5, New Mexico Office of the State Engineer. Santa Fe.

Riley, Carrol L.
1995 *Rio del Norte*. University of Utah Press, Salt Lake City.

Robinson, William J., Bruce G. Harrill, and Richard L. Warren
1973 *Tree-Ring Dates from New Mexico J-K, P, V. Santa Fe-Pecos-Lincoln Areas*. Laboratory of Tree-Ring Research. University of Arizona, Tucson.

Schoenwetter, James, and Alfred E. Dittert
1968 An Ecological Interpretation of Anasazi Settlement Patterns. In *Anthropological Archaeology in the Americas*, edited by Betty J. Meggers, pp. 41-66. The Anthropological Society of Washington, Washington, D.C.

Schroeder, Albert H.
1979 Pueblos Abandoned in Historic Times. In *Handbook of North American Indians*, vol. 9, edited by A. Ortiz, pp. 236-254. Smithsonian Institution, Washington, D.C.

Schutt, Jeanne A.
1989 Lithic Artifact Analysis. In *Report on Surface Collection and Testing at 18 Sites Near Abiquiu Reservoir, Northern New Mexico*, pp. 24-48. Mariah Associates, Inc., Albuquerque.

Simmons, Marc
1979 History of Pueblo-Spanish Relations to 1821. In *Southwest Handbook of North American Indians*, vol. 9, edited by Alfonso Ortiz, pp.179-193. Smithsonian Institution, Washington, D.C.

Shepard, Anna O.
1939 Technology of La Plata Pottery. In *Archaeological Studies in the La Plata District of Southwestern Colorado and Northwestern New Mexico*, by Earl H. Morris, pp. 249-287. Carnegie Institution, Washington, D.C.

1942 *Rio Grande Glaze Painted Ware*. Contributions to American Anthropology and History No. 39. Carnegie Institution Publication 528. Washington, D.C.

1963 *Ceramics for the Archaeologist*. Carnegie Institution Publication 609. Washington, D.C.

Smiley, Terah L., Stanley A. Stubbs, and Bryant Bannister
1953 *A Foundation for the Dating of Some Late Archaeological Sites in the Rio Grande Area, New Mexico: Based on Studies in Tree-Ring Methods and Pottery Analyses*. University of Arizona Bulletin 24(3); Laboratory of Tree-Ring Research Bulletin No. 6. Tucson.

Snow, David
1982 The Rio Grande Glaze, Matte-Paint, and Plainware Tradition. In *Southwestern Ceramics: A Comparative Review*, edited by Albert Schroeder, pp. 235-278. The Arizona Archaeologist No. 15, Arizona Archaeological Society, Phoenix.

1989 Archaeological and Historical Investigations at the Baca-Larranga Site, 425 West San Francisco St., Santa Fe, New Mexico. Manuscript submitted to the City of Santa Fe, and Yates Drilling Co.

Steen, Charles R.
1977 *Pajarito Plateau: Archaeological Surveys and Excavations*. Los Alamos National Laboratory Report 6581. University of California, Los Angeles.

Stuart, David E., and Rory P. Gauthier
1981 *Prehistoric New Mexico: Background for Survey*. Historic Preservation Division, Museum of New Mexico, Santa Fe.

Stubbs, Stanley A.
1954 Summary Report on an Early Site in Tesuque Valley, New Mexico. *El Palacio* 61(2):43-45.

Stubbs, Stanley A., and W.S. Stallings, Jr.
1953 *The Excavation of Pindi Pueblo New Mexico*. Monographs of the School of American Research and the Laboratory of Anthropology No. 18. Santa Fe.

Sudar-Murphy, Toni, Karl W. Lambach, and Dabney A. Ford
1977 Analyses of Ceramic, Lithic, Bone and Flotation Materials. In *Archaeological Investigations In Cochiti Reservoir, New Mexico*, vol. 2, *Excavation and Analysis, 1975 Season*, edited by Richard C. Chapman and Jan V. Biella, pp. 19-28. Office of Contract Archaeology and Department of

Anthropology, University of New Mexico, Albuquerque.

Sundt, William M.
1972 Ceramics. In *Prieta Vista: A Small Pueblo III Ruin in North-Central New Mexico*, by R.A Bice and W.M. Sundt, pp. 98-181. Albuquerque Archaeological Society Press.

1984 *Design Analysis of a Pure Variety of Santa Fe Black-on-white*. Collected Papers in Honor of Hadlock: Papers of the Archeological Society of New Mexico 9, edited by Nancy L. Fox. Albuquerque Archaeological Society Press.

1987 Pottery of Central New Mexico and its Role as Key to Both Time and Space. In *Secrets of a City: Papers on Albuquerque Area Archeology, In Honor of Richard A. Bice*, edited by A. A.V. Poore and J. Montgomery, pp. 116-147. The Archaeological Society of New Mexico Press, Santa Fe.

Sutherland, Patrick K.
1963 Paleozoic Rocks. In *Geology of Part of the Southern Sangre de Cristo Mountains, New Mexico*, edited by John P. Miller, Arthur Montgomery, and Patrick K. Sutherland, pp. 22-46. Bureau of Mines and Mineral Resources Memoir 11. Socorro, New Mexico.

Toll, H. Wolcott, and Peter J. McKenna
1987 The Ceramography of Pueblo Alto. In *Investigations at the Pueblo Alto Complex, Chaco Canyon, New Mexico, 1975-1978*, vol. 3, part 1, *Artifactual and Biological Analysis*, edited by Francis Joan Mathien and Thomas C. Windes, pp. 19-230. Publications in Archaeology 18F, Chaco Canyon Series. National Park Service, Santa Fe.

1993 *The Testimony of the Spadefoot Ceramics. In The Spadefoot Toad Site: Investigations at 29SJ 629, Chaco Canyon, New Mexico*, vol. 2, edited by Thomas C. Windes, pp. 15-134. Publications in Archaeology 12, Chaco Canyon Series. National Park Service, Santa Fe.

Toll, Mollie S.
1983 Changing Patterns of Plant Utilization for Food and Fuel: Evidence from Flotation and Macrobotanical Remains. In *Economy and Interaction Along the Lower Chaco River: the Navajo Mines Archeological Program, Mining Area III*, edited by Patrick Hogan and Joseph C. Winter. Office of Contract Archeology, University of New Mexico, Albuquerque.

1993 Flotation and Macrobotanical Analyses at 29SJ629. In *The Spadefoot Toad Site: Investigations at 29SJ629, Chaco Canyon, New Mexico*, vol. 2, edited by Thomas C. Windes. Publications in Archaeology 12, Chaco Canyon Series. National Park Service, Santa Fe.

1995 Botanical Analyses at Las Campanas: Archaic to Early Classic Small Sites: (LA 847580, 84787, 86139, 16159, 86150, 84793, 98690, 84759). Technical Series 31. Office of Archaeological Studies, Museum of New Mexico, Santa Fe.

Tuan, Yi-Fu, Cyril E. Everard, Jerold G. Widdison, and Iven Bennet
1973 *The Climate of New Mexico*. New Mexico State Planning Office, Santa Fe.

Warren, A. Helene
1969 *The Nambe Project Archaeological Salvage at Nambe Pueblo, Santa Fe County, New Mexico. Notes on Ceramics and Lithics of the Nambe Pueblo*. Laboratory of Anthropology Notes No. 100, Museum of New Mexico, Santa Fe.

1979a Pottery of the Rio Grande. In *Archaeological Investigations in Cochiti Reservoir, New Mexico*, vol. 4, edited by J.V. Biella and R.C. Chapman, pp. 75-101. University of New Mexico Press, Albuquerque.

1979b The Micaceous Pottery of the Rio Grande. In *Collected Papers In Honor of Eric Kellerman*, edited by A.H. Schroeder, pp. 148-166. Albuquerque Archaeological Society Press.

1980a Prehistoric Pottery of Tijeras Canyon. In *Tijeras Canyon: Analysis of the Past*, edited by Linda S. Cordell, pp. 149-168. Maxwell Museum of Anthropology and the University of New Mexico Press, Albuquerque.

1980b Ceramic Studies in Cochiti Reservoir, 1976-1977. In *Archaeological Investigations in Cochiti Reservoir, New Mexico*, vol. 3, *1976-1977 Field Seasons*, edited by Jan V. Biella, pp. 27-39. Office of Contract Archeology, University of New Mexico, Albuquerque.

Wendorf, Fred
1953 *Salvage Archaeology in the Chama Valley, New Mexico*. School of American Research Monograph No.17. Santa Fe.

1954 A Reconstruction of Northern Rio Grande Prehistory. *American Anthropologist* 56(2) 200-227.

Wendorf, Fred, and Erik K. Reed
1955 An Alternative Reconstruction of Northern Rio Grande Prehistory. *El Palacio* 62:131-173.

Wilson, C. Dean
2004 Ceramic Artifacts. In *Excavations at LA 103919, a Developmental Period Site along NM 503 Near Nambé Pueblo, Santa Fe County, New Mexico.* Archaeology Notes 199. Office of Archaeological Studies, Museum of New Mexico, Santa Fe.

Wilson, C. Dean, and Eric Blinman
1995a Changing Specialization of White Ware Manufacture. In *Ceramic Production in the American Southwest*, edited by Barbara J. Mills and Patricia L. Crown, pp. 63-87. University of Arizona Press, Tucson.

1995b Ceramic Types of the Mesa Verde Region. In *Archaeological Pottery of Colorado: Ceramic Clues to the Prehistoric and Protohistoric Lives of the State's Native Peoples*, edited by R. H. Brunswig, B. Bradley, and S.M. Chandler. Colorado Council of Archaeologists Occasional Papers 2. Denver.

Windes, Thomas C.
1977 Typology and Technology of Anasazi Ceramics. In *Settlement and Subsistence Along the Lower Chaco River*, edited by Charles Reher, pp. 270-369. Office of Contract Archeology, University of New Mexico, Albuquerque.

1984 A View of the Cibola Whiteware from Chaco Canyon. In *Regional Analysis of Prehistoric Ceramic Variation: Contemporary Studies of the Cibola Whitewares*, edited by A. P. Sullivan and J. L. Hantman, pp. 31-94. Arizona State University, Tempe.

Windes, Thomas C., and Peter J. McKenna
1989 *Cibola Whiteware and Cibola Grayware: The Chaco Series*. Northwest New Mexico Ceramics Workshop. Red Rock State Park, Gallup.

Winter, Joseph C.
1993 Environment and Subsistence Across the Colorado Plateau. In *Subsistence and Environment*, by Jannifer W. Gish, Julia E. Hammett, Marie E. Brown, Pamela McBride, Joseph C. Winter, Kenneth L. Brown, John J. Poncznski, and Jeanne L. DeLanois, pp. 601-648. *Across the Colorado Plateau: Anthropological Studies for the Transwestern Pipeline Expansion Project*, vol. 15. Office of Contract Archeology and Maxwell Museum of Anthropology, University of New Mexico, Albuquerque.

Wiseman, Regge N.
1989 *The KP Site and Late Developmental Period Archaeology in the Santa Fe District*. Laboratory of Anthropology Notes No. 494. Museum of New Mexico, Santa Fe.

1990 Raw Material Selection for Chipped Stone Artifacts in the Late Developmental Sites of the Santa Fe District. In *Clues to the Past: Papers in Honor of William M. Sundt*, edited by Meliha S. Duran and David T. Kirkpatrick, pp. 345-350. Papers of the Archeological Society of New Mexico 15. Albuquerque.

1995 Reassessment of the Dating of the Pojoaque Grant Site (LA 835), A Key Site of the Rio Grande Developmental Period. In *Of Pots and Rocks: Papers in Honor of A. Helene Warren*, edited by Meliha S. Duran and David T. Kirkpatrick, pp. 237-248. Archaeological Society of New Mexico, Rio Rancho.

Wiseman, Regge N., and Bart Olinger
1991 Initial Production of Painted Pottery in the Rio Grande: The Perspective From LA 835, The Pojoaque Grant Site. In *Puebloan Past and Present: Papers in Honor of Stewart Peckham*, edited by Meliha S. Duran and David T. Kirkpatrick, pp. 209-217. Papers of the Archaeological Society of New Mexico, Albuquerque.

APPENDIX 1

Ceramic Wares by Provenience

Gray Ware Ceramic Types by Provenience

Ceramic Type	Provenience: General Site	Backhoe Trench 1	Backhoe Trench 2	Backhoe Trench 3	Backhoe Trench 4	Backhoe Trench 5	Total	Percent of Gray Ware	Percent of Type
Plain rim	-	-	6	8	9	7	30	1%	29%
Rim, indeterminate	-	-	-	-	-	-	-	-	-
Plain body	28	115	128	111	190	194	766	16%	25%
Wide neckbanded	-	-	-	-	1	-	1	< 1%	11%
Wide neckbanded, wiped	-	-	-	-	-	-	-	-	-
Wiped scored gray	-	-	2	-	-	1	3	< 1%	25%
Basket impressed	-	-	-	-	1	-	1	< 1%	33%
Indented corrugated	3	-	44	22	-	34	103	2%	18%
Corrugated	1	1	-	1	31	6	40	1%	38%
Smeared indented corrugated	13	1	52	32	37	60	195	4%	25%
Sapawi micaceous washboard	-	-	-	-	-	-	-	-	-
Indeterminate texture	-	-	-	-	-	-	-	-	-
Striated gray	-	-	-	-	-	-	-	-	-
Plain incised	-	-	-	-	-	-	-	-	-
Exuberant corrugated	-	-	1	-	1	1	3	< 1%	20%
Rubbed-ribbed	4	-	11	3	1	7	26	1%	28%
Clapboard corrugated	-	-	-	-	3	3	6	< 1%	75%
Zoned corrugated	-	-	1	-	-	-	1	< 1%	100%
Total	49	117	245	177	274	313	1175	24%	
Percent of site (n=6050)	1%	2%	4%	3%	5%	5%	19%		
Percent of gray ware (n=4820)	1%	2%	5%	4%	6%	6%	24%		

Gray Ware Ceramic Types by Provenience (continued)

Ceramic Type	Provenience							Total	Percent of Gray Ware	Percent of Type
	Test Pits 3-6A	Test Pits 3-6B	Test Pits 3-6C	Test Pits 3-6D	Test Pit 7A	Test Pit 7B	Test Pit 7C			
Plain rim	9	8	4	1	-	2	-	24	< 1%	24%
Rim, indeterminate	-	3	-	-	-	-	-	3	< 1%	75%
Plain body	194	231	93	24	31	45	5	623	13%	20%
Wide neckbanded	-	-	-	-	-	-	-	-	-	-
Wide neckbanded, wiped	-	-	-	-	-	-	-	-	-	-
Wiped scored gray	2	1	-	-	1	-	-	4	< 1%	33%
Basket impressed	-	1	-	-	-	-	-	1	< 1%	33%
Indented corrugated	86	80	12	3	7	2	-	190	4%	34%
Corrugated	4	1	6	1	3	-	-	15	< 1%	14%
Smeared indented corrugated	28	38	9	-	1	1	-	77	2%	10%
Sapawi micaceous washboard	-	-	-	-	-	-	-	-	-	-
Indeterminate texture	1	-	-	1	-	1	-	3	< 1%	43%
Striated gray	-	-	-	1	-	-	-	1	< 1%	33%
Plain incised	-	-	-	-	-	-	-	-	-	-
Exuberant corrugated	-	-	2	-	-	-	-	2	< 1%	13%
Rubbed-ribbed	9	5	1	1	2	3	-	21	< 1%	23%
Clapboard corrugated	-	-	-	-	-	-	-	-	-	-
Zoned corrugated	-	-	-	-	-	-	-	-	-	-
Total	333	368	127	32	45	54	5	964		
Percent of site (n=6050)	6%	6%	2%	1%	1%	1%	< 1%	16%		
Percent of gray ware (n=4820)	7%	8%	3%	1%	1%	1%	< 1%	20%		

Gray Ware Ceramic Types by Provenience (continued)

Ceramic Type	Provenience					Total	Percent of Gray Ware	Percent of Type
	Test Pits 8-9A	Test Pits 8-9B	Test Pits 8-9C	Test Pits 8-9D	Test Pits 8-9E			
Plain rim	11	10	8	7	5	41	1%	40%
Rim, indeterminate	-	-	-	-	-	-	-	-
Plain body	220	468	95	84	175	1042	22%	33%
Wide neckbanded	-	-	-	-	6	6	< 1%	67%
Wide neckbanded, wiped	-	-	-	-	-	-	-	-
Wiped scored gray	-	-	-	-	2	2	< 1%	17%
Basket impressed	-	-	-	-	-	-	-	-
Indented corrugated	6	24	8	9	47	94	2%	17%
Corrugated	4	12	1	1	12	30	1%	28%
Smeared indented corrugated	30	91	21	38	63	243	5%	31%
Sapawi micaceous washboard	-	-	-	-	-	-	-	-
Indeterminate texture	-	2	-	-	2	4	< 1%	57%
Striated gray	-	-	-	-	1	1	< 1%	33%
Plain incised	-	-	-	-	-	-	-	-
Exuberant corrugated	-	-	-	-	1	1	< 1%	7%
Rubbed-ribbed	4	7	-	1	3	15	< 1%	16%
Clapboard corrugated	-	-	-	1	-	1	< 1%	13%
Zoned corrugated	-	-	-	-	-	-	-	-
								-
Total	275	614	133	141	317	1480		
Percent of site (n=6050)	5%	10%	2%	2%	5%	24%		
Percent of gray ware (n=4820)	6%	13%	3%	3%	7%	31%		

Gray Ware Ceramic Types by Provenience (continued)

Ceramic Type	Provenience Test Pits 10-13A	Test Pits 10-13B	Test Pits 10-13C	Test Pits 10-13D	Test Pits 10-13 F2	Total	Percent of Gray Ware	Percent of Type
Plain rim	1	-	-	1	-	2	< 1%	2%
Rim, indeterminate	-	-	-	-	-	-	-	-
Plain body	40	15	20	12	4	91	2%	3%
Wide neckbanded	1	-	-	-	-	1	< 1%	11%
Wide neckbanded, wiped	-	-	-	-	-	-	-	-
Wiped scored gray	-	-	2	-	-	2	< 1%	17%
Basket impressed	-	1	-	-	-	1	< 1%	33%
Indented corrugated	11	-	3	-	3	17	< 1%	3%
Corrugated	1	5	-	1	1	8	< 1%	8%
Smeared indented corrugated	11	1	-	-	-	12	< 1%	2%
Sapawi micaceous washboard	-	-	-	-	-	-	-	-
Indeterminate texture	-	-	-	-	-	-	-	-
Striated gray	-	-	1	-	-	1	< 1%	33%
Plain incised	-	-	1	-	-	1	< 1%	100%
Exuberant corrugated	-	2	-	-	-	2	< 1%	13%
Rubbed-ribbed	5	1	1	1	-	8	< 1%	9%
Clapboard corrugated	-	-	-	-	-	-	-	-
Zoned corrugated	-	-	-	-	-	-	-	-
Total	70	25	28	15	8	146		
Percent of site (n=6050)	1%	< 1%	< 1%	< 1%	< 1%	2%		
Percent of gray ware (n=4820)	1%	1%	1%	< 1%	< 1%	3%		

Gray Ware Ceramic Types by Provenience (continued)

Ceramic Type	Provenience Test Pits 14-15A	Test Pits 14-15B	Test Pit 16A	Test Pit 16B	Test Pit 16C	Test Pit 16D	Test Pit 16E	Total	Percent of Gray Ware	Percent of Type
Plain rim	-	1	-	-	-	-	2	3	< 1%	3%
Rim, indeterminate	-	-	-	-	1	-	-	1	< 1%	25%
Plain body	88	93	9	76	39	86	33	424	9%	14%
Wide neckbanded	-	1	-	-	-	-	-	1	< 1%	11%
Wide neckbanded, wiped	-	-	-	-	-	-	-	-	-	-
Wiped scored gray	1	-	-	-	-	-	-	1	< 1%	8%
Basket impressed	-	-	-	-	-	-	-	-	-	-
Indented corrugated	20	17	-	10	3	31	-	81	2%	15%
Corrugated	-	-	-	3	-	1	3	7	< 1%	7%
Smeared indented corrugated	62	44	1	23	4	15	9	158	3%	20%
Sapawi micaceous washboard	-	-	-	-	-	-	-	-	-	-
Indeterminate texture	-	-	-	-	-	-	-	-	-	-
Striated gray	-	-	-	-	-	-	-	-	-	-
Plain incised	-	-	-	-	-	-	-	-	-	-
Exuberant corrugated	1	1	-	-	-	1	-	3	< 1%	20%
Rubbed-ribbed	5	1	-	1	-	6	-	13	< 1%	14%
Clapboard corrugated	-	-	-	-	1	-	-	1	< 1%	13%
Zoned corrugated	-	-	-	-	-	-	-	-	-	-
Total	177	158	10	113	48	140	47	693		
Percent of site (n=6050)	3%	3%	< 1%	2%	1%	2%	1%	11%		
Percent of gray ware (n=4820)	4%	3%	< 1%	2%	1%	3%	1%	14%		

Gray Ware Ceramic Types by Provenience (continued)

Ceramic Type	Provenience Area 1	Area 2	Area 3	Total	Percent of Gray Ware	Percent of Type
Plain rim	2	-	-	2	< 1%	2%
Rim, indeterminate	-	-	-	-	-	-
Plain body	60	5	110	175	4%	6%
Wide neckbanded	-	-	-	-	-	-
Wide neckbanded, wiped	-	-	1	1	< 1%	100%
Wiped scored gray	-	-	-	-	-	-
Basket impressed	-	-	-	-	-	-
Indented corrugated	25	5	43	73	2%	13%
Corrugated	-	1	5	6	< 1%	6%
Smeared indented corrugated	52	4	34	90	2%	12%
Sapawi micaceous washboard	-	-	1	1	< 1%	100%
Indeterminate texture	-	-	-	-	-	-
Striated gray	-	-	-	-	-	-
Plain incised	-	-	-	-	-	-
Exuberant corrugated	4	-	-	4	< 1%	27%
Rubbed-ribbed	8	-	2	10	< 1%	11%
Clapboard corrugated	-	-	-	-	-	-
Zoned corrugated	-	-	-	-	-	-
Total	151	15	196	362		
Percent of site (n=6050)	2%	< 1%	3%	6%		
Percent of gray ware (n=4820)	3%	< 1%	4%	8%		

White Ware Ceramic Types by Provenience

Ceramic Type	Provenience					Total	Percent of White Ware	Percent of Type
	General Site	Backhoe Trench 2	Backhoe Trench 3	Backhoe Trench 4	Backhoe Trench 5			
Cibolan/Chaco tradition								
Mancos Black-on-white, solid designs	-	-	-	1	-	1	< 1%	50%
Mancos Black-on-white, Doghozhi designs	-	-	-	-	-	-	-	-
Unpainted, indeterminate	-	-	-	-	-	-	-	-
Mineral paint, indeterminate	-	-	1	-	2	3	< 1%	38%
Pueblo II squiggle hatchure	-	-	-	-	-	-	-	-
Escavada style solid designs	-	1	1	1	1	4	< 1%	44%
Pueblo II thin parallel lines	-	-	-	2	-	2	< 1%	33%
Escavada Black-on-white	-	-	1	-	-	1	< 1%	50%
Organic paint, indeterminate	-	-	-	-	-	-	-	-
Chaco Black-on-white	-	-	-	-	-	-	-	-
Tewa tradition								
Unpainted, indeterminate	4	9	19	11	33	76	6%	22%
Mineral paint, indeterminate	2	5	1	-	1	9	1%	45%
Red Mesa Black-on-white	-	-	-	1	-	1	< 1%	25%
Pueblo II squiggle hatchure	-	-	-	-	-	-	-	-
Kwahe'e Black-on-white, solid designs	-	-	3	5	2	10	1%	42%
Kwahe'e Black-on-white, Dogozhi hatchure designs	-	-	2	2	2	6	1%	100%
Biscuit Ware, unpainted	-	1	-	-	-	1	< 1%	33%
Indeterminate paint type	-	5	7	1	1	14	1%	25%
Organic paint, indeterminate	5	19	21	16	18	79	7%	32%
Organic paint, Coalition period, indeterminate	-	-	-	-	1	1	< 1%	4%
Santa Fe Black-on-white	3	17	7	4	15	46	4%	19%
Wiyo Black-on-white	3	1	-	-	2	6	1%	17%
Abiquiu Black-on-gray (Biscuit A)	4	4	14	11	14	47	4%	35%
Bandelier Black-on-gray (Biscuit B)	-	-	1	1	-	2	< 1%	14%
Galisteo Black-on-white	-	-	-	-	-	-	-	-
Total	21	62	78	56	92	309		
Percent of site (n=6050)	< 1%	1%	1%	1%	2%	5%		
Percent of white ware (n=1196)	2%	5%	7%	5%	8%	26%		

White Ware Ceramic Types by Provenience (continued)

Ceramic Type	Provenience: Test Pits 3-6A	Test Pits 3-6B	Test Pits 3-6C	Test Pit 7A	Test Pit 7B	Test Pit 7C	Total	Percent of White Ware	Percent of Type
Cibolan/Chaco tradition									
Mancos Black-on-white, solid designs	-	-	-	-	-	-	-	-	-
Mancos Black-on-white, Doghozhi designs	-	1	-	-	-	-	1	< 1%	100%
Unpainted, indeterminate	-	-	-	-	2	-	2	< 1%	100%
Mineral paint, indeterminate	-	-	1	2	-	-	3	< 1%	38%
Pueblo II squiggle hatchure	-	-	-	-	-	-	-	-	-
Escavada style solid designs	-	-	1	1	1	-	3	< 1%	33%
Pueblo II thin parallel lines	-	-	-	-	-	-	-	-	-
Escavada Black-on-white	-	1	-	-	-	-	1	< 1%	33%
Organic paint, indeterminate	-	-	-	-	-	-	-	-	-
Chaco Black-on-white	-	-	-	-	-	-	-	-	-
Tewa tradition									
Unpainted, indeterminate	19	16	8	4	-	1	48	4%	14%
Mineral paint, indeterminate	-	-	1	-	-	-	1	< 1%	5%
Red Mesa Black-on-white	-	-	-	1	-	-	1	< 1%	25%
Pueblo II squiggle hatchure	-	1	-	-	-	-	1	< 1%	100%
Kwahe'e Black-on-white, solid designs	2	2	-	-	1	-	5	< 1%	21%
Kwahe'e Black-on-white, Dogozhi hatchure designs	-	-	-	-	-	-	-	-	-
Biscuit Ware, unpainted	-	-	-	-	-	-	-	-	-
Indeterminate paint type	5	3	-	-	-	-	8	1%	15%
Organic paint, indeterminate	11	8	-	-	-	1	20	2%	8%
Organic paint, Coalition period, indeterminate	-	-	-	-	-	-	-	-	-
Santa Fe Black-on-white	23	2	1	-	-	-	26	2%	11%
Wiyo Black-on-white	1	2	-	-	-	-	3	< 1%	9%
Abiquiu Black-on-gray (Biscuit A)	-	-	-	-	-	-	-	-	-
Bandelier Black-on-gray (Biscuit B)	-	-	-	-	-	-	-	-	-
Galisteo Black-on-white	-	-	-	-	-	-	-	-	-
Total	61	36	12	8	4	2	123		
Percent of site (n=6050)	1%	1%	< 1%	< 1%	< 1%	< 1%	2%		
Percent of white ware (n=1196)	5%	3%	1%	1%	< 1%	< 1%	10%		

Ceramic Type	Provenience: Test Pits 8-9A	Test Pits 8-9B	Test Pits 8-9C	Test Pits 8-9D	Test Pits 8-9E	Total	Percent of White Ware	Percent of Type
Cibolan/Chaco tradition								
Mancos Black-on-white, solid designs	-	-	-	-	-	-	-	-
Mancos Black-on-white, Doghozhi designs	-	-	-	-	-	-	-	-
Unpainted, indeterminate	-	-	-	-	-	-	-	-
Mineral paint, indeterminate	-	1	-	-	1	2	< 1%	25%
Pueblo II squiggle hatchure	-	-	-	-	-	-	-	-
Escavada style solid designs	-	-	-	-	-	-	-	-
Pueblo II thin parallel lines	-	-	-	-	1	1	< 1%	17%
Escavada Black-on-white	-	-	-	-	-	-	-	-
Organic paint, indeterminate	-	-	-	-	-	-	-	-
Chaco Black-on-white	-	-	-	-	-	-	-	-
Tewa tradition								
Unpainted, indeterminate	33	59	21	7	13	133	11%	38%
Mineral paint, indeterminate	-	1	-	-	1	2	< 1%	10%
Red Mesa Black-on-white	-	1	-	-	-	1	< 1%	25%
Pueblo II squiggle hatchure	-	-	-	-	-	-	-	-
Kwahe'e Black-on-white, solid designs	-	-	-	-	1	1	< 1%	4%
Kwahe'e Black-on-white, Dogozhi hatchure designs	-	-	-	-	-	-	-	-
Biscuit Ware, unpainted	-	2	-	-	-	2	< 1%	67%
Indeterminate paint type	10	3	-	-	-	13	1%	24%
Organic paint, indeterminate	19	47	10	13	12	101	8%	40%
Organic paint, Coalition period, indeterminate	-	-	-	-	-	-	-	-
Santa Fe Black-on-white	2	35	16	2	9	64	5%	27%
Wiyo Black-on-white	1	7	1	2	1	12	1%	34%
Abiquiu Black-on-gray (Biscuit A)	35	21	4	2	2	64	5%	47%
Bandelier Black-on-gray (Biscuit B)	4	5	-	-	-	9	1%	64%
Galisteo Black-on-white	-	-	-	-	-	-	-	-
Total	104	182	52	26	41	405		
Percent of site (n=6050)	2%	3%	1%	< 1%	1%	7%		
Percent of white ware (n=1196)	9%	15%	4%	2%	3%	34%		

WHITE WARE CERAMIC TYPES BY PROVENIENCE (CONTINUED)

Ceramic Type	Provenience: Test Pits 10-13A	Test Pits 10-13B	Test Pits 10-13C	Test Pits 10-13D	Test Pits 14-15A	Test Pits 14-15B	Total	Percent of White Ware	Percent of Type
Cibolan/Chaco tradition									
Mancos Black-on-white, solid designs	-	-	-	-	1	-	1	< 1%	50%
Mancos Black-on-white, Doghozhi designs	-	-	-	-	-	-	-	-	-
Unpainted, indeterminate	-	-	-	-	-	-	-	-	-
Mineral paint, indeterminate	-	-	-	-	-	-	-	-	-
Pueblo II squiggle hatchure	-	-	1	-	-	-	1	< 1%	100%
Escavada style solid designs	1	-	-	-	-	-	1	< 1%	11%
Pueblo II thin parallel lines	-	-	-	-	2	-	2	< 1%	33%
Escavada Black-on-white	-	-	-	-	-	-	-	-	-
Organic paint, indeterminate	-	-	1	-	-	-	1	< 1%	100%
Chaco Black-on-white	-	-	-	-	-	-	-	-	-
Tewa tradition									
Unpainted, indeterminate	6	-	3	1	7	2	19	2%	5%
Mineral paint, indeterminate	1	-	-	-	-	-	1	< 1%	5%
Red Mesa Black-on-white	-	-	-	-	-	-	-	-	-
Pueblo II squiggle hatchure	-	-	-	-	-	-	-	-	-
Kwahe'e Black-on-white, solid designs	-	-	-	2	-	-	2	< 1%	8%
Kwahe'e Black-on-white, Dogozhi hatchure designs	-	-	-	-	-	-	-	-	-
Biscuit Ware, unpainted	-	-	-	-	-	-	-	-	-
Indeterminate paint type	2	-	-	-	4	1	7	1%	13%
Organic paint, indeterminate	-	-	-	-	14	3	17	1%	7%
Organic paint, Coalition period, indeterminate	-	2	-	-	-	-	2	< 1%	9%
Santa Fe Black-on-white	1	-	-	-	16	8	25	2%	11%
Wiyo Black-on-white	-	-	-	-	2	3	5	< 1%	14%
Abiquiu Black-on-gray (Biscuit A)	-	-	-	-	-	-	-	-	-
Bandelier Black-on-gray (Biscuit B)	-	-	-	-	-	-	-	-	-
Galisteo Black-on-white	1	-	-	-	-	-	1	< 1%	14%
Total	12	2	5	3	46	17	85		
Percent of site (n=6050)	< 1%	< 1%	< 1%	< 1%	1%	< 1%	1%		
Percent of white ware (n=1196)	1%	< 1%	< 1%	< 1%	4%	1%	7%		

White Ware Ceramic Types by Provenience (continued)

Ceramic Type	Provenience: Test Pit 16A	Test Pit 16B	Test Pit 16C	Test Pit 16D	Test Pit 16E	Total	Percent of White Ware	Percent of Type
Cibolan/Chaco tradition								
Mancos Black-on-white, solid designs	-	-	-	-	-	-	-	-
Mancos Black-on-white, Doghozhi designs	-	-	-	-	-	-	-	-
Unpainted, indeterminate	-	-	-	-	-	-	-	-
Mineral paint, indeterminate	-	-	-	-	-	-	-	-
Pueblo II squiggle hatchure	-	-	-	-	-	-	-	-
Escavada style solid designs	-	-	-	-	-	-	-	-
Pueblo II thin parallel lines	-	-	-	-	-	-	-	-
Escavada Black-on-white	-	-	-	-	-	-	-	-
Organic paint, indeterminate	-	-	-	-	-	-	-	-
Chaco Black-on-white	-	-	-	-	-	-	-	-
Tewa tradition								
Unpainted, indeterminate	1	13	2	17	3	36	3%	10%
Mineral paint, indeterminate	-	2	-	2	-	4	< 1%	20%
Red Mesa Black-on-white	-	-	-	-	-	-	-	-
Pueblo II squiggle hatchure	-	-	-	-	-	-	-	-
Kwahe'e Black-on-white, solid designs	-	-	-	2	-	2	< 1%	8%
Kwahe'e Black-on-white, Dogozhi hatchure designs	-	-	-	-	-	-	-	-
Biscuit Ware, unpainted	-	-	-	-	-	-	-	-
Indeterminate paint type	-	-	-	1	1	2	< 1%	4%
Organic paint, indeterminate	4	13	-	7	1	25	2%	10%
Organic paint, Coalition period, indeterminate	-	-	-	-	-	-	-	-
Santa Fe Black-on-white	-	6	2	2	1	11	1%	5%
Wiyo Black-on-white	-	-	-	-	-	-	-	-
Abiquiu Black-on-gray (Biscuit A)	-	10	1	-	-	11	1%	8%
Bandelier Black-on-gray (Biscuit B)	-	1	-	-	-	1	< 1%	7%
Galisteo Black-on-white	-	-	-	-	-	-	-	-
Total	5	45	5	31	6	92		
Percent of site (n=6050)	< 1%	1%	< 1%	1%	< 1%	2%		
Percent of white ware (n=1196)	< 1%	4%	< 1%	3%	1%	8%		

WHITE WARE CERAMIC TYPES BY PROVENIENCE (CONTINUED)

Ceramic Type	Provenience Area 1	Area 2	Area 3	Total	Percent of White Ware	Percent of Type
Cibolan/Chaco tradition						
Mancos Black-on-white, solid designs	-	-	-	-	-	-
Mancos Black-on-white, Doghozhi designs	-	-	-	-	-	-
Unpainted, indeterminate	-	-	-	-	-	-
Mineral paint, indeterminate	-	-	-	-	-	-
Pueblo II squiggle hatchure	-	-	-	-	-	-
Escavada style solid designs	1	-	-	1	< 1%	14%
Pueblo II thin parallel lines	1	-	-	1	< 1%	17%
Escavada Black-on-white	1	-	-	1	< 1%	50%
Organic paint, indeterminate	-	-	-	-	-	-
Chaco Black-on-white	1	-	-	1	< 1%	100%
Tewa tradition						
Unpainted, indeterminate	21	1	13	35	3%	10%
Mineral paint, indeterminate	2	-	1	3	< 1%	15%
Red Mesa Black-on-white	1	-	-	1	< 1%	25%
Pueblo II squiggle hatchure	-	-	-	-	-	-
Kwahe'e Black-on-white, solid designs	3	1	-	4	< 1%	17%
Kwahe'e Black-on-white, Dogozhi hatchure designs	-	-	-	-	-	-
Biscuit Ware, unpainted	-	-	-	-	-	-
Indeterminate paint type	10	1	-	11	1%	20%
Organic paint, indeterminate	2	-	6	8	1%	3%
Organic paint, Coalition period, indeterminate	20	-	-	20	2%	87%
Santa Fe Black-on-white	44	2	20	66	6%	28%
Wiyo Black-on-white	3	-	6	9	1%	26%
Abiquiu Black-on-gray (Biscuit A)	2	1	10	13	1%	10%
Bandelier Black-on-gray (Biscuit B)	-	-	2	2	< 1%	14%
Galisteo Black-on-white	-	1	5	6	1%	86%
Total	112	7	63	182		
Percent of site (n=6050)	2%	< 1%	1%	3%		
Percent of white ware (n=1196)	9%	1%	5%	15%		

Red Ware Ceramic Types by Provenience

Ceramic Type	Provenience									Total	Percent of Red Ware
	Backhoe Trench 4	Backhoe Trench 5	Test Pits 3-6A	Test Pits 8-9A	Test Pits 8-9B	Test Pits 8-9C	Test Pits 8-9E	Test Pit 16A	Test Pit 16B		
White Mountain Red Ware, indeterminate	-	-	-	1	-	-	-	-	-	1	6%
Puerco Black-on-red	-	1	-	-	-	-	-	-	1	2	12%
Red slip, indeterminate	2	3	1	3	2	1	1	1	-	14	82%
Total	2	4	1	4	2	1	1	1	1	17	
Percent of red ware (n=17)	12%	24%	6%	24%	12%	6%	6%	6%	6%		

Glaze Ware Ceramic Types by Provenience

Ceramic Type	Provenience								Total	Percent of Glaze Ware
	General Site	Backhoe Trench 1	Backhoe Trench 5	Test Pits 8-9A	Test Pits 8-9B	Test Pits 8-9D	Test Pits 8-9E	Test Pit 16B		
Glaze red ware, indeterminate	1	-	-	-	-	-	-	-	1	7%
Glaze-on-red, indeterminate	-	1	-	2	2	1	1	1	8	53%
Glaze-on-white, indeterminate	-	-	-	2	-	-	-	-	2	13%
Glaze-on-yellow, indeterminate	1	-	-	-	-	-	-	-	1	7%
Glaze-on-red and white slip	-	-	-	1	-	-	-	-	1	7%
Agua Fria Glaze-on-red	-	-	1	-	-	-	-	-	1	7%
Cieneguilla Glaze-on-yellow	-	-	-	-	1	-	-	-	1	7%
Total	2	1	1	5	3	1	1	1	15	
Percent of glaze ware (n=15)	13%	7%	7%	33%	20%	7%	7%	7%		

SUMMARY OF WARE GROUPS BY PROVENIENCE

Provenience	Ware Group							
	Prehistoric Gray	Prehistoric White	Prehistoric Red	Prehistoric Glaze	Historic Decorated	Other	Total	Percent of Site
General Site	49	21	-	2	-	-	72	1.2%
Backhoe Trench 1	117	-	-	-	-	-	117	1.9%
Backhoe Trench 2	245	62	-	-	-	-	307	5.1%
Backhoe Trench 3	177	78	-	-	-	-	255	4.2%
Backhoe Trench 4	274	56	2	1	-	-	333	5.5%
Backhoe Trench 5	313	92	4	1	-	-	410	6.8%
Test Pits 3-6A	333	61	1	-	-	-	395	6.5%
Test Pits 3-6B	368	36	-	-	-	-	404	6.7%
Test Pits 3-6C	127	12	-	-	-	-	139	2.3%
Test Pits 3-6D	32	-	-	-	-	-	32	0.5%
Test Pit 7A	45	8	-	-	-	-	53	0.9%
Test Pit 7B	54	4	-	-	-	-	58	1.0%
Test Pit 7C	5	2	-	-	-	-	7	0.1%
Test Pits 8-9A	275	104	4	5	-	-	388	6.4%
Test Pits 8-9B	614	182	2	3	-	-	801	13.2%
Test Pits 8-9C	133	52	1	-	-	-	186	3.1%
Test Pits 8-9D	141	26	-	1	-	1	169	2.8%
Test Pits 8-9E	317	41	1	1	-	-	360	6.0%
Test Pits 10-13A	70	12	-	-	-	-	82	1.4%
Test Pits 10-13B	25	2	-	-	-	-	27	0.4%
Test Pits 10-13C	28	5	-	-	-	-	33	0.5%
Test Pits 10-13D	15	3	-	-	-	-	18	0.3%
Test Pits 10-13 F2	8	-	-	-	-	-	8	0.1%
Test Pits 14-15A	177	46	-	-	-	-	223	3.7%
Test Pits 14-15B	158	17	-	-	-	-	175	2.9%
Test Pit 16A	10	5	1	-	-	-	16	0.3%
Test Pit 16B	113	45	1	1	-	-	160	2.6%
Test Pit 16C	48	5	-	-	-	-	53	0.9%
Test Pit 16D	140	31	-	-	-	-	171	2.8%
Test Pit 16E	47	6	-	-	-	-	53	0.9%
Area 1	151	112	-	-	-	-	263	4.3%
Area 2	15	7	-	-	-	-	22	0.4%
Area 3	196	63	-	-	1	-	260	4.3%
Total	4820	1196	17	15	1	1	6050	
Percent of site	79.7%	19.8%	0.3%	0.2%	< 1%	< 1%	100.0%	

APPENDIX 2

Provenience Assignments for Dating, and Wares Assigned to Phases

Provenience Assignments for Dating

Mixed: General Site, Backhoe Trenches 1, 2, 3, 4, and 5; Test Pits 8-9 (B, C, D, E); Test Pits 10-13 (A); Test Pit 16 (A, B, C); Areas 1, 2 and 3.

Classic: Test Pits 8-9 (A).

Coalition: Test Pits 3-6 (A, B); Test Pits 14-15 (A, B); Test Pit 16 (D, E).

Mixed Coalition-Developmental: Test Pits 10-13 (C).

Developmental: Test Pits 3-6 (C, D); Test Pit 7 (A, B, C); Test Pits 10-13 (D, E).

Wares Assigned to Phases

Unknown: gray and corrugated wares, Deghozhi hatchure design, white wares with indeterminate paint, red slip of indeterminate tradition.

Developmental: Mancos Black-on-white, unpainted or mineral-painted Cibola or Chaco white wares, Escavada Black-on-white, Chaco Black-on-white, White Mountain Red Ware, Puerco Black-on-red, Red Mesa Black-on-white, Kwahe'e Black-on-white, mineral-painted white wares.

Coalition: organic-painted white wares, Santa Fe Black-on-white, Wiyo Black-on-white.

Classic: unpainted biscuit wares, Biscuit A, Biscuit B, Galisteo Black-on-white, glaze wares.

Historic: historic Tewa.

APPENDIX 3

Ceramic Clay Sources in the Pojoaque Area

C. DEAN WILSON

Clay Source	Description	Natural Color	Refired Color
Lower clay strata on hill above LA 103919	Soft and chunky, plastic, with mica inclusions	Brown-tan	Yellow-red
Slightly higher clay strata on hill above LA 103919	Fairly hard, layered, plastic, lots of mica inclusions	Brown-tan	Yellow-red
Clays in blocky reddish alluvial formation on low hill near Nambe Pueblo	Hard, fine, and breaks in small chunks, fairly plastic	Red-brown	Red
Typical alluvial stratum near Nambe Pueblo	Fairly hard, chunky, fairly plastic	Red-brown	Red
Clay from upper pinkish layer in Santa Cruz Valley	Soft, powdery; not of paste quality, possible slip clay, slightly plastic	Pink	Red
Volcanic clay ash deposit near Bandelier turn-off	Soft, powdery, blocky, very fine, plastic	Greenish	Yellow-red

APPENDIX 4

Petrographic Analysis of Selected Ceramics from LA 101412

DAVID V. HILL

INTRODUCTION

Thirty sherds from LA 101412—both utility and decorated wares with production ranges spanning the eleventh to fifteenth centuries—were analyzed petrographically.

METHODOLOGY

The ceramics were analyzed by the author (Hill) using a Nikon Optiphot-2 petrographic microscope. The sizes of natural inclusions and tempering agents are described in terms of the Wentworth Scale, a standard method for characterizing particle sizes in sedimentology. These sizes were determined by measuring a series of grains using a reticle built into one of the microscope's optics. The percentages of inclusions in untempered ceramics were estimated using comparative charts (Matthew et al. 1991; Terry and Chilingar 1955).

Analysis involved reviewing the total ceramic collection and generating a brief description of each of the sherds, then classification groups were created based on the similarity of the paste and temper. This process also allowed for the examination of the variability within each grouping. Additional comments about the composition of individual sherds were made at this time (FS-lot number).

PETROGRAPHIC ANALYSIS

Micaceous indented corrugated; 161-15. Sherd has light yellowish-brown paste, which appears to be highly birefringent. This birefringence is due to the abundance of biotite that makes up virtually all of the ceramic paste. Also present are sparse fine black opaque inclusions, most of which have hematitic halos, suggesting that inclusions represent weathered biotite.

Isolated grains of quartz, plagioclase feldspar, and microcline along with plutonic rock fragments are present in the paste. Quartz occurs as either individual grains, usually displaying undulose extinction, or as composite grains with highly crenelated boundaries. The plagioclase feldspar appears fresh or is slightly altered through sericitization. The isolated mineral grains range in size from fine to medium, and comprise about 5 percent of the ceramic paste. The rock fragments are aggregate masses consisting of quartz, microcline, plagioclase, and occasionally biotite. These rock fragments range in size from coarse to very coarse and make up less than 5 percent of the ceramic paste. A few grains of quartz, plagioclase, and biotite also fall within this size range. Because of the discontinuous distribution in terms of size of the rock fragments and isolated mineral grains, it is suggested that the coarse to very coarse inclusions represent an added tempering agent.

Micaceous indented corrugated; 170-16. The micaceous paste of this specimen is similar to the above sample, as is the discontinuous size distribution of the mineral grains and plutonic rock fragments. This sherd differs from that above in that it contains slightly more coarse to very coarse isolated mineral grains.

Smeared corrugated; 188-15. The paste of this sherd is a light brown color and contains very abundant, very fine biotite. Fine rounded quartz grains make up about 10 percent of the paste. A major feature of this sherd is a void that contains a fragment of carbonized plant material. Isolated coarse to very coarse fragments of quartz, plagioclase, biotite, and plutonic rock fragments constitute less than 3 percent of the ceramic body. The plagioclase feldspars occur as isolated grains and in rock fragments. The feldspars are slightly sericitized.

Sapawe micaceous; 189-10. The birefringent brown color of the paste is the result of its consisting almost exclusively of slightly weathered brown biotite. A few fine subangular quartz grains are also present in the paste.

In addition, the paste contains fragments of very coarse-grained plutonic rock, most likely a granite, which consist of quartz and plagioclase with occasional muscovite and green hornblende. These rock fragments range from coarse to very coarse and make up about 20 percent of the paste. The quartz grains display slight undulose extinction. Some quartz is also contained poikilitically within a few plagioclase grains. The plagioclase appears fresh or slightly altered through sericitization.

Smeared corrugated (Sapawe micaceous); 190-14. The micaceous paste and granitic inclusions of this specimen are very similar to those of the previous specimen. Differences are that this specimen contains microcline in a few of the rock fragments, and that the rock fragments are larger and constitute more than 25 percent of the ceramic paste.

Micaceous smeared corrugated; 195-18. The paste of this sherd is a light tan color and is slightly birefringent. The paste contains approximately 20 percent very fine to fine sands dominated by subangular to rounded quartz. Sparse grains of plagioclase are also observed along with brown biotite. The biotite is usually altered to hematite and clay minerals.

Also present are very coarse fragments of plutonic rock and isolated grains of quartz, plagioclase, and microcline. The quartz displays slight undulose extinction. The plagioclase either appears fresh or slightly altered through sericitization. The rock fragments display a wide range of textures, from very fine to consisting of only two or three mineral grains. One rock fragments displays myrmekitic texture, where the plagioclase is intergrown with vermicular quartz.

Zoned corrugated; 196-23. The paste of this sherd has a color and sandy texture, with some brown biotite present, very similar to the previous specimen. The paste also contains coarse fragments of quartz, plagioclase and microcline. This sherd contains fewer plutonic rock fragments than the previous sample.

Sapawe micaceous; 196-27. The highly micaceous paste and coarse granitic inclusions observed in this specimen are virtually identical to those found in sample 189-10. The inclusions make up only about 15 percent of the paste of this sherd. One rock fragment also displays myrmekitic texture.

Micaceous indented corrugated; 234-25. The light brown color of the paste, abundance of fine sand grains, and presence of fragments of granitic rock in this sherd are nearly identical to those observed in sample 170-16. One fragment of metamorphic quartzite is present. One of the fragments of granitic rock displays myrmekitic texture.

Kwahe'e Black-on-white; 170-23. The paste of this sherd is a light gray color and contains very abundant silt-sized to very fine quartz sands. Medium-sized, subrounded to rounded grains of quartz along with sparse plagioclase feldspars are present. These larger sand grains make up about 5 percent of the paste. A few fine to medium-sized fragments of brown biotite, green hornblende, and black opaque inclusions are also present. These black inclusions appear to be biotite that has altered to hematite and clay minerals. The paste is tempered with crushed potsherds. The sherd temper makes up a little more than 5 percent of the paste. The sherd temper is usually gray to dark brown and appears to have the same fabric as the paste to which it has been added.

Kwahe'e Black-on-white; 186-69. The paste of this sherd is dark brown, and has a "salt and pepper" appearance from the abundance of silt-sized quartz and black opaque inclusions. The black inclusions appear to be the result of alteration of biotite into hematite and clay minerals. Fine to medium-sized, subrounded to rounded quartz and feldspar grains are also present, and make up about 5 percent of the paste. These feldspar grains are partially to completely kaolinized.

A distinctive feature of this sherd is medium to coarse fragments of highly weathered aplite granite or mica schist. These rock fragments make up less than 2 percent of the paste. The feldspars present in these rock fragments are completely kaolinized to opacity. Several of these rock fragments contain secondary calcite filling voids between mineral grains. The biotite in these rock fragments is usually altered to hematite and clay minerals around its margins. The quartz in the fragments displays slight undulose extinction. It appears that these rock fragments, like the isolated quartz, feldspar and biotite grains, represent natural inclusions in the clay used in producing the ceramic vessel.

Santa Fe Black-on-white; 153-17. The paste of this sherd is light gray with few very coarse rounded pellets of gray clay containing fine brown biotite and silt-sized quartz. This clay body contains subrounded sands dominated by quartz. Occasional weathered plagioclase, microcline, green hornblende, augite and biotite are also present, but only in trace amounts. These grains range in size from fine to medium and constitute about 30 percent of the paste. A distinctive feature of this sherd is the presence of calcareous inclusions. These inclusions are derived from a calcareous cement observed adhering to some of the sand grains.

Santa Fe Black-on-white; 167-18. The color of the paste, rounded clay pellets, and the abundance of sands dominated by quartz observed in the previous sample also characterize the paste of this sherd. The only differences between the two sherds are fewer medium-sized sand grains and very few calcareous inclusions in the present sample.

Santa Fe Black-on-white; 185-62. The paste of this sample is light gray mottled with a slightly darker brownish-gray. This paste contains about 5 percent rounded sand grains, dominated by quartz. The sands range from very fine to fine with a few medium-sized grains. A few grains of plagioclase, brown hornblende, and brown biotite are also present. In general, the feldspars are altered to the point of opacity. A single fragment of fine-grained basalt is present.

Santa Fe Black-on-white; 186-59. The paste and inclusions seen in this sherd are virtually identical to those found in sample 153-17. The paste contains fragments of submature sandstones with calcium cement. The quartz grains are supported by the calcium cement.

Santa Fe Black-on-white; 190-35. The color of the paste, presence of rounded clay pellets, abundance of very fine to fine sand grains, and limited amount of calcareous cement fragments are quite similar to sample 162-18. One very coarse fragment of granite was observed in the paste.

Santa Fe Black-on-white; 209-34. The paste color and submature, grain-supported sandstone seen in samples 153-17 and 186-59 are also present in this sherd.

Santa Fe Black-on-white; 201-49. The paste color and abundant sands with the limited amount of calcareous cement that characterized samples 162-18 and 190-35 are also seen in this sample.

Wiyo Black-on-white; 170-21. The paste of this sherd is light brown and contains fine subangular sands dominated by quartz with minor amounts of altered plagioclase and orthoclase. Also present in the paste are fine flakes of brown biotite, many of which have altered to hematite and clay minerals. The quartz sands and biotite make up about 10 percent of the paste. Also present in the paste are subangular fragments of glassy pumice which are medium to coarse and make up about 1 percent of the paste.

Wiyo Black-on-white; 185-50. The paste of this sherd is golden brown; a few fine rounded sand grains and brown biotite are present. The paste contains abundant glass shards derived from glassy pumice. Also present are a few aggregate masses of glassy pumice that contain secondary calcite.

Wiyo Black-on-white; 190-34. The paste of this sherd is light golden brown and appears to be free of inclusions. The paste is tempered with medium to very coarse fragments of glassy pumice which displays some welding and compaction. Occasional fragments of sanidine and volcanic quartz are also present. The pumice makes up about 35 percent of the paste; the mineral grains make up an additional 3 percent.

Wiyo Black-on-white; 236-26. The slightly grayish brown paste of this sherd contains abundant very fine sands and some brown biotite that strongly resembles the clay body of sample 170-21. Unlike sample 170-21, the paste also contains abundant glass shards and a few fragments of glassy pumice. In terms of composition, the major differences between this sherd and sample 170-21 are the presence of a single fragment of calcium-cement-supported submature sandstone in the present specimen, and a greater amount of glassy pumice fragments.

Biscuit B; 185-45. The light gray paste of this sherd appears to be relatively free from natural inclusions. The paste contains finely crushed glass shards that appear to make up more than 50 percent of the clay matrix.

Biscuit A; 185-57. The light brownish-gray paste of this sherd contains very sparse rounded grains of quartz and sanidine. A few coarse rounded clay pellets are also present. The paste is abundantly tempered using finely crushed glassy pumice. Like the previous specimen, these glass shards make up more than 50 percent of the ceramic paste.

Biscuit A; 186-60. The paste of this sherd is light brown. Sparse biotite, silt-sized quartz, and a few large rounded clay pellets appear to be natural inclusions in the ceramic paste. The paste is tempered using crushed glassy pumice. The vesicle size of this pumice appears to be slightly larger than that observed in specimens 185-57 and 186-60. This pumice still accounted for at least 50 percent of the ceramic matrix. Unlike the previous specimens, several pumice fragments are present in the paste of this sherd. The pumice does not display any evidence of compaction.

Biscuit A; 188-55. The light brown paste of this sherd contains very sparse fine rounded quartz, altered feldspars, and brown biotite as natural inclusions along with rounded clay pellets. The paste is tempered using crushed glassy pumice. The glass sherds make up about 50 percent of the ceramic paste.

Biscuit A; 192-72. The light brown paste of this sherd, like sample 188-55, contains very sparse rounded quartz, altered feldspars, and brown biotite as natural inclusions. Also like the previous specimen, a few coarse rounded silty clay pellets are also present. The paste is tempered using finely crushed glassy pumice, which makes up about 40 percent of the paste, slightly less than in the previous sherd.

Biscuit B; 192-74. The paste of this sherd is light gray. A moderate amount of silt-sized quartz and biotite are present in the ceramic clay. Also present are coarse to very coarse subangular to subrounded grains of volcanic quartz and sanidine. A few isolated fragments of green hornblende and plagioclase are also present. These mineral grains make up less than 1 percent of the ceramic paste. Whether any of these isolated mineral grains are related to the added glassy pumice temper could not be determined. The paste of the parent vessel is tempered using crushed glassy pumice. The pumice fragments range in size from very fine to very coarse and make up about 50 percent of the ceramic paste. The largest pumice fragments display welding and compaction.

Biscuit A; 193-34. The paste of this sherd resembles that of sample 190-34 (Wiyo Black-on-white). The brown paste contains silt-sized to fine quartz and brown biotite inclusions. A few rounded clay pellets are also present. These materials appear to be natural constituents of the ceramic clay. The parent vessel is tempered using crushed glassy pumice. Fragments of pumice and the highly reduced glass shards make up about 35 percent of the matrix of the sample. Some of the pumice fragments are very coarse, but the glass shards range down to very fine.

Biscuit A; 197-21. The light brownish-gray paste of this sample contains a few very coarse rounded clay pellets along with silt-sized quartz and very fine flakes of brown biotite. The paste contains about 50 percent fine to medium glassy pumice.

Discussion

All of the utility wares examined contain plutonic rock fragments. In all cases, these rock fragments are an additive to the ceramic paste. Samples 161-15, 170-16, and 234-25, in addition to the presence of plutonic rock fragments, contain abundant fine particles of brown biotite in their pastes and appear to have been made from the same clay. Based on the abundance of brown biotite in samples 189-10, 190-14, and 196-27, the ceramic clay appears to have been derived directly from a weathered micaceous granitic or schistose outcrop. Samples 195-18 and 196-23 also have a similar paste to one another and are most likely from the same source.

Plutonic rocks outcrop in the southern Sangre de Cristo Mountains. Granite and other plutonic rocks would also have been readily available near LA 101412 as stream cobbles and on pediment surfaces (Galusha and Blick 1971; Kelley 1979; Miller et al. 1963). The sherds with the highly micaceous pastes—189-10, 190-14, and 196-27—were made from clays that probably derived from outcrops dominated by weathered micas, most likely in the southern Sangre de Cristo Mountains.

All of the utility wares contained the largest temper particles observed in the petrographic sample examined from LA 101412. It is likely that the coarser temper was used in the utility wares in order to reduce thermal shock when the vessels were used for cooking.

The two Kwahe'e Black-on-white sherds derive from different, though related, productive sources. Sample 170-23 is tempered with crushed potsherds, and the paste contains quartz, plagioclase, brown biotite, and hornblende as natural inclusions, suggesting that the clay may derive from the southern Sangre de Cristo Mountains. Sample 186-69 was probably not tempered but was made using a clay rich in plutonic rock fragments. The parent vessel may also have been produced in the southern Sangre de Cristos.

All of the samples of Santa Fe Black-on-white contain fragments of a submature calcium-cement-supported sandstone. The paste of these sherds contains detrital grains from plutonic rocks. Also present are rounded silty clay pellets. The most readily available source of calcareous sandstones relative to LA 101412 is in the Tesuque formation of the Santa Fe Group (Miller 1963). The Tesuque Valley formation also contains sediments derived from plutonic rocks. Santa Fe Black-on-white containing calcareous sandstone has been reported from Arroyo Hondo, where it was thought to have been found only in imported vessels (Habicht-Mauche 1993). One previous study of Santa Fe Black-on-white has suggested the southern Sangre de Cristos as a potential source of sandstone (Warren 1976).

All four of the Wiyo Black-on-white sherds contain crushed glassy pumice in brown or grayish-brown pastes, although the amount of pumice in the paste is highly variable. Samples 170-21 and 236-26 also contain abundant fine sands; the latter contains a calcareous sandstone fragment. The similarity in paste colors and the presence of glassy pumice in the four sherds suggest that they were made from different clay bodies, but may derive from geologically similar areas.

All Biscuit ware sherds are tempered with crushed glassy pumice. Within the sherds the pumice is somewhat variable in terms of the degree of reduction and the size of the inclusions. Sample 193-34 (Biscuit A) closely resembles sample 190-34 (Wiyo Black-on-white) in terms of paste color, size and amount of pumice particles, glass shards, and quartz and feldspar inclusions in the clay. Wiyo Black-on-white is thought to be a precursor of the Biscuit wares, and these two sherds suggest that in this case there may have been some technological continuity between the two types. Similarities in the paste and temper between Wiyo Black-on-white and Biscuit ware have been observed previously at LA 70 near Cochiti Pueblo (Warren 1976).

References Cited

Galusha, Ted, and John C. Blick
1971 Stratigraphy of the Santa Fe Group, New Mexico. *Bulletin of the American Museum of Natural History* (144)1.

Habicht-Mauche, Judith A.
1993 *The Pottery from Arroyo Hondo Pueblo, New Mexico; Tribalization and Trade in the Northern Rio Grande*. Arroyo Hondo Archaeological Series No. 8. School of American Research Press, Santa Fe.

Kelley, Vincent C.
1979 Geomorphology of the Española Basin. In *New Mexico Geological Society Guidebook: Santa Fe County* (30th Field Conference), pp. 281-288. University of New Mexico, Albuquerque.

Matthew, A. J., A. J. Woods, and C. Oliver
1991 Spots Before the Eyes: New Comparison Charts for Visual Percentage Estimation in Archaeological Material. In *Recent Developments in Ceramic Petrology*, edited by Andrew Middleton and Ian Freestone, pp. 211-264. British Museum Occasional Paper No. 81. British Museum Research Laboratory, London.

Miller, John P.
1963 Cenozoic Deposits. In *Geology of the Southern Part of the Southern Sangre de Cristo Mountains, New Mexico*, by John P. Miller, Arthur Montgomery, and Patrick Sutherland, pp. 50-53. Bureau of Mines and Mineral Resources, Memoir 11. Socorro, New Mexico.

Miller, John P., Arthur Montgomery, and Patrick Sutherland
1963 *Geology of the Southern Part of the Southern Sangre de Cristo Mountains, New Mexico*. Bureau of Mines and Mineral Resources, Memoir 11. Socorro, New Mexico.

Terry, R. D., and V. G. Chilingar
1955 Summary of "Concerning Some Additional Aids in Studying Sedimentary Formations", by M.S. Shvetsov. *Journal of Sedimentary Petrology* 25:229-234.

Warren, A. Helene
1976 The Pottery of Pueblo del Encierro. In *Archaeological Excavations at Pueblo del Encierro, LA 70 Cochiti Dam Salvage Project, Cochiti, New Mexico*, Section B of Final Report: 1964-1965 Field Seasons. Laboratory of Anthropology Notes No. 78. Museum of New Mexico, Santa Fe.

APPENDIX 5

Investigations at LA 101414

JOHN A. WARE

Introduction and Background

During data recovery excavations at LA 101412, OAS field personnel recorded a small cobble feature approximately 40 m northeast of the LA 101412 site boundary. This feature was not recorded during the archaeological survey of the project area (Marshall 1993), but its proximity to a nearby terrace-top prehistoric agricultural field complex suggested a possible connection between the two features. The field complex, designated LA 101414, was originally recorded by Cibola Research Consultants in 1993 (Marshall 1993:16-17). Marshall identified the site as a small Pueblo II unit house, and described the site as follows (1993:16):

> This site consists of a small unit house and light scatter of artifacts. It extends over a 15 by 15 meter area. Cobble alignments at the site are probably basal foundations for a small jacal-adobe unit house. Cobbles used in this construction are granitic stones, 10 to 20 cm in size. Two room units are visible. Estimated depth of the unit house is 50 cm. A possible pithouse may also be present. Scattered artifacts surround the unit house indicating the presence of a shallow midden cover.

On closer examination, the footing cobbles that Marshall described appear to be the linear borders of a gravel-mulched field (e.g., Anschuetz et al. 1985; Buge 1984; Lang 1980; Lightfoot 1990; Maxwell and Anschuetz 1987; Ware and Mensel 1992). Like similar features recorded elsewhere in the northern Rio Grande, the field consists of a rectangular, cobble-bordered plot, internally subdivided into cells filled with gravel mulch. The plot is raised several centimeters above the surrounding ground surface and supports a somewhat higher density of plants than adjacent nonmulched surfaces. Immediately south of the field, on the gravel-terrace edge, is the outline of a small borrow pit (Marshall's possible pithouse) that was presumably excavated to obtain cobbles and gravels for field construction.

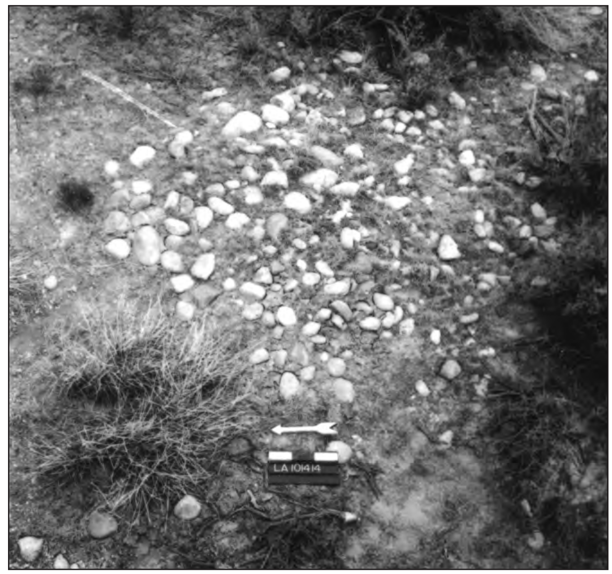

Figure 5.1. Preexcavation view of cobble feature at LA 101414.

The light scatter of refuse that Marshall observed on the surface of the site is not consistent with an agricultural interpretation. Dry-farmed fields in the northern Rio Grande typically exhibit very low densities of surface artifacts, especially ceramics. In addition, the observed preponderance of Pueblo II (ca. A.D. 1000-1150) ceramics at LA 101414 is not consistent with generally accepted age estimates of gravel-mulch technology in the northern Rio Grande (ca. A.D. 1250-1500). However, LA 101414 is located less than 50 m south of a large multicomponent Pueblo site (LA 61) whose boundaries, in all likelihood, overlap the boundaries of LA 101414. Moreover, at this time the presence cannot be ruled out of a fieldhouse or earlier occupation component at LA 101414, either of which may have contributed occupational refuse to the surface of the terrace.

The small cobble feature that is the subject of the present inquiry is located approximately 45 m southwest of the main field complex, near the toe of the terrace slope. The feature consists of a small rectilinear concen-

Figure 5.2. Cobble feature with approximately 10 cm of fill removed from the west half. Note random arrangement of cobbles and absence of internal alignments or "cells."

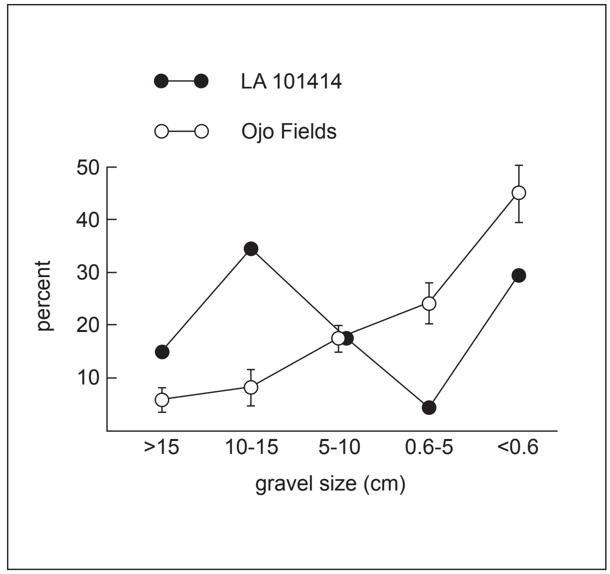

Figure 5.3. Error bar plot of internal material fractions. Average values for two prehistoric fields from the Ojo Caliente Valley (LA 83116 and LA 83117) are plotted (tails indicate 1 SD). Closed symbols represent material fractions recovered from the LA 101414 cobble feature.

tration of water-worn cobbles and gravel measuring roughly 1.5 m on a side (Fig. 5.1). Preliminary inspection of the feature suggested that it might be an example of a common prehistoric field type referred to in the literature as a "postage stamp garden" (Ware and Mensel 1992).

Previous studies of gravel-mulched gardens in the lower Chama Valley north of Española, New Mexico, have documented a large range of field sizes and configurations. Fields recorded at the Ojo Caliente Project (Ware and Mensel 1992) ranged in size from just over 7 to nearly 2,000 square meters. At least part of this variability may be related to field location and the availability of cobbles and gravels for field construction. The largest gravel-mulched fields tend to be concentrated around the margins of fluvial terraces where cobbles and gravel are readily obtained from the excavation of terrace-edge borrow pits. In the interior of the terrace, fields were typically constructed by concentrating and rearranging surface gravels, and since the quantity of surface gravels is usually limited, interior fields tend to be smaller than terrace-margin fields. There may also be functional differences between large and small gravel-mulched fields. Perhaps the small "postage stamp gardens" were used as germination beds for economic crops, or as special gardens for medicinal or other types of "special" crops.

Hypotheses relating to field-size variation and the function of so-called "postage stamp gardens" have never been evaluated because no examples of the small gardens have ever been excavated. It was hoped, therefore, that investigations at LA 101414 might answer several questions about small-field construction, age, and use (Ware et al. 1994).

Research Results

Excavations at LA 101414 were carried out on April 10-12, 1995 by an OAS field crew consisting of Sonya Urban and Caroline Count under the supervision of John Ware. Before excavation, a base map of LA 101414 was made with the aid of an optical transit, and preexcavation photographs were taken of the cobble feature. Once a control grid was established, the western half of the rock feature was excavated by hand in 10-cm levels (Fig. 5.2). A sample of cobble and gravel fill was screened and sorted into five size categories (>15 cm, 10 to 15 cm, 5 to 10 cm, 0.6 to 5 cm, and <0.6 cm) and compared with similar samples from prehistoric garden plots in the lower Ojo Caliente Valley (LA 83117 and 83116). The results of the comparison are summarized in Fig. 5.3.

As Figure 5.3 illustrates, the material size fractions from LA 101414 are very different from the Ojo

Caliente field samples. In the Ojo Caliente samples, over 80 percent of materials from the field matrix consist of gravels and sands less than 10 cm in length (sand comprises a large percentage of all field matrices, mostly due to postabandonment eolian deposition). Gravels in the 1- to 10-cm size range were used in the interior of the field grids as a mulch for moisture retention, and possibly for beneficial solar-gain effects. Cobbles larger than 10 cm were used almost exclusively in the construction of field edge and internal grid borders, and large cobbles always constitute a very small fraction of total material by weight.

The most common materials in the Pojoaque feature consist of large cobbles greater than 10 cm in diameter, followed by very-fine-grained sands and silts. Small gravel accounts for less than 20 percent of total material by weight from the Pojoaque samples, versus nearly 40 percent for the Ojo Caliente field samples. Moreover, excavation yielded no evidence of structural grid alignments, “cells”, or linear cobble borders in the Pojoaque feature. Such structural elements are nearly ubiquitous in prehistoric gravel-mulch field systems in the northern Rio Grande.

During the final stages of excavation at LA 101414, a .30-caliber cartridge casing was recovered in the fill of the rock feature, at a depth of 11 cm below present ground surface. The casing was found under a large rock cobble and was partly crushed. There was no evidence of secondary deposition or intrusion, and the condition of the cartridge suggests that it was deposited either before or at the same time as the rock feature.

On the basis of the evidence presented above, it appears that the rock feature at LA 101414 is not a prehistoric agricultural feature, but a dumping episode of comparatively recent date. Another small rock mound is located 15 m due west of the feature and may be the result of the same earth-moving activity. The two cobble mounds may be related to the construction of a nearby dirt track that originates at the Pojoaque access road and runs in a southerly direction along the toe of the gravel terrace, skirting the edges of both cobble mounds. The rectilinear outline of the excavated cobble mound may be attributable to the nature of the mechanical equipment used. The width of the cobble mound approximates the width of a small backhoe or front-end loader.

References

Anschuetz, Kurt F., T.D. Maxwell, and J. A. Ware
1985 *Testing Report and Research Design for the Medanales North Project, Rio Arriba County, New Mexico*. Laboratory of Anthropology Notes No. 347. Museum of New Mexico, Santa Fe.

Buge, David E.
1984 Prehistoric Subsistence strategies in the Ojo Caliente Valley, New Mexico. In *Prehistoric Agricultural Strategies in the Southwest*, edited by S.K. Fish and P.R. Fish, pp. 27-34. Arizona State University Anthropological Research Paper No. 33. Tempe.

Lang, Richard W.
1980 *Archaeological Investigations at a Pueblo Agricultural Site, and Archaic and Puebloan Encampments on the Rio Ojo Caliente, Rio Arriba County, New Mexico*. Contract Archeology Division Report 007. School of American Research, Santa Fe.

Lightfoot, Dale R.
1990 The prehistoric pebble-mulched fields of the Galisteo Anasazi: agricultural innovation and adaptation to environment. Ph.D. dissertation, Department of Geography, University of Colorado, Boulder.

Marshall, Michael P.
1993 *A Cultural Resource Survey for the Pojoaque-Interchange Highway 285 Improvement Project*. Cibola Research Consultants, Albuquerque.

Maxwell, Timothy D., and K.F. Anschuetz
1987 Variability in garden plot locations and structure in the lower Rio Chama Valley, New Mexico. Paper presented at the 52nd Annual Meeting of the Society for American Archaeology, Toronto.

Ware, John A., and Macy Mensel
1992 *The Ojo Caliente Project: Archaeological Test Excavations and a Data Recovery Plan for Cultural Resources Along U.S. 285, Rio Arriba County, New Mexico*. Archaeology Notes 99. Office of Archaeological Studies, Museum of New Mexico, Santa Fe.

Ware, John A., Stephen C. Lentz, and James L. Moore
1994 *A Data Recovery Plan for LA 101414: A Late Prehistoric Agricultural Field Component at the Pojoaque Interchange, Santa Fe County, New Mexico*. Archaeology Notes 162. Office of Archaeological Studies, Museum of New Mexico, Santa Fe.