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OFFICE OF ARCHAEOLOGICAL STUDIES

THE PHANTOM PALMS: A MESILLA PHASE JORNADA MOGOLLON SITE NEAR SANTA TERESA

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ADMINISTRATIVE SUMMARY

Between November 10 and December 12, 1997, the Office of Archaeological Studies, Museum of New Mexico, excavated a portion of LA 110621 for the New Mexico State Highway and Transportation Department (NMSHTD). The portion of the site excavated was within the project limits for the proposed improvements to NM 273 near Santa Teresa. LA 110621 is located on state land acquired from private sources and administered by NMSHTD. This report describes the excavation at LA 110621. Funds proved by the NMSHTD and the Federal Highway Administration were used for this project.

LA 110621 is a Jornada Mogollon Mesilla phase habitation site. Excavation of both a pit structure and a surface structure yielded a large amount of discarded prehistoric artifacts. Specialized artifact and sample analyses provided detailed information with which to interpret the artifacts in light of research questions proposed in the data recovery plan.

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INTRODUCTION

Between November 10 and December 12, 1997, New Mexico State Highway and Transportation Department (NMSHTD) archaeologists excavated the site of LA 110621 on NM 273 in Doña Ana County, New Mexico. The NMSHTD proposed to improve NM 273, encompassing a portion of LA 110621 within the proposed right-of-way. Therefore LA 110621 was recommended for data recovery. This report presents the results of the excavations. Funds provided by the NMSHTD and the Federal Highway Administration were used for this project.

The data recovery plan and subsequent archaeological data recovery efforts were proposed and performed by the Office of Archaeological Studies, Museum of New Mexico. The principal investigator was Yvonne R. Oakes and the project director was Peter Y. Bullock. Field assistants were Raul Troxler, Philip Alldritt, and Jesse Murrell. The report was edited by Robin Gould, graphics were drafted by Ann Noble, drawings were by Robert Turner, and photographs were printed by Warren Lieb.

LA 110621 is located on state land acquired from private sources and administered by NMSHTD (Fig. 1). Site location data are included in Appendix 2 (removed from copies in general circulation).

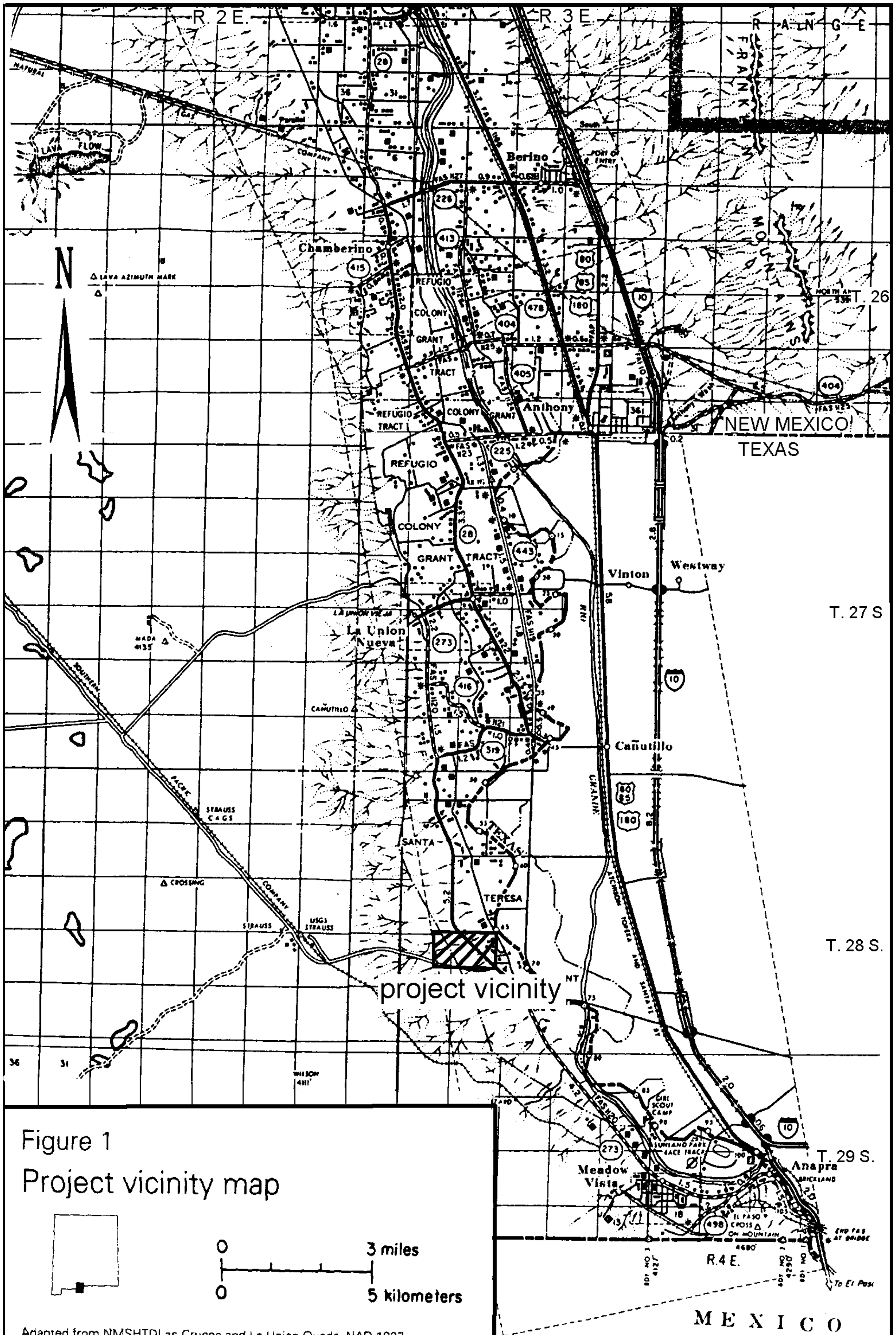

Figure 1
Project vicinity map

ENVIRONMENT

The project area is located to the west of the Rio Grande in the eastern area of the intermontane lowland known as the Mesilla Bolson. Site elevation is 1,152.1 m (3,780 ft).

The countryside, west of the Rio Grande Valley and north of Santa Teresa, is rolling desert grassland (Castetter 1956, fig.1). The site area is in a region of active coppice dunes. Historically these dunes have been stabilized; however, overgrazing has reduced the local grasses, allowing an increase in the level of erosional duning activity. The invasive species of mesquite, creosote bush, and soap-tree yucca dominate the local vegetation (Dick-Peddie 1975). An in-depth analysis of the general project area's environmental setting is available in O'Laughlin (1980).

Geology

The project area is within the Mexican Highland section of the Basin-and-Range Physiographic Province (Fenneman 1931:379-380). The area is characterized by north-south block fault ranges uplifted in the Tertiary period. These ranges are separated by intermontane basins that were filled during the upland erosion of the Pleistocene (Kottlowski 1958; Strain 1966). The project area is within one of these basins known as the Mesilla Bolson (Fenneman 1931:385). The Mesilla Bolson is bounded to the west by the Sierra de las Uvas and the Potrillo Mountains, and by the Organ and Franklin mountains to the east.

The Franklin Mountains are located approximately 11 km (7 miles) east of the project area (O'Laughlin 1980:6). These mountains are a Tertiary uplift of Precambrian, Paleozoic, Cretaceous, and Tertiary sedimentary rock, with rhyolite, granite, and andesite intrusions (McAnulty 1967).

The project area is on the first river terrace west of the Rio Grande, in an area known as the Leeward Slope zone. This includes both the alluvial fans and shallow drainages below the La Mesa deposits to the west, as well as an extensive strip of coppice dunes just above the Rio Grande flood plain. The Leeward Slope zone is dominated by eolian deposits brought in by the prevailing westerly winds, and has been heavily affected by erosion and duning. Sandy soils dominate this zone, although limited areas of gravelly soils do occur (O'Laughlin 1980:19).

West of the project area is a region of nearly level basin sediments. This once formed the bed of the Pleistocene Lake Cabeza de Vaca (Strain 1966), and is known as the La Mesa Surface (Hawley and Kottlowski 1969). Eolian sands blowing off the La Mesa surface have been deposited in the Rio Grande Valley by westerly winds (Davis 1989:4), forming most of the soil comprising the coppice dunes in the project area (Strain 1966).

The soils of the project area reflect this redeposited erosional material (O'Laughlin 1980:10). These soils are Typic Torripsamments, which are generally comprised of loose noncalcareous fine sand over thick deposits of fine sand, sometimes grading into sandy loam or sandy clay. This type of soil is also common in areas of duning (Maker et al. 1974:35).

Climate

The climate of the project area is semiarid mesothermal, with hot days and cool nights. Reflected heat from the north-south oriented Franklin Mountains east of the project area contributes to higher temperatures for this whole section of the Rio Grande Valley (Tuan et al. 1973:68-69). Average annual precipitation for El Paso is 20.1 cm (O'Laughlin 1980:12; Tuan et al. 1973:18). Most rainfall occurs in the mid summer months of July, August, and September (Gabin and Lesperance 1977:114; Maker et al. 1974:26; Tuan et al. 1973:20).

The average number of frost-free days is 248 (O'Laughlin 1980:12; Tuan et al. 1973, fig. 35), while the potential growing season for domesticated crops is closer to 348 days (Smith 1920:273, fig. 79). O'Laughlin (1980:12) has noted that this combination of temperature and rainfall results in one long growing season. Variability of microclimates and localized conditions have the greatest effect on productivity and crop yield.

The low levels of rainfall make most agriculture impossible in the general area without irrigation. However there is prehistoric evidence of maize being planted in runoff catchment areas on the slopes of the Franklin Mountains (O'Laughlin 1980) and on the shores of seasonal lakes or playas in the general site area (Carmichael 1986).

The current pattern of summer rains and cool dry winters first appeared in the middle Holocene with the amount of moisture much greater than at present. Despite a great deal of variability (wetter periods are suggested for 1000 B.C. and A.D. 1000), there has been an overall drying trend through time. One result of this drying trend has been a gradual change in biotic communities from piñon-juniper woodland to juniper-oak to savannah grassland, with scattered juniper and oak in broken mountainous areas (Davis 1989:21; O'Laughlin 1980:12-14; Van Devender and Spaulding 1979).

Flora and Fauna

One by-product of the range of environmental zones present in the general project area is an increased variety in available plant and animal resources. Plant communities generally vary with elevation in the Franklin Mountains (Castetter 1956). The riverine ecosystem of the Rio Grande floodplain serves as a distinct linear oasis, providing habitat for plant and animal communities not normally associated with the desert landscape. Some species such as migrating birds, utilize this area in only a transitory manner. However, the increased variety in plant and animal communities puts more species in closer proximity.

The grazing of livestock has modified the vegetation of the general project area (Castetter 1956:261-262). The previously occurring heavy grass cover of dropseed and black grama has been eliminated, primarily through over grazing (Dick-Peddie 1975). Mesquite, soap-tree yucca, four-wing saltbush, and creosote bush dominate the existing vegetation (O'Laughlin 1980:19).

The general project area supports the Chihuahuan desert faunal complex of jackrabbits, pronghorn, mule deer, desert cottontail, with a variety of birds and small rodent species also present (O'Laughlin 1980:21). The general site area, adjacent to the Rio Grande flood plain, is also accessible to a wide range of riverine and aquatic wildlife not usually available in the general area away from the river.

CULTURAL HISTORY

A complete cultural history of the project area is beyond the scope of this report. More in-depth prehistoric and historic coverage of the area is available in Lehmer (1948), Moore (1996), Price (1995), Stuart and Gauthier (1981) and Timmons (1990). This discussion is limited to the period represented at LA 110621, the Puebloan Jornada Mogollon or Formative period.

Pueblo Period

The Pueblo period in south-central New Mexico is part of the Jornada Mogollon culture. Known as the Formative period (O'Laughlin 1980), it is believed to be a direct offshoot of the late Archaic Hueco phase (Hard 1983). Major cultural changes that occur include an increased dependence on agriculture, the development of ceramics, and increased sedentism (Hard 1983:9). The Formative period is comprised of three phases originally developed by Lehmer (1948), and later modified (Moore 1996; Whalen 1977).

Mesilla Phase

Beginning between A.D. 1 and A.D. 200, and extending to A.D. 1100 (O'Laughlin 1980; Whalen 1980b), the Mesilla phase is characterized by the dominant use of El Paso Brown ceramics. Intrusive ceramics commonly occur in small numbers, Alma Plain and San Francisco Red occur at early Mesilla phase sites, and Mimbres White Wares in later assemblages (Moore 1992, 1996).

Pit structures are present during this phase. These tend to be round, although rectangular structures also appear on later sites. Mesilla phase pit structures in the Rio Grande Valley tend to be larger and deeper than those found in other areas (Whalen 1994a). Pit structures on village habitation sites also tend to be deeper than those at seasonal or resource procurement sites. Internal features may or may not be present. It is now apparent that surface structures (including jacal or adobe structures, brush shelters or ramadas), can also occur on Mesilla phase sites. Also common at sites dating to this period are extramural storage cists and hearths and the presence of sheet trash deposits (Hard 1983:9; Lehmer 1948:77).

Regional trade during the Mesilla phase is indicated by intrusive ceramics, suggesting contacts with both the Mogollon and Mimbres Cultures to the northwest, and the Livermore horizon of the West Texas Big Bend area to the east. Shell from the Gulf of California also occurs on Mesilla phase sites (Lehmer 1948; O'Laughlin 1985; Whalen 1994a; Zamora 1993).

Doña Ana Phase

The Doña Ana phase dates between A.D. 1100 and A.D. 1200. This is a transitional phase between the earlier Mesilla and the later El Paso phases. It has also been suggested, however, that the Doña Ana phase represents an overlap of the other two phases rather than a transition (Maudlin 1993).

The Doña Ana phase is characterized by the presence of both El Paso Brown Ware and El Paso Polychrome in the same cultural deposits (Hard 1983:9-10; Lehmer 1948:78-80). An increased range of intrusive ceramic types, in greater numbers, occurs in the Doña Ana phase. Nonlocal ceramics present on Doña Ana phase sites include Chupadero Black-on-white, St. Johns Polychrome, Three Rivers Red-on-terracotta, Mimbres Classic, and Playas Red Incised (Moore 1996).

Small surface pueblos begin to appear during this phase (O'Laughlin 1980:26). Round pit structures are common, with rectangular pit structures also present. However most of the cultural material of this phase shows little change from the preceding Mesilla phase (Moore 1996). Trough metates tend to become more common within the assemblages, suggesting a greater dependence on agriculture and the processing of maize (Lehmer 1948:78-80). Continued regional trade is indicated by the presence of nonlocal ceramics and shell from the Gulf of California (Moore 1996).

El Paso Phase

The El Paso phase dates between A.D. 1200 and A.D. 1500. Ending dates for the El Paso phase have been problematic. The El Paso phase is now considered to have ended with the end of Glaze A ceramic production in the Piro district to the north. Well-dated sites also tend to support A.D. 1500 as an ending date, with abandonment occurring prior to Spanish arrival (Moore 1996).

Ceramic changes are extensive during the El Paso phase. El Paso Brown continues to be made, but the vast majority of ceramics on El Paso phase sites are El Paso Polychrome. A wider range of imported ceramics appear on El Paso phase sites than in earlier phases. Commonly occurring in small amounts are ceramics from the Zuni area, the Rio Grande area, the Sierra Blanca region, and the Galisteo Basin near Santa Fe. Intrusive Salado ceramics from the west occur on El Paso phase sites. A large variety of northern Mexican ceramic types are also present in small amounts (Hard 1983; Lehmer 1948; Moore 1996).

The El Paso phase is characterized by above-ground adobe structures, with roomblocks grouped around plazas or in rows oriented east to west. A few L-shaped structures are also known. Pueblos range from 8 to 200 rooms, with the smaller roomblocks being the most common.

Internal features are common (Lehmer 1948:8), usually postholes, pits, and hearths (Moore 1996). Village placement is usually near the base of slopes, possibly to take advantage of seasonal water runoff for agricultural purposes (Hard 1983:10). Village size varies, with clusters of villages reported for both the Alamogordo area (Lehmer 1948) and in the Hueco Bolson (Whalen 1977). Specialized sites such as hunting camps, and plant gathering and processing camps, are easily discernable (O'Laughlin 1980:26). Pit structures, although still in use, generally seem to have been phased out by the El Paso phase (Moore 1996).

Ritual, at the village level, is suggested by the presence of specialized rooms at most El Paso phase villages. These rooms are larger than the other rooms in the village, with caches of ritual material often located beneath the floors (Moore 1996).

Overall the artifact assemblage of the El Paso phase is also more complex, with a wider range of items and types of tools represented than in either of the two earlier phases (Lehmer 1948:81). Marine shell, nonlocal materials, as well as a large variety of imported ceramics are some of the goods from an extensive regional exchange network moving into the southern Jornada Mogollon area (Moore 1996). The trend during the El Paso phase is one of increasing cultural complexity until abandonment around A.D. 1500 (Hard 1983).

DATA RECOVERY RESEARCH ORIENTATION AND GOALS

This section provides the orientation and goals or expectations for the research that guided the data recovery effort. It is primarily derived from the recovery plan for LA 110621 developed by Bullock (1997).

The data from other Jornada Mogollon Mesilla phase sites indicates both a wide variation in structure types, and patterns between pit structure morphology and location. Mesilla phase structures occur as deep pit structures with vertical walls, along the Rio Grande Valley. Surface structures can also be present. In areas away from the Rio Grande, Mesilla phase structures are characterized by saucer-shaped floors of varying depth and shape (Hard 1983; Moore 1996).

Testing revealed LA 110621 to be a habitation site. With this in mind, the data recovery effort for LA 110621 focused on identification issues. These have been identified as refinement of the area chronology, a determination of site activities and their relationship to site function, and an assessment of how LA 110621 fits into the subsistence and settlement patterns suggested for the Jornada Mogollon (Bullock 1997). The goals and expectations of the data recovery effort were as follows:

1. Changes in settlement patterns, community organization, and other aspects of cultural development within the Mesilla phase of the Jornada Mogollon are dependent on an ability to date individual sites from the phase. Establishing a date for LA 110621 should both aid in refining the suggested dates for the Mesilla phase, and enable the placing of the site within models of Mesilla phase mobility.

Several carbon-14 samples were collected from the floor of the pit structure at LA 110621. Dendrochronology dating may also be applicable to the larger pieces of charred wood recovered from the pit structure floor. These may enable the precise dating of the pit structure and will also aid in establishing dates for site use.

The ceramic assemblage from LA 110621 will be analyzed to produce data that will identify local pottery. This may be accomplished through the study of tempers present, and through petrographic analysis. Both local and intrusive pottery may also be identified on the basis of paste, surface finish, and design elements. The frequencies of intrusive ceramic types through time should provide information on the regional social and economic organization. The proportion of ceramic types within site assemblages changes through time, allowing the determination of a site chronology for the two structures. The ceramic assemblage from LA 110621, when compared with assemblages from other Mesilla phase sites, will enable the establishment of relative site dates between sites within the Mesilla phase. Cultural change within the Mesilla phase may be documented in this way.

2. A site's occupational history can be postulated based on the sequence of overlapping features. In addition, spatial patterns of activity and discard areas may reflect differences in a site's length of occupation, changes in both site function and composition through time. Long-term residential or habitation sites should contain formal features, exhibit artifact diversity, and contain accumulated discard areas.

LA 110621 was originally believed to contain two overlapping pit structures and a midden deposit discard area (Bullock 1997). Excavation proved this was not the case. The excavated portion of the site contained two structures, one pit structure and one surface structure, but no extramural features or deposits. The two structures did not physically overlap. This necessitated a change in focus away from stratified overlapping features, and more toward an analysis of site structure.

Site structure at LA 110621 can be understood through a determination of on-site activities, by the location and function of site and pit structure features and their relationships. Feature function can be determined through the description of the feature, and the analysis of the associated artifacts and other material.

Nonlocal lithic materials may provide information about the social and economic organization. The presence of lithic materials that have specific source areas may confirm or supplement the data obtained from the petrographic study of the pottery.

Any resulting chronological information will help develop a sequence of structure or feature use at LA 110621. Comparison of the resulting information with other aspects of LA 110621, such as a possible relationship with the adjacent later El Paso phase pueblo at LA 110620 can thus aid in the reconstruction of the site's occupational history.

3. The form of subsistence at a site will vary depending on the type of occupation that occurs at the locale. Subsistence should also reflect differences in how the site was used; seasonal use will differ from long-term sedentary occupation. Dietary evidence can be combined with indirect technological evidence to infer the level of subsistence pursued at the site level.

Subsistence at LA 110621 should reflect the site's locale on the first terrace of the Rio Grande. Utilizing the model developed by O'Laughlin and Gerald (1977), subsistence at LA 110621 should follow a riverine strategy of river bottom associated plants and animals (fish, waterfowl, etc.), combined with lowland plant and animal resources (rabbit, pronghorn), and cultivated crops.

Excavation of cultural features and deposits may yield faunal and macrobotanical remains. These remains will be analyzed for anatomical portion, age, condition, and frequency to determine dietary information.

Pollen from cultivated plants will enable us to infer aspects of farming. Large amounts of pollen are likely to indicate intensive farming and consumption. Pollen analysis also reveals information about the general prehistoric environment, including the favorability of agricultural conditions. The types of grinding implements present may also correspond to the plants (gathered or cultivated) involved.

The analysis of ceramic and lithic artifacts will provide information on the range and intensity of activities pursued at LA 110621. Differences in the activities pursued in relation to each of the two structures excavated may provide information on differences in hunting and gathering strategies pursued at LA 110621 at different times. Artifacts associated with hunting versus gathering versus maize processing can all occur on residential sites such as LA 110621.

Changes in Mesilla phase subsistence may be apparent through comparison of known sites and their distribution through time and space (O'Laughlin and Gerald 1977). A combination of ceramically derived relative site dates and more precise radiocarbon (^{14}C) and dendrochronology dates will allow the seriation of site structures by age, making apparent changes in the associated subsistence. An understanding of site subsistence can also contribute to understanding the importance of exchange and group mobility.

DESCRIPTION OF LA 110621

LA 110621 is north of Santa Teresa (Fig. 1) on the first terrace west of the Rio Grande flood plain. The site covers a large area (230-by-60 m), however most of it is outside of the project area to the north and east. Within the project limits, the main site area includes a pit structure, a surface structure, and an associated concentrated surface ceramic and lithic artifact scatter (Fig. 2). This suggests that this is a habitation site. The portion of LA 110621 within the project area measures 29-by-5 m for an area of 145 sq m. Surface artifacts for the portion of the artifact concentration within the project area totaled 69 for a density of 0.5 artifacts per square meter.

The lack of external features at LA 110621 may be at least partially due to earlier site modification through highway shoulder maintenance. This removed large portions of the original ground surface, as well as the upper portions of both structures in the project area. Areas of the site to the west have been completely removed by earlier highway construction. Both a water line and pipeline run parallel to the highway within the existing right-of-way. The gas pipeline is outside of the intact portion of the site, between the site and the highway pavement. However, the water line cuts through the intact site area.

Just to the north of the project area is LA 110620, the site of a later El Paso phase pueblo. The two areas may actually form one larger site, possibly part of a continuous Jornada Mogollon settlement sequence.

Excavation Methods

The first goal of the excavation was to collect surface artifacts within the existing right-of-way. This was accomplished by setting up a 1-by-1-m grid system across the right-of-way. A site datum was established as 0N/4E with an arbitrary elevation of 1.00 m. Grid numbers were assigned to the southwest corner of each unit. Each grid unit was examined for artifacts, which were bagged by grid. A total of 145 sq m was inspected and the surface artifacts collected.

Following the surface collection, two of the earlier test units were reopened (Test Pit 3 and Test Pit 4), revealing the stratigraphy of the site's two structures (one pit structure, one surface structure). The site stratigraphy was also revealed in this manner.

Once Stratum 1 (churned site overburden) was identified, it was surface stripped from 111 additional grids to expose the rest of the two structures and any extramural features or deposits that may exist in the immediate area. This overburden averaged 10 cm in depth, and away from the structures was directly over culturally sterile clay (Stratum 2). Stratum 1 was removed as a single layer. No cultural layer or extramural features were present outside of the two structures. This confirmed previous auger tests conducted during testing that indicated that no subsurface cultural material was present outside of the excavated area (Bullock 1997).

All of the dirt excavated at LA 110620 was sifted through ¼-inch screen mesh. Artifacts were collected in paper bags that were labeled with vertical and horizontal provenience information.

Two prehistoric structures (Pit Structure 1 and Structure 2) were exposed by the removal of Stratum 1. Once the horizontal extent of each structure was defined, it was dealt with as a single structural unit.

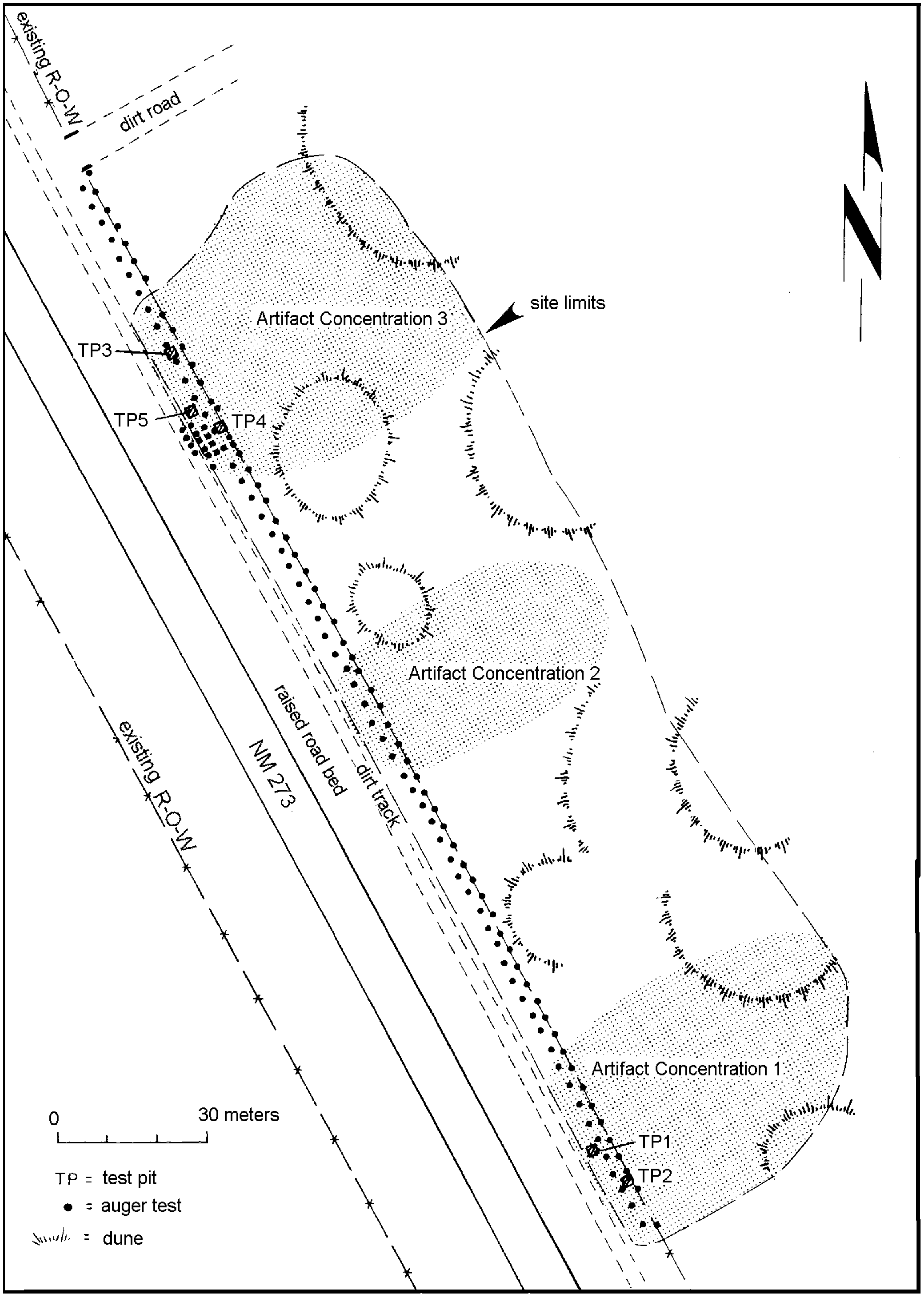

Figure 2. LA 110621, testing results.

A 1-m-wide trench extending the length of the pit structure was hand excavated across the length of Pit Structure 1. The position of this trench (designated Segment 1) was dictated by the location of Test Unit 4, which was extended east and west across the width of the pit structure until it intersected with the pit structure walls. This trench was excavated in 10 cm levels to identify the pit structure's interior stratigraphy. A profile was drawn of the pit structure fill, and the rest of the fill was removed by natural strata. All of the fill was screened, and the artifacts bagged by provenience.

A single floor was identified within Pit Structure 1, based on the stratigraphic profile exposed within the Segment 1 trench. As the floor was uncovered, the floor surface and any features or artifacts present on the floor were mapped. Any features present on the floor were then excavated.

All interior features within the pit structure were excavated in a similar manner. Once the horizontal extent of the feature was defined, it was excavated in halves. The first half was used to identify natural or cultural stratum. The second half of each feature was excavated by natural strata. If stratified deposits were absent, the feature was excavated in arbitrary 10 cm levels. Samples were taken from contexts that appeared likely to yield the most data on feature function and age. Each feature was drawn and profiled, photographed, and described on field journal forms.

Similar excavation procedures were applied in the excavation of the second structure present at LA 110621 (Structure 2). Structure 2 (a surface structure) was first bisected. Because of the shallow nature of the structure it was then excavated in halves. The first half was used to identify natural or cultural strata, the second half was then excavated by strata. Samples were taken from contexts likely to yield the most data on structural function and age. The floor surface and any artifacts or features present on the floor surface were mapped. Any features present on the floor were excavated following the same procedure as in Pit Structure 1.

Because Structure 2 extended outside of the project area onto private land, only the portion within the project area was excavated. The exposed profile was drawn, and the rest of the feature fill was removed in natural strata. The stratigraphy and the feature were profiled, photographed, and described on field journal and grid forms. The forms included excavated depth in centimeters below site datum, information about soil color and texture, and artifact types and density. Soil colors were described using Munsell color notation.

After excavation was completed, the site was mapped with a transit and stadia rod, including the limit of the excavation, location of auger tests, and cultural features. After mapping, the excavation was backfilled.

All artifacts, unprocessed samples, and field notes, drawings, and maps are stored at the New Mexico Archaeological Research Collections,and the New Mexico Archeological Records Management Section in Santa Fe.

Stratigraphy

Excavation defined three strata present across the site, outside of the structures. These were assigned consecutive numbers that were used in the excavation notes and site and feature drawings. No intact cultural strata were found outside of either the pit structure or surface structure.

Stratum 1 is a grayish tan, finely textured, churned, silty loam. Primarily eolian in origin, highway shoulder modification and standing water have also contributed to Stratum 1. This stratum is present at LA 110621 as the modern topsoil layer. It contains prehistoric artifacts and flecks of charcoal. Some lenses of gravel and isolated cobbles are also present. Modern trash is present throughout this stratum. The depth of Stratum 1 ranges from 10 to 18 cm.

Stratum 2 is a fine, tan, sandy silt, eolian in origin. This stratum is directly under Stratum 1, and contains flecks of caliche. Although both structures are dug into this stratum, it is culturally sterile.

Stratum 3 is a dense, light pink clay. This material is located directly below Stratum 2, and is culturally sterile. It is fine textured, and contains caliche deposits, gravel lensing and occasional cobbles. Stratum 4 forms the floor of Pit Structure 1.

Feature Descriptions

Pit Structure 1

Dimensions: Length 5.10 m; Width 4.80 m; Area 24.48 m; Depth 35-50 cm

Pit Structure 1 is a straight-walled circular pit structure located in an area of a previously recorded ceramic and lithic artifact scatter (Fig. 3). No other surface indications of the pit structure were present. Two test units (Test Pits 4 and 5), excavated during the testing phase of the project, cut through the fill of Pit Structure 1. These test units were relocated and uncovered. Working out from these earlier test units, 63 sq m were excavated to a depth of 10 cm, exposing the pit structure's walls. Upper portions of the pit structure's walls may have been removed by earlier routine highway shoulder maintenance.

Once the pit structure was defined, a trench measuring 4.80 m in length and 1 m wide was dug across the center of the pit structure. The position of the Segment 1 trench was dictated by the location of the earlier Test Pit 4. This trench (Segment 1) was dug in arbitrary 10 cm levels to culturally sterile soil. The resulting profile of the pit structure's contents was drawn, and revealed the presence of a single floor. The remaining fill was removed by stratigraphic layers, each stratum as a single unit. Pit Structure 1 is ceramically dated to the Mesilla phase (A.D. 1-1100). Carbon-14 samples collected from the surface of the floor yielded a calibrated date of A.D. 895-1115, with an intercept date of A.D. 1005.

Stratigraphy: The fill of Pit Structure 1 is a combination of eolian deposits and burned cultural fill. Two layers of material are present in Pit Structure 1. These are described in descending order from the top of the exposed pit structure down to the Floor 1 surface.

Stratum 1 is a deposit composed of a fine, yellowish tan silty loan. Small flecks of charcoal, artifacts, and some ash, are present within Stratum 1. This material has a combined origin of eolian soil and alluvial deposition eroding into the pit structure. A similar material may have originally been present across the site. Within Pit Structure 1, this stratum ranges in thickness from 20 to 30 cm.

Stratum 2 is a deposit of dark gray, silty, sandy loam, located directly between Stratum 1 and Floor 1. This material is a combination of eolian soil, charcoal, and ash from the burning of Pit Structure 1. This stratum also contains some artifacts and isolated pieces of burned wood. Stratum 2 varies in thickness from 10 to 25 cm, and is present directly above Floor 1.

Architecture: Pit Structure 1 is circular in shape with straight walls. It measures 5.10 m north-south, by 4.80 m east-west. Depth of the pit structure from modern ground surface to Floor 1 ranges from

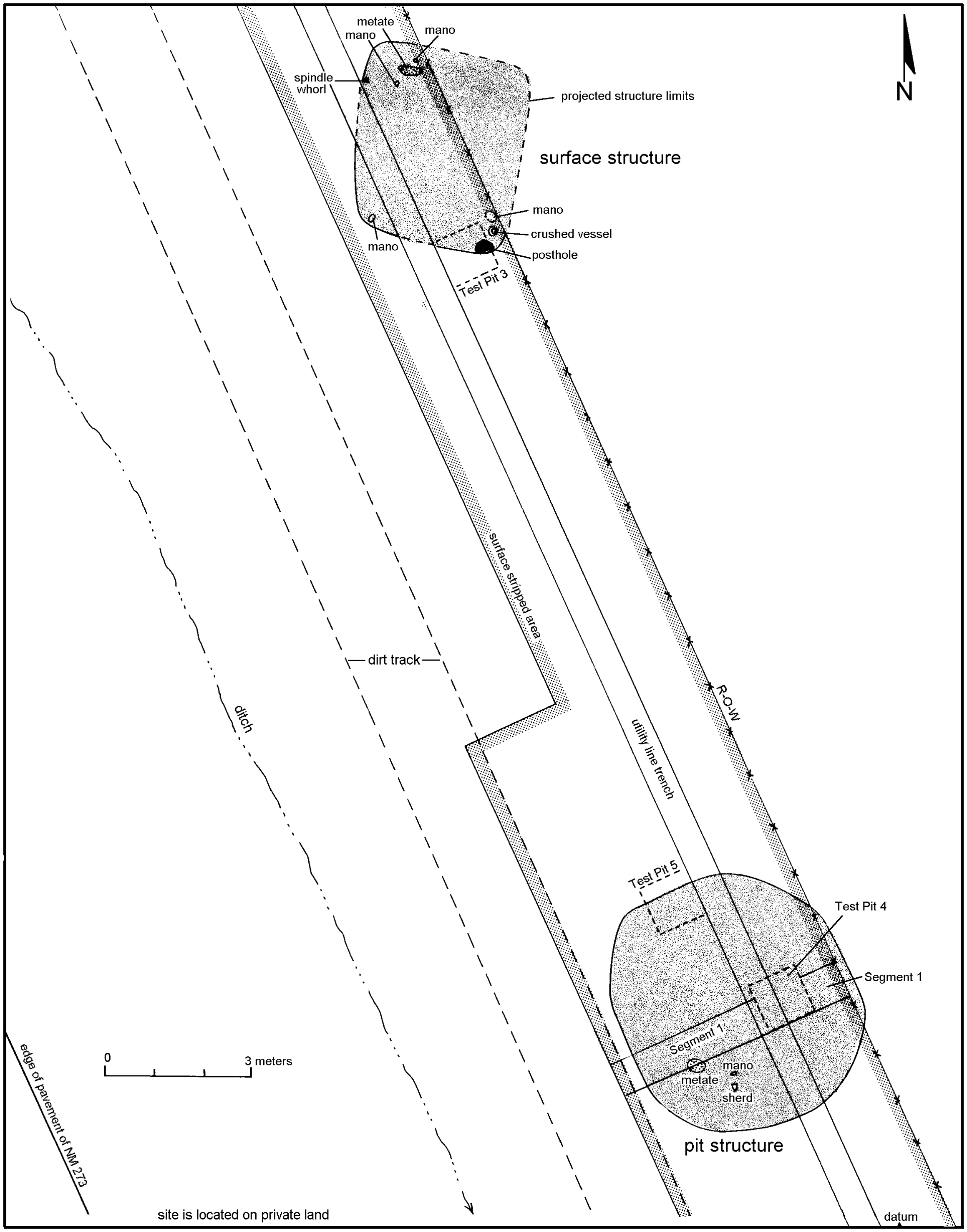

Figure 3. LA 110621 site plan, showing Pit Structure 1 and Surface Structure 2.

45 to 60 cm. Pit Structure 1 was constructed by excavation of a pit through culturally sterile sandy soil to clay. This smoothed clay formed the surface of Floor 1. There is nothing to indicate that the walls of Pit Structure 1 were plastered, or finished in any way. There is nothing present to indicate the type or position of the pit structure's entrance. The pit structure is bisected by a utility (waterline) trench.

Pit Structure 1 has vertical adobe walls and a smoothed clay floor. The floor slopes downward toward the middle of the structure, the depth varying by 15 cm. There is no bench or pilasters. No interior features were found in Pit Structure 1. There is no interior hearth, although this may have been removed by a waterline trench that crosses the pit structure. A single floor is present, which is very lightly stained, despite the burning of the pit structure. Very few floor artifacts were present on the pit structure floor. Short-term use of Pit Structure 1 is suggested by the lack of remodeling and low level of floor staining (floor staining is generally perceived to be caused by use). Large amounts of burned fill (Stratum 2) indicate that Pit Structure 1 burned.

Walls: The walls of Pit Structure 1 are vertical, ranging in height from 45 cm in height on the east side of the pit structure to 35 cm in height on the west. There is no indication of any kind of lining or plastering for the interior of Pit Structure 1. This is probably the result of poor preservation caused by the sandy nature of the soil into which the pit structure was constructed.

The walls are dug directly to the Floor 1 surface. The exact height of the walls is not known. Upper portions of the walls have been removed by earlier routine highway shoulder maintenance.

Floors: One floor is present within Pit Structure 1. There are no features associated with this floor. Floor 1 (Fig. 3) is a well-prepared, slightly charcoal-stained clay floor that merges with all four of the pit structure walls. The floor is flat, but not level, sloping downward toward the center of the pit structure. The western side has a decidedly steeper slope than the rest of the pit structure. Floor depth is 45 to 60 cm below site datum (BSD). The modern ground surface is at 0 BSD. There are no floor features within the pit structure. Floor artifacts are limited to two ground stone artifacts, two lithic artifacts, and a single ceramic sherd. Charred wood was also present on the Floor 1 surface. Most of this was collected for both dendrochronology dating and ^{14}C dating.

Artifact Distribution: Artifact distribution reveals little about the activities that may have taken place in association with Pit Structure 1 because artifact frequency is low. This suggests that either the pit structure saw little use prior to burning, or that it was emptied and abandoned shortly before burning.

A single corrugated sherd was present on Floor 1. Two pieces of ground stone (a basin metate fragment and a two-hand mano fragment) were also present on the Floor 1 surface. Two lithic artifacts were recovered from Floor 1. The presence of ground stone artifacts on Floor 1 suggests that food processing may have taken place during the pit structure's occupation. The other artifacts suggest a number of additional possible activities that may have also been pursued within the structure. While no faunal remains were recovered from Floor 1, there was burned wood present on the Floor 1 surface.

Construction Sequence and Interpretation: Initially, a circular pit was excavated for the pit structure in culturally sterile soil. The pit was dug with straight sides and a flat base that sloped downward toward the center. Once the pit structure was roofed, the base of the original excavated pit became the floor (Floor 1) of the pit structure. There is no evidence that the walls or floor were plastered or finished in any way, although this was a common method of finishing construction (Hard 1983). The lack of postholes also makes it impossible to determine the exact manner in which Pit

Structure 1 was roofed. But it is suggested that the structure's roof had main supports located outside of the excavated portion of the structure. There were no interior features found within the pit structure, although an interior hearth may have been removed by the utility trench.

The light degree of staining suggests that the pit structure was occupied for a relatively short period of time before it burned. There is no evidence of any remodeling. The lack of any eolian deposition between the Floor 1 surface and the burned fill suggests that the pit structure burned either during use, or immediately after abandonment.

The short-term use of Pit Structure 1 is problematic. While it is possible that this could be indicative of limited or seasonal use, the intense size and depth of the structure coupled with its location in a large village site makes this seem unlikely. The slight degree of use and lack of remodeling make abandonment unlikely except in extraordinary circumstances. This is a distinct possibility. A death or other occurrence may have resulted in a perceived need to abandon and burn the pit structure as an act of ritual closure. The structure may have burned as part of a hostile act or raid by hostile neighbors. It is also possible that the pit structure may have caught fire accidently and burned.

Structure 2 (Surface Structure)

Dimensions: Length 4.10 m; Width 4.60 m; Area 18.86 m; Depth 11-20 cm

Structure 2 is a large rectangular surface structure in the area of a surface artifact concentration (Fig. 3). It is located 13 m to the northeast of Pit Structure 1. This structure was first visible as an area of discolored soil, obvious after the surface soil was removed to a depth of 10 cm. No other indications of the structure were present.

One test unit (Test Pit 3) excavated during the testing phase of the project cut through the fill of Structure 2. This test unit was relocated and uncovered. Working out from this earlier test pit, an additional 23 sq m were excavated to a depth of 10 cm to define the area of Structure 2. Approximately two-thirds of the structure is within the project area limits, the rest extends north outside of the project limits onto private land. The portion of the structure outside of the project area was not excavated. An additional 24 sq m between Pit Structure 1 and Structure 2 were also excavated to a depth of 10 cm in an effort to located possible extramural features between the two structures.

There is little evidence to indicate either the form of the structure, apart from its rectangular shape, or the method of its construction. There is no evidence of either adobe or jacal used in the structure's construction. Upper portions of the structure's walls have been removed by scraping connected with earlier routine highway shoulder maintenance. The floor of Structure 2 is a shallow depression that slopes upward from a flat surface to the possible base of the walls. No features were found within the structure, and there is nothing to indicate the type or location of the structure's entrance. Although scraping connected with routine highway maintenance has removed the upper portion of this structure, the remaining charcoal stained portion suggests that the structure burned.

Once the area of Structure 2 was defined, it was divided in half. The northern half of the structure was then excavated in arbitrary 10 cm levels until the bottom of the structure was reached. This profile revealed the presence of a single layer of material within Structure 2. Once the resulting profile was drawn and photographed, the remaining half of the structure's fill was removed by natural strata. A single floor was present within Structure 2. Artifacts on the floor were piece-plotted.

Stratigraphy: The fill in Structure 2 is a heavily charcoal-stained soil deposit. A single stratum of material is present with the structure.

Stratum 1 is a layer of fine, very heavily charcoal-stained sandy silt. This stratum is composed of charcoal-stained soil and ash from the burned structure. Stratum 1 filled the shallow depression on the floor of Structure 2. A number of artifacts are present on the Structure 2 floor surface.

Architecture: Structure 2 is a surface structure (Fig. 3). The floor is comprised of a shallow depression in culturally sterile soil. Whether this was intentionally dug into culturally sterile soil as a form of preparation, or was worn down through use, is not known. However, the floor of the similar structure at the Northgate site (Aten 1972) was dug into the ground approximately 30 cm, suggesting that this floor may have been constructed in a similar manner.

The structure has a rectangular form, however there is little evidence present regarding the shape of the walls and roof. There is also nothing present to indicate the type and location of the structure's entrance. Upper portions of the structure have been removed by scraping connected with earlier highway shoulder maintenance. A utility trench (waterline) dug parallel to the highway crosses the structure.

A surface structure remarkably similar to Structure 2, was found during excavations at the Northgate site in El Paso County (Aten 1972). Dating to the late Mesilla phase, this site is approximately 18 miles to the northeast of LA 110621, on the east side of the Franklin Mountains. Better preserved than Structure 2, the Northgate structure suggests clues to LA 110621's construction and use (Fig. 4).

The rectangular structure at the Northgate site, measuring 4.45-by-4.0 m, is smaller than the example at LA 110621. Both structures have the same orientation to true north (Aten 1972). While both structures burned, the Northgate structure is better preserved than Structure 2 at LA 110621. The floor artifact assemblages also differ, although there are some striking similarities.

The Northgate structure was constructed as a shallow rectangular pit dug into the ground. This was surrounded by a row of upright posts forming vertical walls. These walls may have had coverings of jacal, or at least horizontally woven twigs. The walls supported a flat roof constructed of wood, and possibly covered with dirt or adobe (Aten 1972). Structure 2, at LA 110621, was probably constructed in a similar manner.

Walls: The walls of Structure 2 were probably constructed in a manner similar to those of the Northgate structure, as a series of upright vertical posts. Although no postholes were found associated with Structure 2, their absence is probably another result of scraping associated with highway shoulder maintenance. The Northgate structure is almost 20 cm deeper than this structure, suggesting that a corresponding upper portion of Structure 2 (including postholes) may have been removed. Aten (1972) admits that excavating removed some postholes at the Northgate site. While it is possible that Structure 2 may have resembled a ramada (a roofed shelter with open sides), the large amount of ash and charcoal staining present within the fill suggests that the structure (like the Northgate example) had solid walls.

Floors: One floor is present within Structure 2. There are no features associated with this floor. Floor 1 is an unprepared, slightly charcoal-stained floor of packed sandy silt. The floor is a sloping

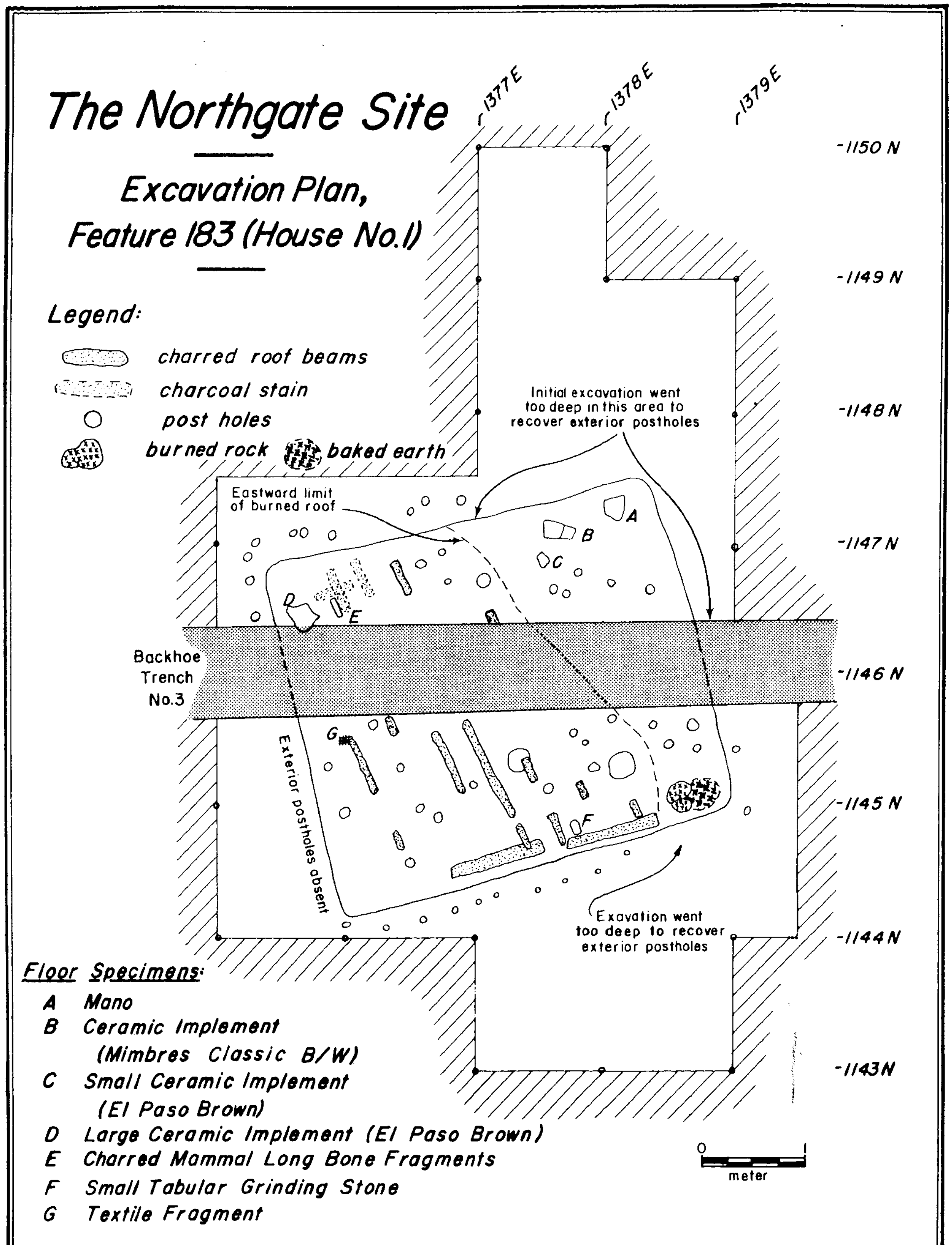

Figure 4. Plan of Feature 183 (House 1) at the Northgate site (from Aten 1972).

depression with a depth of 1.11 m below site datum (BSD). The modern ground surface in the area of Structure 2 ranges from .76 to .91 m below the site datum. The modern ground surface at the site datum is 0 BSD. The edges of the floor depression slope upward to meet the base of the walls. There are no floor features present within Structure 2. A similar floor, also lacking features, was present in the contemporary Northgate structure excavated by Aten (1972) north of El Paso. Floor artifacts are limited to six pieces of ground stone, a small ceramic bowl cached with two large sherds, and a sherd modified into a spindle whorl.

The presence of ground stone artifacts on the Floor 1 surface indicates that food processing (typically women's work; White 1974) took place within Structure 2. The spindle whorl, evidence of spinning, is a further indication that Structure 2 served as a working area for women. All of the recovered artifacts from the floor of Structure 2 show evidence of having been burned. The fire that destroyed Structure 2 burned at a hot enough temperature that one of the metates shattered from the intense heat. Little remained of the actual structure other than charcoal staining and ash.

Artifact Distribution: The artifact assemblage on the floor of Structure 2 is limited in size, numbering six pieces of ground stone and four ceramic artifacts. All of the artifacts on Floor 1 were positioned against the walls of the structure. Two manos and a basin metate were in the northwest corner of Structure 2, two manos and a basin metate were also in the southeastern corner of Structure 2. A small brown ware bowl cached with two large sherds was also part of the southeastern cluster of ground stone artifacts on Floor 1. The only other ceramic artifact, a brown ware sherd modified into a spindle whorl was also adjacent to a ground stone artifact cluster, this one in the northwestern corner of Floor 1.

Construction Sequence and Interpretation: Structure 2 (the surface structure) was probably constructed as a shallow rectangular depression dug into culturally sterile soil. The unprepared floor slopes upward to the base of the walls.

Although the lack of postholes limits our ability to picture the configuration of the walls and roof, the walls of a rectangular structure are likely to be vertical, suggesting that the roof would have been flat. The vertical walls and flat roof of Structure 2 were most likely constructed of jacal, in a similar manner to the Northgate structure (Aten 1972). There is no indication that the walls were covered with adobe or plaster, although it is likely that this was the case.

Structure 2 may have served as a summer work area, sheltered from the sun, but designed to take advantage of any available breeze. The lack of an interior hearth is another indication of seasonal use for Structure 2. As an area for grinding and spinning, this structure probably served as a working area for women. Within Structure 2, maize and gathered wild seed were processed, and other food processing may have also taken place. The spinning of yarn or cordage was another activity that possibly took place in Structure 2, indicated by the spindle whorl.

At some point Structure 2 burned. This may have been an accidental fire, or the result of a raid by hostile neighbors. It is also possible that the structure was purposely destroyed as part of a ritual closure. The presence of site furniture (metates and manos) within the structure at the time of its destruction indicates that the structure was not abandoned prior to being burned. How the burning of both Pit Structure 1 and Structure 2 may relate is not known.

SITE DATING

Dating LA 110621 has proved to be possible, based on the success of radiocarbon (^{14}C) dating. Other dating methods have not proved successful. It has also been possible to determine a relative date for the site within the Mesilla phase based on the ceramic assemblage.

Dendrochronology can give a precise date based on the tree rings from specific species of wood recovered from an archaeological context. Three wood fragments were collected at LA 110621 from the floor of Pit Structure 1 that were large enough to date through the use of dendrochronology. Unfortunately, our attempts at utilizing dendrochronology were unsuccessful. The recovered wood fragments were from tree species (cottonwood and mesquite) that do not lend themselves to this dating technique, making its application impossible.

Archaeomagnetic dating is based on the presence of iron in the soil. Released by heat, these particles line up on magnetic north and remained fixed once they cool down. By measuring the angle present, and comparing it to the route of the wandering north pole, a precise date can technically be obtained for any area of burned earth (such as a hearth). Although both structures at LA 110621 had burned, the sandy nature of the soil and lack of oxidation precluded the use of archaeomagnetic dating. A slight degree of oxidation was present in Structure 2 that exhibited evidence of intense burning, but the sandy nature of the soil made archaeomagnetic sampling impossible.

Radiocarbon dating (^{14}C) involves the dating of carbonized organic material through the measurement of its radiocarbon content. One sample of burned wood recovered from the Floor 1 surface of Pit Structure 1 was subjected to radiocarbon dating by Beta Analytic, Inc. This sample yielded a conventional ^{14}C age date of 1040 ± 50 B.P. This is a calendar calibrated date of A.D. 895-1115, with an intercept date of A.D. 1005. There is a caution with radiocarbon dating involving the "old wood" problem. This is caused by old wood being scavaged and used. Any date resulting from the radiocarbon dating of this material results in a date that is falsely older than it should be. The resulting radiocarbon date was then cross-checked with the relative dates of the ceramics present at the site. The relative ceramic date matches the ^{14}C date quite well, suggesting that there is little effect on our obtained date from the "old wood" problem.

Relative dates for LA 110621 are obtainable through comparison of the LA 110621 ceramic assemblage with those from other Mesilla phase sites. This allows gross age differences to be determined within the Mesilla phase. The ceramic assemblage from LA 110621 dates to the late Mesilla phase between A.D. 850 and A.D. 1100. This date meshes well with our ^{14}C date.

CERAMIC ANALYSIS

C. Dean Wilson

Analytical Methods

This chapter discusses information resulting from the analysis of 621 sherds from a single site (LA 110621) excavated during the Phantom Palms project northwest of El Paso, Texas. Information relating to the 28 sherds recovered during the testing phase of this site are discussed in the Riverside project testing report (Wilson 1997). Examinations of pottery from LA 110621 provided for a continuing opportunity to examine and compare ceramic trends associated with Jornada Mogollon components in this area documented during recent projects by the Museum of New Mexico (Wilson 1996, 1997, 1998) and other studies in this area (Seaman and Mills 1988; Whalen 1994b). In order to compare ceramic data from LA 110621 with that presented in other investigations, attempts were made to record attributes and types similar to those described and used in other studies and type descriptions (Kegly 1980; Mbutu 1997; Runyon and Hedrick 1987; Seaman and Mills 1988; Whalen 1977, 1981, 1994a, 1994b).

Descriptive Attributes

The recording of descriptive attributes reflecting resource use, technology, manufacture, decoration, vessel form, and post-firing modifications of pottery vessels allows for the examination of a variety of patterns. Attributes recorded for all sherds examined include temper, surface manipulation, wall thickness, paste profile, and vessel form. Refired paste color was recorded for a smaller subsample of sherds.

Temper

Temper categories were identified by examining freshly broken sherd surfaces through a binocular microscope. Temper refers to aplastic particles that were either intentionally added or naturally occurred in the clay. Various temper categories were recognized based on distinctive combinations of color, shape, fracture, and sheen of observed particles. A few sherds for which the temper could not be determined were assigned to an indeterminate category.

Most of the pottery from LA 110621 exhibited similar temper consisting of relatively large white angular fragments composed of quartz and feldspar, and seems to represent crushed granite from nearby sources. This temper is described as crushed granite, for which the nearest source to the Santa Teresa area is the Franklin Mountains to the east (Hill 1996). This material is similar to temper described in other studies as crushed leucocratic, but is referred to here as crushed granite because of the proximity and known use of such sources. The presence of relatively large granite temper fragments is one of the main traits used to place brown ware sherds into an El Paso Brown category thought to have been produced in the area in which LA 110621 is located.

Another temper group was distinguished by numerous small, clear to dark fragments, and is referred to here as crystalline igneous rock. Larger grains are sometimes present and are usually roundish and crystalline in structure, and are sugary in appearance. This group may represent the use of aplites found in the Capitan Mountains in the Sierra Blanca region, and thus possibly indicate pottery produced in areas to the northeast.

Still another category represented was characterized by finer and more varied crushed tuff particles, consisting of fine shiny white to gray quartz and tuff particles and reflects the use of weathered volcanic clastic rocks common in the Mogollon Highlands. These inclusions are similar to those noted in self-tempered clays used in the production of Mogollon Brown Ware and Mimbres White Ware types in areas of the Mogollon Highlands in southwest and south-central New Mexico (Hill 1998). During the present study, such inclusions were only noted in sherds exhibiting pastes, surface, and styles commonly noted in Mimbres Mogollon types such as Alma Plain and Mimbres White Wares. This further indicates that the presence of this temper reflects nonlocal pottery produced in the Mogollon Highlands.

Paste Profile

The color or color combinations of a sherd cross section reflects both clay iron content and the conditions in which a vessel was fired. Reddish or buff profiles indicate final oxidation atmospheres. Black or dark gray profiles result from final reduction atmospheres. Color categories recorded for sherd cross sections included gray to dark gray cross section; brown or reddish throughout; red or brown on outside, gray on the inside; red and gray streaks; white to light gray; and white and red streaks.

Surface Manipulation

Surface manipulations were recorded for both interior and exterior sherd surfaces. Attributes employed refer to the presence and type of surface texture, compaction, and slip. Plain unpolished implies surfaces where coil junctures had been completely smoothed, and are fairly rough indicating they were not polished. Smoothed and slightly polished refers to intermediate treatments that are either highly smoothed or lightly polished. Plain heavily polished indicate surfaces that are polished more highly. Polishing implies intentional smoothing with a polishing stone to produce a compact and lustrous surface. Surfaces over which a high iron slip clay was applied and then polished were assigned to a polished red slipped category. Those over which a low iron slip was applied over a polished surface, as is represented in many white wares, were assigned to a polished white slipped category. Unpolished striated refers to the presence of a series of long, shallow, parallel grooves on a unpolished surface probably resulting from brushing with a fibrous tool. Indeterminate indicates examples with missing or undefinable surfaces.

Wall Thickness

Since changes in wall thickness of Jornada Brown Ware pottery has been documented (Whalen 1994b), sherd thickness was recorded to the tenth of a millimeter. This measurement was made at an area of the sherd that appeared to be fairly typical of the overall thickness of that sherd.

Vessel Form

Vessel form categories were assigned based on observed shapes of rims or the presence and location of polishing and painted decorations. While it is often possible to identify the basic form (bowl versus jar) of body sherds from many Southwestern regions by the location of polishing and painted decorations, such distinctions may not be as easy for Jornada Brown Ware types. In contrast to many Southwest pottery traditions, Jornada Brown Ware bowl and jar sherds are often polished or smoothed on either side. Such observations result in a reluctance here to assign brown ware sherds to specific vessel form categories. While the location of surface polishing may convey relevant information, caution must be employed in the resulting interpretations. Therefore, body sherds were not assigned to specific vessel form categories, but were placed in a series of categories reflecting the presence and location of surface polishing. Categories recorded for body sherds include indeterminate (one or both sides missing), unpolished, polished both sides, interior side polished (bowl), exterior side polished (jar). The only nonrim sherds assigned to more distinct form categories reflect jar neck sherds as identified by the presence of distinct curves. Bowl rim refers to sherds exhibiting inward rim curvature indicative of bowls. Cooking-storage jar rim refers to items exhibiting rims with distinct shapes associated with necked jars with relatively wide rim diameters that could have been used for cooking or storage.

Modification and Wear

Evidence of post-firing modification and wear of sherds was limited to a single sherd with drilled holes. This is a circular shaped item, with a drilled hole in the center, and four regularly spaced drilled holes between the center hole and the edge of the disk (see Fig. 8).

Refired Paste Color

Clips from a number of sherds were also fired in controlled oxidation conditions at a temperature of 950 degrees C in order to standardize ceramic pastes. This provides for a common comparison of pastes based on the influence of mineral impurities (particularly iron) on paste color, and may be used to identify sherds that could have originated from the source. The color of each sample was recorded using a Munsell Soil Color Chart.

Type Categories

Ceramic types represent convenient groupings incorporating information about spatially and temporally important trait combinations. Ceramic items are assigned to typological categories based on a series of observations. First, an item is placed into a spatially distinct ceramic tradition based on temper, paste, and technological traits. Next, it is assigned to a particular ware group based on technological and surface attributes. Finally, a sherd is placed into a type category based on temporally sensitive surface textures or design styles.

Most of the sherds analyzed during the present project displayed characteristics indicative of types commonly found in the southern Jornada Mogollon area. A total of 568 (91.4 percent) of the sherds from LA 110621 represent sherds that would be classified by most archaeologists as El Paso Brown. The majority of the pottery from sites dating from A.D. 200 to A.D. 1200 along the Rio Grande Valley near the Texas-New Mexico border and the Tularosa Basin represent El Paso Brown Ware types. These ceramics appear to differ from other Jornada Brown Ware pottery types mainly by the presence of a coarse angular temper of local origin, although a lesser polish is sometimes assumed (Anyon 1985; Hard 1983; Jennings 1940; Lehmer 1948; Runyon and Hedrick 1987; Whalen 1994b). It is often difficult to distinguish El Paso Brown Ware sherds from other Jornada Brown Ware types without careful characterization of the associated temper. Thus, the various El Paso Brown Ware types are best considered a regional variant of Jornada Brown Ware (Whalen 1994b).

Most brown ware sherds from sites in the El Paso area exhibit plain surfaces that may be rough to polished. Most El Paso Brown Ware sherds are smoothed, although occasional sherds exhibiting El Paso pastes and temper exhibit coiled or corrugated textures (Jelinek 1967; Jennings 1940; Lehmer 1948). Surface colors range from gray, brown, to red, and cross sections range from brown to black, with various combinations of exterior and core colors.

During the present study, El Paso Brown Ware sherds were further divided into types based on the presence of painted decoration or surface texture. El Paso Brown rim, as defined here, is identical to ceramics previously classified as El Paso Plain Brown (Mills 1988). This type refers to smoothed and unpainted El Paso Brown Ware rim sherds. Unpainted rim sherds are assigned to a different type than body sherds because temporally diagnostic El Paso Polychrome vessels are often undecorated in the lower portion of the vessel only. El Paso Brown body is similar to the category defined by others as unspecified El Paso Brown (Anyon 1985; Hard 1983; Mills 1988). This category includes sherds where attributes, such as paint and rim, most commonly used to distinguish El Paso Brown from El Paso Polychrome vessels were absent. A total of 25 (4 percent) of the sherds from LA 110621 exhibit temper and paste identical to El Paso Brown and also exhibited extremely thin vessel walls (less than 4 mm). Very thin vessel wall is often cited as a characteristics of El Paso Polychrome, although no painted El Paso Polychrome sherds were recovered. The small number of unusually thin vessels were assigned to a distinct thin brown ware category. While such sherds could be potentially derived from El Paso Polychrome similar sherds have also been noted at assemblages that clearly predate the production of this type, so that given the lack of other evidence of an El Paso phase occupations, it is more likely that the few very thin brown ware sherds identified during the present study simply represent a variant of El Paso Brown.

Red Ware

A total of two sherds (.3 percent), with pastes and temper typical of those noted for El Paso Brown, also had dark red slips over polished interiors. These were assigned to a slipped red category, and probably represent a variation of the El Paso Brown ceramic technology.

Mimbres Mogollon Types

A small but significant number of sherds identified during the present study exhibited characteristics resulting in their assignment to types common at sites in the Mogollon area to the Southwest. These types have a fine volcanic temper characteristic of the self-tempered sources in the Mogollon Highlands. Brown wares exhibiting fine volcanic paste also tend to be somewhat lighter in color than El Paso Brown sherds, and exhibited surface polish. Brown ware sherds exhibiting this combination of characteristics were assigned to Alma Plain, a Mogollon Brown Ware type (Haury 1936). Sherds classified as Alma Plain mostly likely originated in similar areas of the Mimbres as did the Mimbres Boldface sherds also identified during the present study.

Most of the sherds assigned to Mimbres Mogollon types during the present study had the distinct combination of traits noted in Mimbres White Ware types. Mimbres White Ware types refer to the white slipped and painted pottery known to have been produced in the southern Mogollon area. Painted decorations are executed in iron-based mineral pigments applied over a white slipped surface and usually polished over. Surfaces are usually moderately to lightly polished, but not as lustrous as contemporaneous white ware types from other regions. Slip tends to be soft and easily weathered, resulting in the common obliteration of painted or slipped surfaces. Painted decorations are executed in a mineral pigment that are usually polished over. Mimbres White Wares are assigned to temporally distinct types based on design styles. Sherds exhibiting distinct paste and slip characteristic of Mimbres White Ware vessels but without painted decorations were classified as unpainted Mimbres White, while those exhibiting indistinct painted decorations were classified as indeterminate painted Mimbres White.

All sherds examined during the present study that could be assigned to a distinct Mimbres White Ware type were classified as Mimbres Boldface or Mangus Black-on-white (Fig. 5). This type is very widespread and while it is best known in the Mimbres areas of the Mogollon (Brody 1977; Haury 1936; LeBlanc 1982, 1983; Lekson 1990; Woosley and McIntyre 1996), it is the dominant white ware type for the time period at sites in the northern Mogollon area (Martin and Rinaldo 1950; Wilson 1998). Some recent studies have also placed ceramics that here would be placed into Boldface

Black-on-white into a Mimbres Style I or Early Style II category (Schaefer and Brewington 1995) or Phase I (LeBlanc 1983).

While the majority of Boldface Black-on-white examples are decorated in black paint, a significant frequency of examples of this type are decorated with brown to red paint. Pastes tend to be brown to gray in color. Slips are white to pink and are often soft and chalky. Slipped surfaces are usually very smoothed and have a relatively high polish. The exterior of bowls and interior of jars are usually unslipped, but show a slight polish. Unslipped surfaces are usually gray to brown in color. The majority of sherds assigned to this type are derived from bowl sherds, although jar forms are also present. The great majority of the bowl sherds are polished on the interior and exterior surfaces. Rims are usually rounded to tapered and solidly painted.

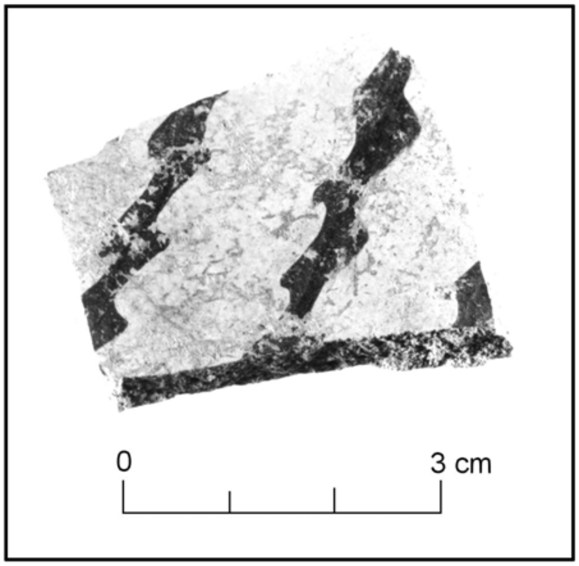

Figure 5. An example of Mimbres Boldface Black-on-white.

Designs are executed in bold designs covering much of the decorative surface. Motifs include straight and wavy lines, triangles, curvilinear scrolls, occasional life forms, and ribbons with wavy hatchure. While design styles are similar to those noted on earlier Mogollon painted types, definite changes in the organization of these designs took place over time (Brody 1977). Designs are often arranged into quartered or banded patterns where different elements were combined together to form larger motifs. These often included a mixture of hatchured and solid designs. These sections were often separated from similar pattern combinations by a series of thin precisely executed lines. Sectional designs common in early forms were sometimes recombined to form large central motifs. Overall design layouts present include designs that are divided into quadrants, circular layouts, and the extension of unbroken fields across the surface (Brody 1977). Lines tend to be finer and better executed than early forms but not as much so as in Mimbres Classic Black-on-white. Similar elements and layouts appear to have been executed in pottery associated with different pastes and surface treatments associated with contemporaneous pottery produced in other Southwestern regions. For example, painted styles described for Mangus Black-on-white are similar to those noted in Santa Cruz Red-on-buff and Gila Butte Red-on-buff in the Hohokam region and Red Mesa Black-on-white in the Anasazi region.

Ceramic Patterns

The small number of sherds recovered from LA 110621 provide information of the dating of these sites and associated ceramic trends. In the following discussions, data regarding the distributions of various ceramic types and ware groups (Tables 1 and 2) and attribute categories (Tables 3-7) are first used to determine the potential time of occupation of various sites and components. Next, various distributions are used to examine issues including patterns of vessel production, exchange, and use.

Table 1. Distribution of Ceramic Types

Type	Number	Percent
El Paso Body	558	89.8
El Paso Rim	10	1.6
Thin Brown "El Paso" Polychrome	25	4.0
Jornada Brown Body	1	0.2
Slipped red	2	0.3
Alma Plain body	5	0.8
Unpainted Mimbres White Ware	2	0.3
Mimbres Bold Face Black-on-white	9	1.4
Mimbres indeterminate black-on-white	9	1.4
Total	621	100.0

Table 2. Temper Distributions for Ceramic Groups

Ware Group	Indeterminate		Crushed Granite		Crystalline Igneous		Tuff		Total	
	#	%	#	%	#	%	#	%	#	%
Jornada Brown Ware	3	100.0	587	98.8	1	33.3	3	11.1	594	95.7
Slipped red ware					2	66.7			2	0.3
Alma Plain							5	18.5	5	0.8
Mimbres White Ware			1	0.2			19	70.4	20	3.2
Total	3	100.0	588	100.0	3	100.0	27	100.0	621	100.0

Table 3. Paste Color Distributions for Ceramic Groups

Ware Group	Gray to Dark Gray Cross-Section		Brown or Reddish Throughout		Red or Brown on Exterior; Gray on the Interior		Red and Gray Streaks	
	#	%	#	%	#	%	#	%
Jornada Brown Ware	426	95.3	25	96.2	107	99.1	35	94.6
Slipped red ware	2	0.4						
Alma Plain	4	0.9					1	2.7
Mimbres White Ware	15	3.4	1	3.8	1	0.9	1	2.7
Total	447	100.0	26	100.0	108	100.0	37	100.0

Table 3. Continued

Ware Group	White to Light Gray		White and Red Streaks		Total	
	#	%	#	%	#	#
Jornada Brown Ware	1	50.0			594	95.7
Slipped Red Ware					2	0.3
Alma Plain					5	0.8
Mimbres White Ware	1	50.0	1	100.0	20	3.2
Total	2	100.0	1	100.0	621	100.0

Table 4. Interior Manipulation by Ceramic Groups

Ware Group	Plain Unpolished		Plain Slightly Polished		Plain Heavily Polished		Polished With White Slip	
	#	%	#	%	#	%	#	%
Jornada Brown Ware	528	99.4	32	94.2	7	77.8		
Slipped Red Ware			1	2.9				
Alma Plain	2	0.4	1	2.9	2	22.2		
Mimbres White Ware	1	0.2					19	100.0
Total	531	100.0	34	100.0	9	100.0	19	100.0

Table 4. Continued

Ware Group	Plain with Red Slip		Total	
	#	%	#	%
Jornada Brown Ware			572	92.1
Slipped red ware	2	100.0	24	3.9
Alma Plain			5	0.8
Mimbres White Ware			20	3.2
Total	2	100.0	621	100.0

Table 5. Exterior Manipulation by Ceramic Groups

Ware Group	Plain Unpolished		Plain Slightly Polished		Plain Heavily Polished		Unpolished Striated	
	#	%	#	%	#	%	#	%
Jornada Brown Ware	552	96.3	32	91.4	8	88.9	2	100.0
Slipped red ware	1	0.2						
Alma Plain	1	0.2	3	8.6	1	11.1		
Mimbres White Ware	19	3.3						
Total	573	100.0	35	100.0	9	100.0	2	100.0

Table 5. Continued

Ware Group	Indeterminate		Polished with White Slip		Total	
	#	%	#	%	#	%
Jornada Brown Ware					594	95.7
Slipped Red Ware	1	100.0			2	0.3
Alma Plain					5	0.8
Mimbres White Ware			1	100.0	20	3.2
Total	1	100.0	1	100.0	621	100.0

Table 6. Vessel Form by Ceramic Groups

Ware Group	Indeterminate Body Both Sides Polished		Bowl Rim		Bowl Body		Indeterminate Body, Both Sides Unpolished	
	#	%	#	%	#	%	#	%
Jornada Brown Ware	25	89.3	13	65.0	12	41.4	501	99.8
Slipped red ware								
Alma Plain	3	10.7					1	0.2
Mimbres White Ware			3	3.5	17	58.6		
Total	28	100.0	20	100.0	29	100.0	504	100.0

Table 7. Vessel Form by Ceramic Groups

Ware Group	Constricted Jar		Cooking-Storage Jar Rim		Cooking-Storage Jar Neck		Exterior Surface Polished		Indeterm-inate		Total	
	#	%	#	%	#	%	#	%	#	%	#	%
Jornada Brown Ware	4	100.0	4	80.0	14	100.0	17	94.5			594	96.6
Slipped red ware			1	20.0					1	100.0	2	0.3
Alma Plain							1	5.5			5	0.8
Mimbres White Ware											20	3.2
Total	4	100.0	5	100.0	14	100.0	18	100.0	1	100.0	621	100.0

Table 8. Sherd Thickness by Type

Ceramic Type	Mean	#	Std Deviation
El Paso Polychrome	5.8	557	1.071
El Paso rim	5.8	10	0.694
Thin brown	3.9	25	0.628
Jornada Brown body	6.7	1	0.000
Slipped red	7.0	2	0.990
Alma Plain body	5.5	5	0.747
Unpainted Mimbres White Ware	4.8	2	2.404
Mimbres Bold Face Black-on-white	5.8	9	0.806
Mimbres Indeterminate Black-on-white	5.6	9	0.459
Total	5.7	620	1.117

Analytical Results

Dating LA 110621

The assignment of specific dating spans to sites in the southern Jornada Mogollon country can be very difficult. Problems encountered in assigning ceramic-based dates to assemblages from this site in this region reflect both the very conservative nature of pottery technology in the Jornada Mogollon region as well as the scarcity of independently dated sites. The conservative character of Jornada Mogollon ceramic technology is reflected by the very long-lived dominance of brown ware ceramics exhibiting very similar ranges of paste, temper, and surface manipulation. Such similarities have resulted in the placement of most sherds from sites in this area into El Paso Brown Ware and related types.

Tables 1 and 2 illustrate distributions of types and ware groups that may provide clues concerning the time of occupation of LA 110621. Ceramic dating studies in the Jornada Mogollon region have relied on a variety of data including the cross-dating of intrusive types from better dated sites in other regions (such as the Mimbres Mogollon), the documentation of the shift to El Paso Polychrome in the later spans of the ceramic sequence, and the examination of potential changes and trends in surface treatment and rim shape of local brown ware sherds (Lehmer 1948; Whalen 1978). Given the small number of sherds usually recovered from sites in this region, attempts to date small assemblages using relatively rare types can easily result in sampling error and skewed dating results.

The ceramic occupation of the southern Jornada Mogollon area has long been divided into a three-phase chronology (Lehmer 1948), which includes the Mesilla (A.D. 1 to 1100), Doña Ana (A.D. 1100 to 1200) and El Paso (A.D. 1200 to 1400) phases. The earliest ceramic period (the Mesilla phase) is almost exclusively represented by pithouse occupations and is identified ceramically by the introduction of plain brown ware ceramics in this region at about A.D. 0 to 500 and ends about A.D. 1100 with the production of El Paso Polychrome (Lehmer 1948; Whalen 1994a). Pottery tends to be relatively rare at components dating to earlier spans of the Mesilla phase. Sites dating to this phase are overwhelming dominated by undecorated pottery that would be classified here as El Paso rim or El Paso body. Distinct intrusives are often lacking at Mesilla phase sites, even when relatively large assemblages are represented. Intrusive types that are sometime present in components dating to this phase include Mimbres Boldface, Mimbres Classic Black-on-white, Mimbres Corrugated, San Francisco Red, Alma Plain, Reserve Smudge, and Reserve Corrugated (Lehmer 1948). The occurrence of Mimbres White Wares in many Mesilla phase assemblages at sites dominated by El Paso Brown may allow for the further placement of Mesilla phase sites into more distinct temporal spans. Intrusive types clearly dating to the early part of the Mogollon phase such as Mogollon Red-on-brown and Three Circle Red-on-white are extremely rare to absent at sites in the southern Jornada Mogollon country (Mera 1943). Very large assemblages without Mimbres White Wares and other decorated types may mark the earliest span of the Mesilla phase from about A.D. 200 to 850 (Batcho et al. 1985; O'Laughlin 1977; Miller and Stuart 1991; Stuart 1990; Whalen 1980a, 1981, 1994b). Those containing Mimbres Boldface and contemporaneous types may be assumed to date between A.D. 850 and 1000, and those displaying Mimbres Classic most likely date between A.D. 1000 and 1150.

Some studies have also attempted to document certain technological changes associated within the long-lived production of El Paso Brown vessels by either lumping these sherds into a series of finer defined subtypes distinguished by combinations of paste and surface characteristics (Carmichael 1985), or through the independent recording and monitoring of potentially sensitive attributes for El Paso Brown Ware types (Whalen 1981, 1994b). Such examinations indicate gradual changes in Jornada Brown Ware pottery that may include a decrease in temper size, and an increase in fineness of surface finish and surface hardness through time (Whalen 1994a).

Plain ware vessels appear to have been gradually replaced by painted vessels during the Doña Ana phase (Whalen 1977). The Doña Ana phase is thought to date to between A.D. 1100 and A.D. 1200, and is often characterized by a mixture of ceramic types or attributes defined for the Mesilla and El Paso phases (Lehmer 1940). Such a definition results in difficulties in distinguishing Doña Ana phase sites from those containing a mixture of ceramics derived from earlier and later phases. Intrusive types that may be present during the Doña Ana phase include Mimbres Classic Black-on-white, San Francisco Red, Alma Plain, Mimbres Corrugated, Chupadero Black-on-white, Three Rivers Red-on-terracotta, and St. Johns Polychrome. El Paso Polychrome is present at Doña Ana phase sites, but retains a number of El Paso Brown traits including evenly shaped rim profiles (Whalen 1981).

It is sometimes assumed that a shift to the dominance of El Paso Polychrome vessels occurred by the beginning of the El Paso phase. It is likely, however, that the production of some unpainted

El Paso Brown vessels continued into the early El Paso phase (Seaman and Mills 1988). Thus, one can not automatically assume that an assemblage with both El Paso Polychrome and El Paso Brown rim sherds definitely dates before the El Paso phase. The frequency of unpainted El Paso Brown sherds, however, is significantly lower in El Paso phase components than in those associated with the preceding period. Unfortunately, the total frequency of El Paso Polychrome at a given site may vary significantly depending on conventions in type assignment. Obviously, conventions where unpainted sherds are assigned to El Paso Polychrome result in the identification of much higher frequencies of this type. El Paso Polychrome associated with later occupations is characterized by consistently averted rims of varying wall thickness (Whalen 1981). A low frequency of textured brown wares may also be present at El Paso phase components. A very large number of intrusive types may occur at El Paso phase sites. Other Jornada types include Chupadero Black-on white, Lincoln Black-on-red, and Three Rivers Red-on-terracotta. Western Pueblo types include Heshotauthla Polychrome and St. Johns Polychrome. Salado types include Gila Polychrome and Tucson Polychrome. Rio Grande types may include Galisteo Black-on-white and various Rio Grande Glaze Ware types. Mexican types include Playas Red, Ramos Black, Ramos Polychrome, Playas Red, Casas Grandes Incised, Carretas Polychrome, Villa Ahumada Polychrome, Madera Black-on-red, and Babicora Polychrome.

The dominance of sherds clearly derived from El Paso Brown vessels at LA 110621 indicates an occupation dating to the Mesilla phase, although the presence of intrusive Mimbres types provides further clues concerning the time of occupation at this site. Distribution of attributes recorded during the analysis of the 593 unpainted El Paso Brown Ware identified at this site may be compared with those described for other sites in this area assigned to various phases. Rim profiles are tapered or angled, and walls tend to be even in thickness beginning close to the rim (Whalen 1981, 1993). These profiles are similar to the range of variation noted in relatively early formative assemblages.

Another comparison involved the recording of average wall thickness. The average vessel thickness of the El Paso Brown Ware sherds from LA 110621 was 5.8 mm (see Table 8). This is very similar to that noted in other examinations of ceramics from Mesilla phase sites (Whalen 1994a; Wilson 1997).

Surface finish of El Paso Brown sherds from later assemblages tends to be finer or more smoothed or polished than those associated with earlier phases (Whalen 1994b). Both interior and exterior surfaces of most El Paso Brown sherds examined were smoothed but unpolished, and support an association with the Mesilla phase.

The strongest evidence of the specific time of occupation of this site is the presence of sherds from a number of Mimbres White Ware vessels. All the white ware sherds exhibiting enough of a painted design so that they could be assigned a specific type were Mimbres Boldface (see Fig. 5). A quick review of the literature indicates the presence of a number of Mesilla phase sites containing Mimbres White Wares, although most of these are described as dominated by Mimbres Classic Black-on-white (Anyon 1985; Brethauer 1978; Hard 1983; Kegly 1980; O'Laughlin 1977). Boldface Black-on-white represents the earliest Mogollon type consistently decorated with black paint and appears to have been produced sometime between A.D. 750 and A.D. 1050. This type is most common at sites dating to the Three Circle phase spanning from A.D. 900 to 1000 (Berman 1979; Martin and Rinaldo 1950; Wilson 1998). Thus, based on the presence of sherds derived from several Mimbres Boldface vessels, and the absence of other decorated types, a possible date anywhere from A.D. 750 to 1000, and a most likely date in the tenth century is postulated. This would place the time of occupation of this site well within the Mesilla phase during a time contemporary with the Late Pithouse occupations of the Mimbres Mogollon. Except for the presence of sherds derived from an intrusive Mimbres Boldface vessel, the pottery is extremely typical of that occurring throughout the

Mesilla phase.

Pottery Production and Exchange

As previously indicated, the pottery identified during the present study represents a mixed assemblage of local Jornada Brown Ware types (El Paso Brown) that were most likely produced at LA 110621 or nearby as well as a much smaller number of types probably produced in the Mimbres region to the west. Characteristics of brown ware types provide clues concerning the nature of local pottery production while the occurrence of nonlocal types documents exchange with other regions.

Characteristics of pastes and temper noted in El Paso Brown Ware types from all contexts indicate the use of clay and temper resources as well as ceramic technology was similar to that represented at other contemporaneous sites in this region. Previous investigations of this area by OAS during the Santa Teresa project (Moore 1996) resulted in the collection of four clay samples from the lower El Paso Valley near Ysleta, Texas (Hill 1996). Characteristics of this material indicated that these clays were not employed in the production of El Paso Brown from the Santa Teresa site (Hill 1996). In an attempt to find clays that may have been utilized in the Phantom Palms project area, samples of clays were collected from the general project area. Of the samples collected, five exhibited sufficient working qualities to have been possible ceramic clays (see Appendix 1). Quality clay sources were extremely abundant, and all clays located represented alluvial or soil deposits probably ultimately associated with the Rio Grande flood plain. These clays tend to be tan to brown, and fired to reddish colors. Clays tended to be fine without large aplastic material. In the immediate area, sources for granite temper tended to be rare, although outcrops are available in the Franklin Mountains, related formations, and associated gravel deposits. Still, the absence of igneous temper sources may have been more of a factor influencing or limiting pottery production than clays which are more ubiquitous in the area LA 110621 is located.

All of the subsample of El Paso Brown sherds subjected to refiring analysis fired to similar red (2.5YR in hue), and may indicate the use of similar clay sources. It is most likely clays from alluvial sources along the Rio Grande or associated drainages were employed. The temper in all brown ware sherds consist of similar looking angular fragments, and indicates the use of similar sources. A crushed granite probably derived from the Franklin Mountains also appears to be represented (Hill 1996).

El Paso Brown Ware sherds examined are relatively soft. Many of the sherds appear to fairly well vitrified. Most sherds exhibited brown surfaces, although red and gray-brown surfaces were also noted. Cross sections of most sherds were grayish, or gray with a reddish core (see Table 3). Given the use of high iron clays, these cross sections indicate that most vessels were initially exposed to a reducing atmosphere, but oxidized during the later part of the firing. Thus, the brown color of the El Paso sherds is more of a reflection of the high iron content of the clays employed than a oxidation atmosphere.

Only one sherd assigned to Jornada Brown appears to have derived from a vessel produced elsewhere in the Jornada Mogollon, possibly the mountainous areas to the northeast. Pastes and temper characteristics of sherds classified as Alma Plain and Mimbres White Ware types indicate they derived from vessels produced in the Mogollon area, most likely the Mimbres region. Other studies of the Mimbres White Wares from southern Jornada Mogollon sites also indicated they originated from sites in Mimbres region (Abbott et al. 1996). Occurrences of Mimbres White Ware types at southern Jornada Mogollon sites are relatively common, and indicate exchange and interaction between these areas. The presence of five Alma Plain sherds at LA 110621 indicates similar movement of Mogollon Brown Ware vessels produced in the Mogollon Highlands into the southern Mogollon country.

It is likely that the well-made black-on-white vessels produced in the Mimbres region during the tenth century would have been desirable to Jornada Mogollon groups who only produced plain utility ware vessels. White wares produced in the Mimbres country reflect the use of local self-tempered alluvial clays. Although the use of the same type of resources was used in brown utility wares produced in the Mimbres clays, different sources were exploited in the production of vessels associated with different ware groups. This is reflected by the tendency toward slightly lower iron content and distinct tuff inclusions in Mimbres Black-on-white pottery (Wilson 1998). Paste characteristics also indicate that the area of regional production of Mimbres White Wares may have been more limited than that represented by brown utility ware types (Hill 1996).

The exchange of Mimbres Boldface vessels into the southern Mogollon country may have been a part of a larger pan-regional phenomenon. Mimbres Boldface was also the dominant black-on-white pottery occurring at tenth-century Three Circle phase sites in the northern Mogollon (Martin and Rinaldo 1950; Wilson 1998). Examinations of Boldface Mimbres Black-on-white pottery from sites in the northern Mogollon Highlands investigated during the Luna Project indicate that this pottery most likely originated in the Mimbres region (Wilson 1998). Thus, it appears that Mimbres Black-on-white vessels produced in the Mimbres region were widely exchanged into areas to both the north and south. The movement of vessels from the Mimbres into the southern Jornada Mogollon was largely, but not exclusively, limited to white ware vessels. Such influences appear to have had no effect on local utility ware production, as neckbanded, coiled, and smudged textures common in Three Circle phase occupations appear to be absent in contemporaneous Mesilla phase sites. The actual extent of exchange of Mimbres White Wares during this time is difficult to determine because information concerning occupation during the end of the Late Pithouse period and evidence of the movement of vessels from the Mimbres area are both dependent on the presence of Mimbres Boldface. Thus, contemporaneous sites into which Mimbres White Wares were not traded would be lumped into a larger Mesilla phase period, unless indicated by other dating evidence.

Pottery Function and Use

Distributions of various attributes and categories may also provide insights about various functional trends. In many areas of the Southwest, combinations of sherd shape and the location of polishing or painted decorations help indicate associated vessel forms (Wilson 1995). For example, in some Southwestern ceramic traditions sherds derived from jar body sherds can be identified by the absence of polishing on either surface or their presence on the exterior surface only. Bowls are recognized by decoration or polishing on the interior. Unfortunately, such distinctions do not appear to be as useful in Jornada Mogollon Brown Ware assemblages. An examination of the El Paso Brown rim sherds from various sites in the El Paso area indicates that there is often no association between vessel shape and the presence or location of polishing. Therefore, few attempts were made to recognize various vessel forms based on the presence or location of polish during the present study, although information concerning the presence and location of polish is reflected in both surface manipulations and vessel form categories used. Such distributions are illustrated in Tables 4, 5, and 6. For brown ware utility ware sherds, attempts to recognize specific vessel forms were generally limited to rim and jar neck sherds exhibiting shapes characteristic of a particular form. The vessel form represented by white ware body sherds were much easier to determine. Those exhibiting exterior polish or painted decorations were assigned to a jar sherd category, while those with interior polish or painted decorations were assumed to have derived from bowls.

Distributions of ceramic ware groups also provide information concerning vessel use. Very different ranges of vessel forms are often reflected in different ware groups. In addition, pottery exhibiting similar shapes, but belonging to different pottery ware groups, may have been used in very different activities. Some of the main differences between ceramics assigned to different ware groups relate to hardness, durability, and porosity, and would have certainly influenced their function and uses. Therefore, distributions of various vessel form attributes are described separately for sherds belonging to each of the three ceramic groups identified.

A total of 599 sherds (96.5 percent) of the sherds from LA 110621 represent brown utility ware types. Only 2 sherds (.3 percent) represent slipped red wares, and 20 (3.2 percent) represent slipped white wares. The majority (92.1 percent) of the brown ware sherds were body sherds for which the overall form could not be determined. Most of the rim sherds appear to represent bowls or partly constricted jars, although rim sherds from cooking-storage jars were also identified. All of the red ware and most of the white ware sherds examined were derived from bowls.

Thus, the majority of sherds from this site appear to be derived from bowls, with a significant but lower proportion of the total sherds derived from necked or constricted jars. Frequencies of vessel forms vary significantly for sites in this region as some are dominated by bowl forms and others by jar forms (Anyon 1985; Scarborough 1992; Seaman and Mills 1988; Michalik and Batcho 1988; Whalen 1994a). Some trends toward increasing frequencies through time of rim sherds from necked jars during the Mesilla phase has been noted. It has been suggested that increasing frequencies of necked jars may indicate increased activities where vessels were used for cooking or boiling (Abbott et al. 1996).

Distributions of partial vessels, sherd associations, and a modified sherd from the floor of Structure 2 also provide clues concerning activities associated with ceramic vessels. A number of sherds could be reconstructed into a half complete El Paso Brown vessel (Fig. 6). It represented a small constricted jar about 5 cm in diameter and 4 cm high. Overall shape was fairly crude and both interior and exterior surfaces were rough and unpolished. Paste cross section and interior and exterior surfaces were dark gray, and exterior surface exhibited fire clouds. No evidence of surface wear was observed. In addition, a number of sherds formed part of a El Paso Brown vessel (Fig. 7). Both interior and exterior surfaces were rough and unpolished. Paste cross section and interior and exterior surfaces were dark gray. Not enough of the vessel is represented to determine the overall form, given the curvature, it is likely these sherds are derived from a large jar. Other studies indicate the occurrence of large sherds from use surfaces, and indicate that large sherds or partial vessels may have been utilized for various functions (Braun 1983; Blinman 1988). An unusual, modified ceramic item was also recovered from this structure (Fig. 8). This item was fashioned from an El Paso Brown sherd with a polished exterior. It is circularly shaped with a large drilled hole in the middle and four regularly spaced drilled holes on the edges. It is 3.1 to 3.2 cm across, and appears to represent a spindle whorl. Pottery from the floor of Structure 2 may reflect a variety of activities in which vessels or sherds were used.

Despite some variation in vessel form at Mesilla phase sites, ceramic forms appear to have been remarkably consistent for almost a thousand years. The apparent lack of any significant change in surface forms over many centuries may also have important functional implications. El Paso Brown Ware ceramic assemblages exhibit characteristics similar to the earliest pottery produced in the Mogollon, Hohokam, and Anasazi regions. Like El Paso Brown Wares, ceramics associated with the

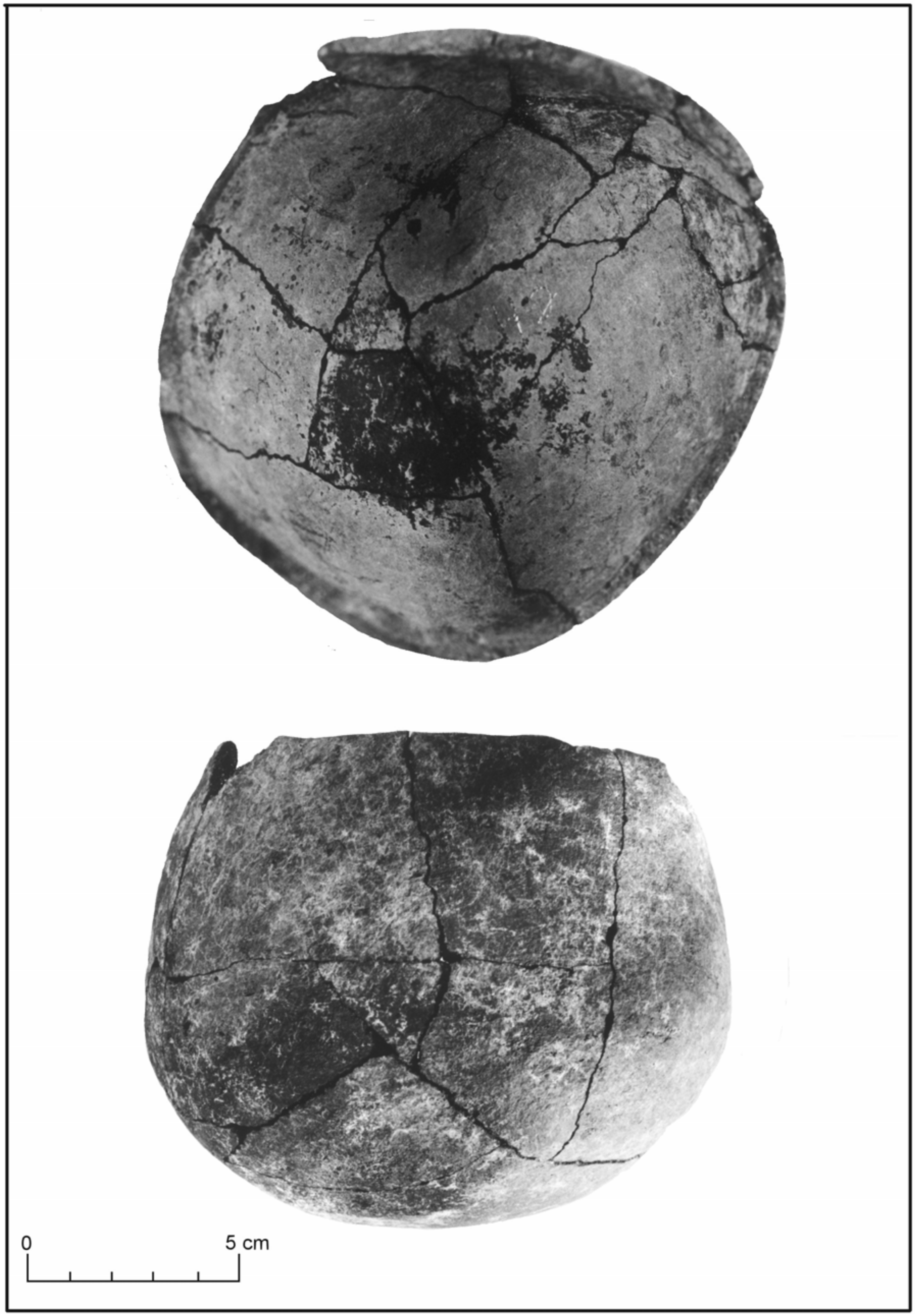

Figure 6. Partial El Paso Brown vessel from the floor of Structure 2.

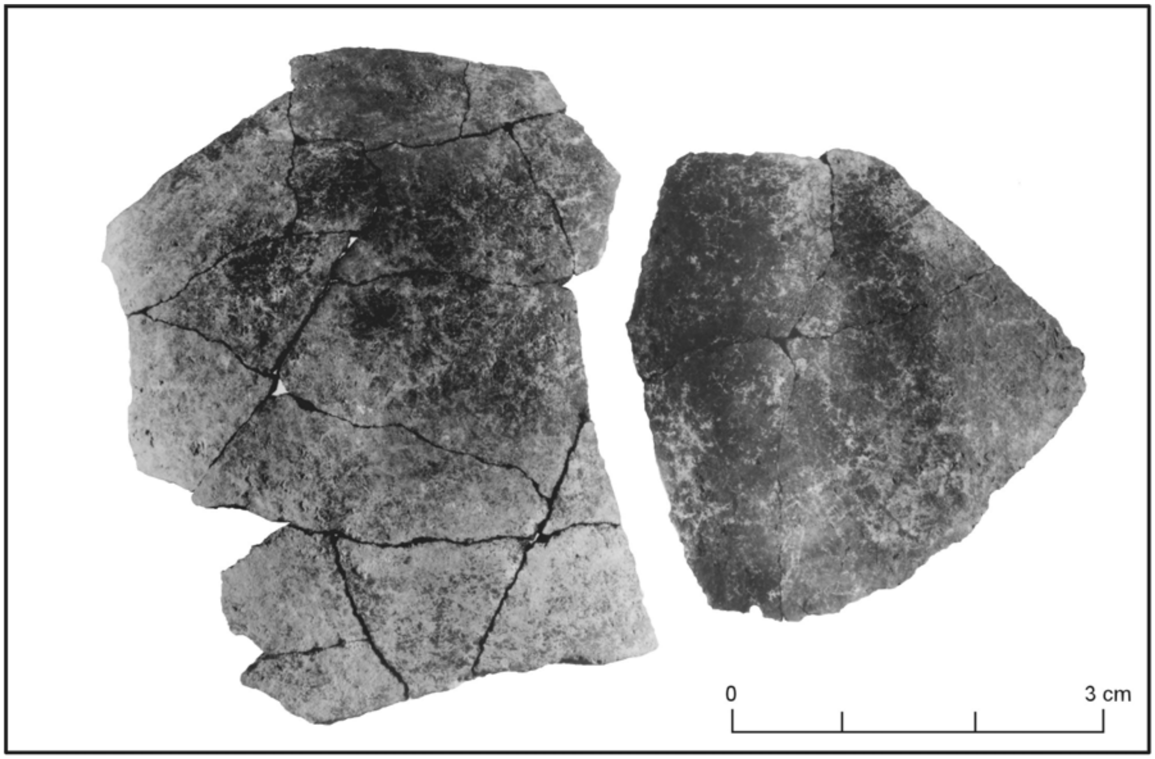

Figure 7. Second partial El Paso Brown vessel from the floor of Structure 2.

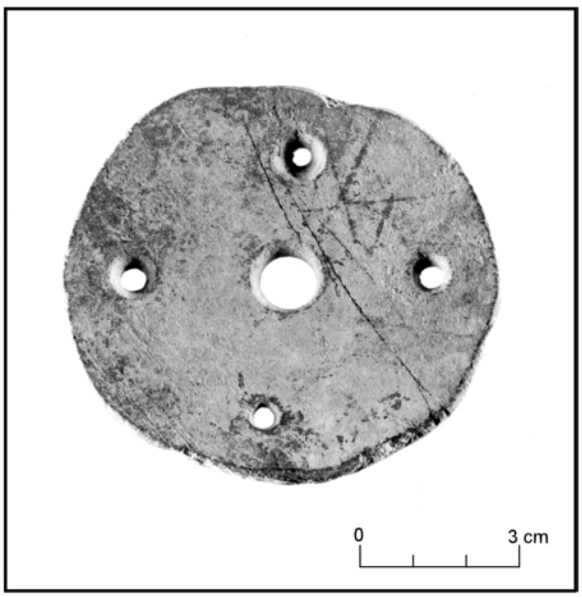

Figure 8. Sherd modified into a spindle whorl from the floor of Structure 2.

earliest Southwest occupations tend to be relatively rare, and the earliest pottery from these regions represent an undecorated polished brown ware produced with high-iron alluvial clays and often exhibiting a dark paste (Wilson 1994, 1995). A wide and varying range of forms are associated with these early brown wares including bowls, seed jars, and necked jars. Such ceramics are often associated with groups that practice agriculture, but still are fairly mobile and dependent on wild food sources. Characteristics of ceramics produced in many regions of the Southwest changed significantly by the beginning of the seventh century, when both painted and textured decorations along with ware distinctions become more prevalent. Such changes seem to correlate with increasingly sedentary life-styles that may have resulted in increased specialized use, differentiation, and decoration of pottery vessels. For example, the increased distinction of decoration, paste, and form between utility and decorated wares may reflect increased reliance on specialized activities associated with sedentary agriculture including the boiling and serving of corn, rather than the very generalized vessel assemblages associated with earlier mobile or seasonal strategies. While white wares produced from other regions may appear as trade wares at Jornada Mogollon sites such as LA 110621, their overall frequency is extremely low as compared to that represented in other regions. The lack of a major shift in the types of ceramics produced over much of the Jornada Mogollon region may in part reflect the continuation of mobile or seasonal patterns of plant and game exploitation similar to those associated with earlier occupations elsewhere in the Southwest (Whalen 1994a).

The conservative nature of ceramic change in the southern Jornada Mogollon as compared to other areas of the Southwest may ultimately reflect selective pressures relating to mobility on the decorations, construction, and forms of ceramic vessels. Characteristics of pottery vessels ultimately reflect their production for use as ceramic containers, which reflect facilities that function to even out spatial and temporal heterogeneity in subsistence resources (Mills 1988). Preceramic groups dealt with resource heterogeneity through mobility. Pottery, however, provides technological alternatives to full-scale mobility (Mills 1988, 1989). One model for understanding potential changes in ceramic production and manufacture involves the distinction of maintainable and reliable systems (Mills 1988). Maintainable systems sacrifice durability for other factors such as modularity and portability, while reliable systems are designed for increased durability. The expected characteristics of containers resulting in maintainable systems include ease of manufacture and repair, involve little time for manufacture and use, lack of backup systems, portability, are utilized for a limited number of tasks, and involve simple and easily transferred construction and firing techniques. Containers resulting from reliable production systems tend to be abundant and sturdy, involve more specialized forms, are resistance to failure during a specific task, and may require more specialized manufacturing and firing techniques that may be relatively time consuming. Mills (1988) notes widespread trends concerning the shift from reliable to maintainable production systems in the Anasazi from the Basketmaker III to Pueblo II periods. The lack of such dramatic change, during the same temporal span, may indicate less need for the development of maintainable containers. At most, an increase in the frequency of bowls and the occasional acquisition of white wares exhibit more characteristics of a reliable production system reflected during later occupations.

PETROGRAPHIC ANALYSIS OF CERAMICS FROM THE PHANTOM PALMS SITE

David V. Hill

Petrographic analysis was conducted on a sample of five sherds from LA 11621, the Phantom Palms site. Three brown ware sherds and two Mimbres Black-on-white sherds were analyzed.

Methods

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

Analysis was conducted by first going through the total ceramic collection and generating a brief description of each of the sherds. A second phase created classification groups based on the similarity of the paste and temper between sherds. Additional comments about the composition of individual sherds were made at this time.

Description of the Petrographic Samples

Sample 1

The paste of this sherd is a reddish brown color and slightly birefringent. The paste contains about 25 percent fine to coarse angular rock fragments derived from granite. These granite particles grade continuously in size and occur as isolated minerals or fragments of granite. The granite consists of equal proportions of quartz, often displaying undulose extinction, orthoclase, and plagioclase. Microcline is present, but only makes up about 10 percent of potassium feldspar present. A few feldspar grains display perthritic intergrowths of albite. Also present, but in trace amounts, are brown biotite and black inclusions that may represent biotite which has altered to hematite and clay minerals. The feldspars are also altered along crystallographic planes to sericite and clay minerals.

Sample 2

The paste of this sherd is also a reddish brown color, similar to Sample 1. This sherd also contains granitic rock fragments that grade continuously from fine to coarse. In this sherd these particles make up about 30 percent of the ceramic body. Like the previous specimens, the particles consist of single mineral grains of quartz, orthoclase, and plagioclase with sparse microclase. Trace amounts of brown biotite and black opaque fragments are also present. The feldspars in this sherd, like the previous specimen, display weathering.

Sample 3

The paste of this sherd is quite similar to the previous two samples in terms of the color of the paste and the presence of isolated mineral grains and sparse rock fragments derived from granite. These rock fragments make up about 30 percent of the paste and consist of the same mineral as observed in the previous two sherds. Also like the previous specimens, the feldspars display alteration to sericite and clay minerals.

Sample 4

The paste of this sherd is a medium gray color. The paste contains 25 percent fine to medium-sized rounded sand grains that were derived from a volcanic source. A wide variety of isolated grains are present. Two types of grains are present, those that represent isolated minerals and rock fragments. The rock fragments are slightly more common in the paste than the isolated mineral grains and tend to be larger in size. The most common type of rock fragment is a brownish gray rhyolite, which occasionally contains porphyritic sanidine. The groundmass of those rhyolite grains is more often altered to clay minerals presenting a gray opaque mass. The next most common rock type is a very fine-grained trachyitic basalt. A trace amount of chalcedony is also present.

In terms of isolated mineral grains the most common are untwinned feldspars, predominantly sanidine. Also present are grains of quartz. The quartz and untwinned feldspar are present in about equal amounts. Plagioclase and brown biotite are present, but only in trace amounts.

Sample 5

The paste of this sherd is a medium gray color. The ceramic body contains sands consisting of a mixture of rock fragments and isolated mineral grains that are quite similar to those observed in the previous specimen in terms of size, amount, and comparison. Slightly more chalcedony was present in this specimen than in the previous one.

Discussion

The paste of the three brown ware sherds are similar enough to one another that they were probably derived from the same productive source. The lack of very fine mineral grains in the ceramic bodies indicates that the granitic material was added to the clay body.

The two Mimbres Black-on-white sherds also have very similar pastes to one another and were probably made from the same source of materials. Like the brown ware sherds, the continuous size distribution on the particles suggests the use of a sandy clay for the vessels' construction.

The brown wares and the Mimbres Black-on-white were made using ceramic resources from different places. In the case of the three brown ware sherds, all contained an abundant amount of temper derived from a granitic source in the same reddish brown body. Outcrops of Precambrian granite occur nearest LA 110621 in the San Andres Mountains to the east and in the southern end of Cook's Range (Jicha 1954; Condie and Budding 1979; Seger 1981).

The two Mimbres White Ware sherds appear to have been made using clays that contained reworked volcanic deposits. The similarity of the paste of the two sherds indicates that they were derived from the same productive source. Extrusive volcanic deposits of rhyolitic composition are ubiquitous throughout southwestern New Mexico. Without extensive petrographic characterization, supported with chemical compositional analysis, the discrimination of Mimbres White Wares from individual settlements is not possible (Elston 1957).

LITHIC ARTIFACT ANALYSIS

Lithic artifact analysis was accomplished with two basic goals. The first goal was to provide a descriptive summary of the lithic artifacts from the site. The second goal was to provide information that could be used to address the general research problems outlined in the data recovery plan for LA 110621. Jornada Mogollon sites tend to have less lithic artifacts for their size than earlier prehistoric sites. However, the lithic artifact assemblage for LA 110621 is small, even for an Jornada Mogollon site. The artifact assemblage for LA 110621 contains 758 chipped stone artifacts.

The descriptive artifact analysis attempted to identify patterns in prehistoric artifact production and use. Patterns present would allow the identification of patterns attributable to different activities, based on the different proportions of formal tools, utilized flakes, ground stone, and exotic materials. Interpretation is based on the assumption that Jornada Mogollon lithic assemblages reflect the need to satisfy two needs. One need is the production of flakes that can be utilized without further modification as expedient tools. The other need is for material that can be further modified into formal specialized tools.

It has been argued that expedient tools, flakes utilized with little or no modification, are the result of material abundance on residential sites (Post 1993). However, they may also represent convenience of both manufacture and use (Abbott et al. 1997).

The existence of formal tools such as projectile points, drills, etc., within an assemblage, implies design directed toward specific tasks or activities. Early stages of both formal tool manufacture and expedient flake production produce flakes that are indistinguishable from each other. The waste flakes produced in the later stages of formal tool production, however, are distinctive biface flakes.

Distinctive resharpening, or rejuvenation, flakes are a common by-product of tool maintenance and reuse. Their presence is an indication of these specific activities occurring on a site.

The presence of nonlocal, or exotic, materials can be used to postulate spheres of social and economic interaction. Conversely, an absence of nonlocal lithic material may reflect the isolation of a population or community.

The research design developed for LA 110621 (Bullock 1997) focused on the identification of site activities, as a manner of inferring site function. While this small lithic assemblage can be expected to yield only limited information, it can at least indicate a range of activities that may have taken place at LA 110621. Different activities can be inferred through the presence of different artifact types and their frequencies. Since LA 110621 contains a residential structure, a wider range of actives can be expected than at a hunting camp, or short-term procurement area.

Analytical Methods

The guidelines and format of the Office of Archaeological Studies *Standardized Lithic Artifact Analysis: Attributes and Variables Code Lists* (OAS 1994a) were followed in the analysis of lithic artifacts from LA 110621. Definitions used in lithic analysis are also included in this volume. The following attributes were included in the analysis.

Material Type

Codes for material types are for general material groups unless the material is unquestionably from a recognized source. For example, although a wide range of chert occurs on these sites, all were classified as "chert." If a specimen was of a specifically named chert (such as Washington Pass chert), it was coded by the specific name.

Morphology (Artifact Type)

This is the characterization of artifacts by form.

Portion

Portion is that part of the artifact present. Flakes and tools can be whole or fragmentary. Angular debris and cores are whole by definition.

Dorsal Cortex

Cortex is estimated to the nearest 10 percent increment. For flakes, this is the cortex on the dorsal surface. Cortex on the platform was not included. For other morphological types the percentage of cortex on all surfaces is estimated and added together.

Flake Platform

Flake platform is recorded for whole and proximal flakes. Some lateral flakes also have their platforms recorded, if the platform is still present. Either the morphology of the impact area prior to flake removal or extreme modifications of the impact area caused by the actual flake removal is coded.

Size

Artifact size is recorded in millimeters.

Edge Number

Artifacts can have one or more utilized edges. Each utilized edge on an artifact is given an edge number. Consecutive numbers are used for artifacts with more than one utilized edge. Each edge was analyzed separately for function and wear patterns.

Function

Function describes and characterizes artifact form.

Wear Patterns

Artifact modification caused by human use is coded as wear.

Analytical Results

The lithic artifact assemblage for LA 110621 totals 758 artifacts.

Table 9. LA 110621, Artifact Morphology by Material Type

Artifact type	Material									
	Metamorphic Sandstone		Chert		Rhyolite		Siltstone		Limestone	
	N	%	N	%	N	%	N	%	N	%
Core flake	25	100.0	56	93.1	338	97.4	35	94.6	79	96.3
Biface thinning flake			1	1.7						
Resharpening flake			1	1.7	1	0.3				
Hammerstone flake			1	1.7	1	0.3	1	2.7	3	3.7
Biface (1st stage)										
Biface (2th stage)					1	0.3				
Bidirectional core							1	2.7		
Multidirectional core			1	1.7	6	1.7				
Total	25	100.0	60	100.0	350	100.0	37	100.0	82	100.0

Table 9. Continued

Artifact type	Material									
	Quartzite		Quartzitic Sandstone		Obsidian		Thunderbird Rhyolite		Total	
	N	%	N	%	N	%	N	%	N	%
Core flake	10	100.0	5	100.0	2	100.0	17 8	95.2	728	96.0
Biface thinning flake									1	0.1
Resharpening flake									2	0.3
Hammerstone flake							4	2.1	13	1.7
Biface (1st stage)							1	0.5	1	0.1
Biface (2d stage)									1	0.1
Bidirectional core									1	0.1
Multidirectional core							4	2.1	11	1.5
Total	10	100.0	5	100.0	2	100.0	18 7	100.0	758	100. 0

Material Selection

Lithic artifacts collected at LA 110621 were comprised of nine materials; metamorphic sandstone, chert, two types of rhyolite (undifferentiated rhyolite and a local variety known as Thunderbird rhyolite), siltstone, limestone, quartzite, quartzitic sandstone, and obsidian (Table 9). Rhyolite is the most common material present at this site, making up 46.1 percent of the total assemblage. The variety known as Thunderbird rhyolite comprises an additional 24.7 percent. Limestone is the next most common material at 10.8 percent. Chert comprises 7.7 percent of the total, and siltstone 4.9 percent. Metamorphic sandstone is present as 3.3 percent of the artifact assemblage. Quartzite, quartzitic sandstone, and obsidian are also present in very small amounts.

Table 10. LA 110621, Percent of Dorsal Cortex by Material Type

Cortex	Material									
	Metamorphic Sandstone		Chert		Rhyolite		Siltstone		Limestone	
	N	%	N	%	N	%	N	%	N	%
0	12	48.0	34	55.2	181	51.7	16	43.2	35	42.7
10			3	5.2	21	6.0	6	16.2	6	7.3
20	2	8.0	3	5.2	18	5.2	1	2.7	5	6.1
30	2	8.0	5	8.6	25	7.2	3	8.1	7	8.5
40	1	4.0	2	3.4	19	5.5			5	6.1
50			3	5.2	12	3.4	4	10.8		
60	1	4.0	2	3.4	16	4.3			6	7.3
70	2	8.0	2	3.4	18	5.2			4	4.9
80	3	12.0	3	5.2	10	2.9	1	2.7	7	8.5
90	1	4.0	2	3.4	17	4.9	4	10.8	4	4.9
100	1	4.0	1	1.7	13	3.7	2	5.4	3	3.7
Total	25	100.0	60	100.0	348	100.0	37	100.0	82	100.0

Table 10. Continued

Cortex	Material									
	Quartzite		Quartzitic Sandstone		Obsidian		Thunderbird Rhyolite		Total	
	N	%	N	%	N	%	N	%	N	%
0	6	60.0	1	20.0	1	50.0	81	43.3	367	48.4
10			1	20.0			11	5.8	48	6.3
20							12	6.4	41	5.4
30							13	7.0	55	7.3
40	1	10.0					10	5.3	38	5.0
50			2	40.0			4	2.1	25	3.3
60	1	10.0			1	50.0	5	2.7	32	4.2
70	1	10.0					14	7.5	41	5.4
80	1	10.0					12	6.4	37	4.9
90			1	20.0			10	5.3	39	5.1
100							15	8.0	35	4.6
Total	10	100.0	5	100.0	2	100.0	187	100.0	758	100.0

All of the materials represented in the lithic assemblage at LA 110621 are available locally in the Las Cruces area. Although obsidian is usually considered an exotic material, it is available locally as various sized nodules in the Pleistocene gravel deposits. Visually, this obsidian resembles Grants obsidian. Sources of this material are the Sierra de las Uvas Mountains and the Black Range to the north and northwest of the general site area (Shackley 1995).

Material use serves as an indication of human-decision making processes with regard to the suitability of materials (Young and Bonnichsen 1985:128). The presence within a site area of either tested material, or of substantial numbers of core flakes exhibiting dorsal cortex, can thus be presumed to illustrate the manner in which this material suitability is determined regarding both material quality and reduction. The LA 110621 assemblage contains both tested material and large numbers of core flakes exhibiting a wide percentage of dorsal cortex (Table 10). However, in most material categories the numbers are so small they could represent a single stone knapping episode. Only the rhyolite and Thunderbird rhyolite material categories contain both the range and numbers of core flakes with dorsal cortex to represent material selection. Despite this, of the lithic artifact total, 43.3 percent of the core flakes lack any dorsal cortex whatsoever. This suggests that although some lithic material suitability analysis was conducted at LA 110621 (particularly for rhyolite and Thunderbird rhyolite), it was also taking place at another area of the site or at some other unknown location.

Artifact Morphology

Core flakes make up the largest category of artifacts at LA 110621, forming 96 percent of the total assemblage (Table 11). The next largest categories are comprised of hammerstone flakes (1.7 percent), and multidirectional cores (1.5 percent). All of the additional morphological categories present are limited to one or two occurrences.

The high percentage of core flakes can represent either core reduction, the manufacturing of flakes for use as expedient tools, or both activities. Core flakes are present in all material types occurring at LA 110621. This range of occurrence suggests that the creation of core flakes for use as expedient tools was taking place. This form of convenient disposable lithic technology is characteristic of Anasazi sites (Neusius 1988). Only among rhyolite and Thunderbird rhyolite artifacts in this assemblage are there the range of cortex occurrence that might indicate core reduction.

Table 11. LA 110621, Flake Type by Flake Portion

Flake type	Portion											
	Whole		Proximal		Medial		Distal		Lateral		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Core flake	679	97.7	25	100	1	100	9	100	12	100	726	97.8
Biface thinning flake	1	0.1									1	0.1
Resharpening flake	2	0.3									2	0.3
Hammerstone flake	13	1.9									13	1.8
Total	695	100	25	100	1	100	9	100	12	100	742	100

Flake Portion

Numbers of distal and proximal flake portions within an assemblage can be an indication of either core reduction or tramping by livestock. An extremely high percentage of distal fragments suggests breakage took place during core reduction. Numbers of distal and proximal fragments that are roughly equal are believed to represent breakage caused by livestock (Moore 1994) as are high percentages of proximal fragments.

The LA 110621 flake assemblage (Table 11) contains a majority of whole flakes. A majority of fragmentary flakes recovered at the site are proximal fragments suggesting trampling by livestock or modification by some other means such as the use of mechanical equipment by highway maintenance crews.

Flake Platform Type

Flake platforms are the remnants of the core or tool from which the flake was struck. Platform types provide information on the level of core reduction technology pursued at a particular site. Cortical platforms are those that contain cortex material, thus representing early stage reduction. Single-facet platforms can occur at any stage of reduction. Multiple-facet platforms represent late-stage core or biface reduction (Moore 1994).

Platform types are shown in Table 12. Single-facet platforms are by far the largest category present in the assemblage at 62.5 percent. Flakes with a cortical platform comprised 32.6 percent of the total. Other platform types were also present, but in very small amounts. Both cortical and single-facet platforms are commonly produced during lithic material reduction and expedient tool production.

Table 12. LA 110621, Flake Type by Platform Type

Flake type	Platform											
	Absent		Cortical		Single		Multiple		Collapsed		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Core flake	10	100	245	99.2	462	97.5	1	33.3	8	100	726	97.8
Biface thinning flake							1	33.3			1	0.1
Resharpening flake					1	0.2	1	33.3			2	0.3
Hammerstone flake			2	0.8	11	2.3					13	1.7
Total	10	100	247	100	474	100	3	100	8	100	742	100

Tools

Evidence of utilization is present on 71 (9.4 percent) of the lithic artifacts recovered at LA 110621 (Table 13). Included in this assemblage are 15 scrapers, 6 gravers, 4 cores utilized as hammerstones, 3 spokeshaves, 2 drills, 1 knife, and 40 pieces of utilized-retouched debitage.

Table 13. LA 110621, Artifact Function by Material Type

Function	Material									
	Metamorphic Sandstone		Chert		Rhyolite		Siltstone		Quartzitic Sandston e	
	N	%	N	%	N	%	N	%	N	%
Utilized debitage	3	100.0	5	45.5	27	69.3	1	33.3	2	50. 0
Hammerstone			1	9.1	1	2.6				
Drill			1	9.1	1	2.6				
Graver			1	9.1	2	5.1			1	25. 0
Spokeshave					2	5.1	1	33.3		
Scraper (end)			2	18.2	4	10.3	1	33.3	1	25. 0
Scraper (side)			1	9.1	2	5.1				
Knife										
Total	3	100.0	1 1	100.0	39	100. 0	3	100.0	4	100 .0

Table 13. Continued.

Function	Material			
	Thunderbird Rhyolite		Total	
	N	%	N	%
Utilized Debitage	2	18.2	40	56.3
Hammerstone	2	18.2	4	5.6
Drill			2	2.8
Graver	2	18.2	6	8.5
Spokeshave			3	4.2
Scraper (end)	3	27.3	11	15.5
Scraper (side)	1	9.1	4	5.6
Knife	1	9.1	1	1.4
Total	11	100.0	71	100.0

Utilized debitage makes up 56.3 percent of the total utilized assemblage. However, this only comprises 5.4 percent of the 743 flakes in the assemblage. This number of utilized-retouched debitage is low for a Puebloan habitation site where we would expect to find a large number of utilized expedient tools.

The small number of formal tools was dominated by scrapers. Fifteen, made of five materials, are in the assemblage. Four of this total are end scrapers. These are primarily made of rhyolite (three of the four). The eleven side scrapers are made of a wider range of materials, but the majority are rhyolite and chert. Gravers (n = 6) are the next highest occurring formal tool.

The presence of bifaces, and their percentage within an assemblage, has been used by Kelly (1988:721-723) to differentiate between types of sites. Biface production should take place at residential sites, indicated by the presence of large numbers of bifaces and biface thinning flakes. In contrast, logistical camps and resource procurement areas should have few biface thinning flakes, but large percentages of resharpening flakes and biface fragments (Phagan 1986).

The frequency of both bifaces and biface thinning flakes is low in this assemblage, not what we would expect for a residential site. The relatively large percent of expedient flake tools, and the small percentage of formal tools, are, however, typical for such a site, and suggests a range of activities representing a year-round habitation (Akins and Bullock 1992).

Gross interpretations can be made of possible activities represented by utilized artifacts. Bidirectional wear is traditionally considered an indication of cutting and slicing, while unidirectional wear is thought to indicate scraping. Experiments conducted by Brose (1975), Vaughan (1985), and Moore (1994) show that wear patterns are unreliable indicators of use. However, it should be possible to determine, however roughly, the types of activities pursued at this site (Christenson 1987:77).

The lack of projectile points may suggest that hunting was not a primary focus of activity at LA 110621. The tool assemblage from these two structures is more suggestive of domestic activities (traditionally pursued by women). The presence of the scrapers and gravers suggests that animal butchering and possibly leather processing were carried out at this site. Gravers are specialty tools usually associated with the processing (splitting) of wood and bone into other tools forms. Drills are specialized tools generally connected with the construction and repair of clothing. Spokeshaves are used for trimming wood. The presence of hammerstones may be related to the striking of flakes to use as expedient tools, although they could have also been used to sharpen (pit) the surfaces of ground stone tools. Many of the expedient flake tools utilized in this assemblage could have also functioned in a similar manner as the formal tools. They may however, represent different unknown activities such as the processing of vegetal foodstuffs. They could also be the result of unplanned actions, such as the repairing of clothing or equipment.

Material Texture

While material selection may depend on local availability as well as the intended project, studies have shown different material textural preferences for Puebloan and Archaic groups (Elyea and Eschman 1985:246). Archaic groups tended to prefer fine-grained material quite often exotic in origin. Puebloan people on the other hand, while preferring fine-grained material for sharp edges and course-grained material for durability, quite often compromised their preferences for material convenience and availability.

As Table 13 indicates, both expedient and formal tools mirror the occurrence of materials within the assemblage, with more of both tool categories made of the most common materials. Thus rhyolite and chert are the most commonly utilized materials.

This suggests that although formal tools are generally made of material that will enhance their specialized functions, practicality may also play a role in material selection. An ability to have a sharp edge is balanced against edge durability. A greater variety of materials are acceptable as utilized debitage, where the main value of the artifacts may be availability and convenience.

Discussion

Analysis of the lithic artifacts from LA 110621 shows that an expedient core-flake reduction technology was utilized by the site's inhabitants. Very little tool manufacturing was carried out in this portion of the site, as evidenced by the almost nonexistent number of biface thinning flakes. What tool production did take place, focused on expedient tools. Little initial core reduction took place at LA 110621, rhyolite being the one exception. However, only a fraction of the generated core flakes were utilized.

Assemblages from excavated Puebloan sites reflect an expedient lithic technology, with flakes produced for use as short-term, disposable tools (Vierra et al. 1993). This is true for both Anasazi and Mogollon cultural groups. Formal tools, other than projectile points, are relatively rare (Larralde 1994; Vierra et al. 1993).

LA 110621 reflects this Puebloan type of assemblage, with its small number of biface flakes. Bifacial reduction is generally associated with Archaic and Basketmaker II sites (Vierra et al. 1993; Moore 1994) and seems to have been replaced as part of the general cultural shift to a sedentary agricultural lifestyle (Abbott et al. 1996). Since LA 110621 is a Mesilla phase habitation site, it should reflect this post-sedentary shift. However, as already noted, the number of tools recovered at this site is unusually small for a prehistoric Formative habitation site. As such, this assemblage seems to support the theory of a mixed economy (primarily a hunting and gathering subsistence supplemented by limited agriculture) suggested for the Jornada Mogollon by Whalen (1994a). However, this may be a skewed view resulting from the modified nature of the site.

Exotic lithic material is nonexistent at LA 110621. Superficially this lack of exotic material suggests little long-distance resource procurement and a lack of regional trade as part of a larger settlement system. However, such an interpretation should be approached with a degree of caution due to both the small portion of the site excavated and the high degree of previous road maintenance modification.

GROUND STONE ARTIFACT ANALYSIS

Eleven ground stone artifacts were collected from LA 110621. These artifacts were analyzed at the OAS in Santa Fe.

Analytical Methods

Attributes chosen for analysis reflected the desire to achieve the greatest return of useful information within the available time constraints. The guidelines and format followed the Office of Archaeological Studies *Standardized Ground Stone Artifact Analysis: A Manual For the Office of Archaeological Studies* (OAS 1994b).

Analytical Results

Ground stone artifacts recovered from LA 110621 occur in three areas of the site. The floor of Pit Structure 1 contained one metate and one mano. Two metates and four manos were present within Structure 2. Two additional pieces of ground stone (one metate fragment and a mano fragment) were found during surface stripping between the two structures.

Manos

Six mano and mano fragments were recovered from LA 110621. The two whole manos collected from LA 110621 are made of quartzite river cobbles. The four mano fragments are all made of a fine-grained sandstone.

One mano was recovered from the surface of Floor 1, in Pit Structure 1. This is an edge fragment of a two-hand mano. Only one side has been used for grinding. The remaining end exhibits worn flake scars, proof that the rock was at least partially shaped prior to use. The utilized side has a grinding surface that extends up the remaining end. This type of wear indicates that the mano was used with a trough metate (Schlanger 1991). The grinding surface also exhibits resharpening, pitting the use surface in order to revive the artifact's grinding capability.

Four manos were recovered from Floor 1 of the surface structure (Structure 2). Two manos were in the northwestern corner of the structure. One is a whole two-hand mano of fine-grained quartzite. Heavily ground on two facets, this mano exhibits no evidence of artifact preparation prior to use. Both ends of the mano show signs of battering, indicating that it was used as a hammerstone. A mano fragment was also collected in this corner of the structure. Made of fine-grained sandstone, this is a center portion of a two-hand mano. Only one side has been used for grinding.

The other two manos were in the southeastern corner of Structure 2. One is a whole one-hand mano made from an unmodified cobble of fine-grained quartzite. This shows slight wear on two sides. A mano edge fragment of fine-grained sandstone was also in the southeastern corner of the structure. Although too small to enable identification of the type of mano represented, this fragment showed evidence of resharpening of the surface through pitting.

One mano edge fragment was recovered during excavation from the area between the two structures. One is a middle edge fragment of fine-grained sandstone. Because this is an edge fragment from the middle of the mano, it is impossible to determine the type of mano represented. However, the mano was ground on two sides, one of which was heavily resharpened by pecking to roughen its use area.

Metates

Four metates, or metate fragments, were recovered from LA 110621. All of the metates are basin metates, three were constructed from sandstone and one was constructed from andesite.

One metate was present on Floor 1 of Pit Structure 1. This is a side fragment of a deep basin metate. Made of fine-grained sandstone, the stone was shaped by pecking prior to use. The single use surface is deeply worn from both use and repeated pecking to rejuvenate its grinding surface.

Two basin metates were found in Structure 2. A complete basin metate was present in the northwestern corner of Structure 2. This metate is made of a large block of fine-grained sandstone that was shaped by flaking prior to use. The extremely shallow grinding surface suggests that this metate was only slightly used prior to the burning of Structure 2. This artifact shattered during the burning of the structure. During testing at LA 110621, half of a shallow basin metate was found in the southeastern corner of Structure 2. This metate is made of medium-grained andesite that was shaped by flaking and pecking prior to use. The use surface was resharpened at least once by pecking to roughen and rejuvenate the grinding surface.

In addition, a small edge fragment of a basin metate was found during surface excavations between the two structures. Made of a fine-grained sandstone, this metate fragment was shaped by pecking prior to its use as a metate. This pecking is present over the entire external surface area of the fragment. The grinding surface shows evidence of repeated use and rejuvenation through pecking.

Discussion

Although small, the ground stone assemblage from LA 110621 provides important information on both the degree of agriculture and the related activities pursued at the site. The presence of ground stone artifacts on the floors of both structures suggests that the use of these artifacts, as well as the activities they represent, took place at both locations.

Basin metates are common artifacts at Jornada Mogollon sites. Differentiation of ground stone use between cultivated maize and gathered wild seed is usually determined by the form of the manos present (Bartlett 1933). Two-hand manos are generally connected with the efficient grinding of maize, while one-hand manos are generally assumed to reflect the processing of wild seed (Lancaster 1986; Whalen 1994a).

Two-hand manos and basin metates are the major elements of a Jornada Mogollon grinding technology oriented toward efficient domesticated maize processing (Bartlett 1933; Lancaster 1986). These artifacts are portable, and are found in archaeological contexts that show they were either carried to short-term use areas, and also used inside of structures, or in sheltered areas (Schlanger 1991). Basin metates, unlike trough metates, are rarely found as built-in features. They are usually found either sitting on the floors of structures, or stored and leaning against the walls. The metates in both Pit Structure 1 and Structure 2 were found sitting upright on the floors of both structures.

Manos (particularly two-hand manos) and metates had to be resharpened frequently. Bartlett (1933) suggested this had to be done every five days when the tools were in constant use. This resharpening was done by pecking the grinding surface with a hammerstone or core to rejuvenate the grinding surface. This resharpening was responsible for most of the wear on these ground stone tools. Two-handed manos had to be resharpened more frequently, and had to be replaced more frequently than metates (Wright 1990).

The larger mano and metate fragments from LA 110621 are the result of transverse breaks. Common forms of breakage, transverse breaks occur when these types of artifacts are being resharpened and the worker fails to provide enough support for the artifact (Shelley 1983). When these artifacts are broken they may be discarded immediately, stored for future use, or utilized in some other manner (Schlanger 1991).

While it is true that ground stone artifacts can have additional uses after their lives as grinding implements end, none of the ground stone artifacts from LA 110621 show any indication of secondary wear, indicating that they were not used later for another purpose such as the grinding of clays or paints, or for the shaping of beads. The broken edge of one metate fragment was reshaped by pecking, but shows no evidence of having been reused.

The ground stone artifacts found in Pit Structure 1 may have been stored, or could have been discarded prior to abandonment. The ground stone in Structure 2 may have been stored prior to the burning of the structure.

Schlanger (1991) has found that there is a correlation between the locations of mano and metate fragments, and length of site occupation. Broken mano and metate fragments only occur in fill and trash deposits when the site occupations or structures last longer than the use-life of these tools. The broken artifacts are first delegated to a floor surface. Through time these artifacts accumulate, and are then "transformed" into trash and removed from the structure to designated trash locations (midden areas, fill, sheet trash, etc.).

In the case of LA 110621, the broken ground stone artifacts remained on the floor surfaces of both structures and never made the transition to trash status. This suggests that the pit structure at LA 110621 was only occupied for a short period of time. A similar interpretation has been suggested for Structure 2, based on the presence of broken mano and metate fragments. The presence of ground stone fragments in sheet trash between the two structures indicate that they had been relegated to the category of "trash."

The combination of basin metates and two-hand manos, designed for the efficient grinding of domesticated maize (Bartlett 1933; Wright 1990), appears on Jornada Mogollon sites in the early Mesilla phase (Whalen 1994a). This development is a logical outgrowth of the use of basin metates with one-hand manos in the processing of gathered wild seed (Bartlett 1933; Shelley 1983; Wright 1990).

Maize cultivation is considered one of the attributes for the development of the Jornada Mogollon. This is generally dated between A.D. 1 and 200 (Whalen 1977; O'Laughlin 1980), although it is often given a later date of between A.D. 200 and 500 (Moore 1996; Whalen 1994a). This developed dependence on maize was well established by the late Mesilla phase in the Rio Grande Valley. Although two-hand manos can be used for other things, the presence of two-hand manos with basin metates at LA 110621 suggests that a maize-based subsistence system may have been in place at this site during its occupation.

FLOTATION AND RADIOCARBON SAMPLE WOOD FROM PHANTOM PALMS (LA 110621)

Pamela J. McBride

Two quadrants of the pit structure at LA 110621 were sampled for plant remains. In addition, three radiocarbon samples were examined for wood species composition. The goals of the analysis were to identify fuel or construction wood species and possible plant resources used by site occupants. Burned material found on the pit structure floor seems to consist primarily of roof fall material.

Methods

Radiocarbon Sample Analysis

Charcoal samples, prior to submission for radiocarbon dating, were examined by snapping each piece to expose a fresh transverse section and identified by microscope at 45x. All charcoal from each field specimen (FS) was identified and separated by taxon with the exception of very small fragments of charcoal that were impossible to identify. Charcoal from each taxon identified was weighed on a top-loading digital balance to the nearest one-hundredth of a gram and placed in labeled foil packets. 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.

Flotation Processing

The three soil samples collected during excavation were processed at the Museum of New Mexico's Office of Archaeological Studies by the simplified "bucket" version of flotation (Bohrer and Adams 1977). Each sample was immersed in a bucket of water, and a 30-40 second interval allowed for settling out of heavy particles. The solution was then poured through fine screen (about 0.35 mm mesh) lined with a square of "chiffon" fabric, catching organic materials floating or in suspension. The fabric linings were laid out on coarse mesh screen trays, until the recovered material had dried.

Flotation Full-Sort Analysis

Each sample was sorted using a series of nested geological screens (4.0, 2.0, 1.0, 0.5 mm mesh), and then reviewed under a binocular microscope at 7-45x. Charcoal and uncharred reproductive plant parts like seeds and fruits were identified and counted. Nonreproductive plant parts such as pine needles and grass stems were also identified and recorded as an estimated number per liter of soil processed.

Flotation data are reported as the actual number of seeds recovered. To aid the reader in sorting out botanical occurrences of cultural significance from the considerable noise of post-occupational intrusion, data in tables are recorded as "Cultural" (all carbonized remains) and "Noncultural" (unburned) materials, especially when taxa are not economically useful, and when found in disturbed contexts together with modern roots, insect parts, scats, or other signs of recent biological activity.

From each flotation sample with at least 20 pieces of wood charcoal present, a sample of 20 pieces of charcoal was identified (10 from the 4 mm screen and 10 from the 2 mm screen). In smaller

Table 14. LA 110621, Flotation Sample Plant Remains

Cultural	Pit Structure NE 1/4 floor	Pit Structure SW 1/4 floor	Pit Structure SW 1/4 floor (under ceramic on floor)
	FS 155	FS 157	FS 159
Annuals: *Chenopodium* goosefoot		1*	1*
Cheno-am		3*	
Helianthus sunflower		2*	3*
Portulaca purslane			1*
Talinum flame flower	1*	5*	
Grasses: Gramineae grass family	stems+*	5*	
Phragmites common reed		stems+*	Stems+*
Sporobolus dropseed grass		49*	1*
Other, undetermined		9*	
Perennials: cf. *Prosopis* mesquite		1* fragment	
Noncultural Annuals: *Amaranthus* pigweed		1	
Portulaca purslane		1	

Note: Plant remains are seeds unless indicated otherwise. Numbers of plant remains are actual counts.
*=charred. +=1-10/liter.

samples, all charcoal from the 4 mm and 2 mm screens was identified. Each piece was identified in the same manner as radiocarbon wood specimens.

Results

Seeds of weedy annuals dominate the floral assemblage from the pit structure along with grass seeds and stems (Table 14). The adaptive advantage that weedy annuals like goosefoot and purslane have of proliferating in the disturbed ground around habitation sites, agricultural fields, and middens make them a readily available resource, and their seeds have been recovered from a wide array of prehistoric assemblages. The common reed stems recovered probably represent part of the roof fall debris. Common reed was frequently used as roof closing material (as at Pueblo Bonito in Chaco Canyon, Judd 1954; see also Whiting 1939:66) and was used as thatching material at the Gallo Mountain site (LA 5407) in the Mogollon Highlands.

Table 15. LA 110621, Species Composition (by Count and Weight in Grams)

of Flotation Wood

	Pit Structure NE 1/4 floor	Pit Structure SW 1/4 floor	Pit Structure SW 1/4 floor (under ceramic)	Totals	
	FS 155	FS 157	FS 159	Weights	%
Prosopis mesquite	20/2.3g	16/1.6g	14/0.9g	4.8 g	94%
Populus/Salix cottonwood/willow		4/0.2g	6/0.1g	0.3g	6%
Total	20/2.3g	20/1.8g	20/1.0g	5.1g	100 %

Dropseed grass seeds were the only plant remains from common grass stems that occurred in large numbers. Even though dropseed grass grains are very small, abundant seed production and the retention of the grains by the plant after maturation (preventing their loss before harvesting; Doebley 1984) suggest dropseed could have been a significant food resource. A single possible mesquite bean fragment is the sole representative of perennial plant use. Uncharred plant material was minimal (Table 14), indicating a low degree of disturbance. Roots, insect parts, and feces were also present, but not in significant amounts.

Mesquite charcoal (Tables 15 and 16) represented 94 percent of the total flotation wood weight. A small amount of cottonwood/willow was identified in flotation sample wood, while over one half of the radiocarbon wood weight is composed of cottonwood/willow. Percentages are skewed in the radiocarbon sample because the cottonwood/willow specimen identified is a single large piece of wood that may represent a beam fragment. The mesquite wood then, probably represents fuelwood residue, while the cottonwood/willow may represent construction material.

Table 16. LA 110621, Species Composition (by Count and Weight in Grams) of Charcoal Samples for ^{14}C Dating

	Pit Structure floor		NW 1/4 floor	Totals	
	FS 112	FS 150	FS 151	Weight	%
Prosopis mesquite	3/3.2g	63/49.9g	1/2.0g	84.1g	48%
Populus/Salix cottonweood/willow			1/90.0g	90.0g	52%
Total	3/3.2g	63/49.9g	2/92.0g	174.1g	100.5

Discussion

Unfortunately for comparative purposes, flotation samples were not collected during excavation of the nearby Northgate site in northeast El Paso (Aten 1972). At the time, analysis of plant remains was not a common practice. However, many sites of the Formative period have been investigated in the El Paso region and charred plant remains are compared to those from Phantom Palms in Table 17. Eight weedy annual taxa are represented in Table 17. Purslane is the most common weedy annual, recovered from all sites except Site 3:739. Prehistoric utilization of purslane in the El Paso area is neatly substantiated by an unusual recovery of a significant volume of these tiny seeds in a Chupadero Black-on-white jar (Phelps 1968).

Table 17. Charred Remains of Economic Plant Taxa at Formative Period Sites in the El Paso Region

Locations	Basin					Foothills	Valley Margins	
Site	White Sands	Ft. Bliss 4:84M	Ft. Bliss 3:739	NAHO-St. Teresa	Mockingbird	Wind Canyon	Turquoise Ridge	Phantom Palms
Perennials: mesquite	+		+				+	cf.+
hedgehog cactus	+		+			+		
prickly pear	+		+			+		
agave						+		
yucca			+				+	
sotol						+		
beargrass						+		
Grasses: grass family								+
dropseed	+				+		+	+
common reed								+
Weedy Annuals: bugweed							+	
flame flower						+		+
goosefoot	+		+chen-am			+	+	+
pigweed	+			+				
purslane	+	+		+	+	+	+	+
mallow	+							
sunflower			+		+		+	+
spurge				+				
sumpweed						+		
tansy mustard							+	
carpetweed						+		
evening primrose						+		
Cultivars: beans							+	
corn	+		+				+	
Total taxa	9	1	7	3	3	11	10	8

White Sands is a temporary camp with hearth and fire-cracked rock scatters (Toll 1986)
Ft. Bliss 4:84M is a hamlet (Ford 1977).
Ft. Bliss 3:739 is a small village (Wetterstrom 1978).
NAHO-St. Teresa is III-3SE Feature 1A and III-21NW;Sample 6, Feature 8 (Scott and Toll 1987).
Mockingbird is 3 hearths (Toll and McBride 1995).
Wind Canyon is FCR Feature 14 (AD 1020)(Bohrer 1994).
Turquoise Ridge (Minnis and Goldborer 1991).

The most diverse array of plant taxa was recovered from Turquoise Ridge, including corn and the only specimens of domesticated beans. Considering the fact that Turquoise Ridge is located on the edge of the Hueco Bolson, the best-watered spot between the desert basin zone and the mountain zone, this diversity is not surprising. Evidence of the exploitation of leaf succulents is present at three of the eight sites, but positive identification of agave is limited to Wind Canyon. Other perennial plant taxa include mesquite, hedgehog cactus, and prickly pear cactus. Sites in the basin and foothills display the greatest presence of cactus and leaf succulents.

Grasses are scarce in the archaeological record from the El Paso region, which is somewhat surprising in an area where the edible grasses were abundant. Samples from Phantom Palms yielded the greatest number of grass taxa including dropseed grass, grass family, and common reed. Dropseed grass was identified at only three of the other eight sites. Common reed remains from Phantom Palms represent the only evidence of riperian plant use from the region. Since Phantom Palms is the only site situated in close proximity to a river, the lack of riparian resources from the record at the other eight sites is not unexpected.

Fuel wood selection at Phantom Palms centered on mesquite, as it did at the Mockingbird site where mesquite comprised 100 percent of the Mesilla phase wood charcoal. Wood was either not present in identifiable sizes or not analyzed at the remaining Formative period sites. However, a previous analysis (Toll and McBride 1996) also found that mesquite was the preferred fuel wood during the Archaic and the late Formative periods in the Mesilla Bolson, Hueco Bolson, and Tularosa Basin. Mesquite is a dense wood which provides a "bed of coals" (Ford 1977:200). This admirable fuel quality is surely responsible for the clear prehistoric preference for this fuel material, even in areas of the El Paso region where it is not particularly abundant today, such as the High Desert Zone on Fort Bliss (Ford 1977:200).

The presence of cottonwood/willow wood is restricted to locations like Phantom Palms (50 m from the edge of the second terrace above the floodplain of the Rio Grande River) and Keystone Dam (on an alluvial terrace east of the Rio Grande and west of the Franklin Mountains, giving site occupants access to both riverine and montane plant resources). Keystone Dam sites date to the Archaic and early Mesilla phase and for this reason were not included in comparative tables in this study.

Two quadrants of a late Mesilla phase pit structure were sampled for plant remains at LA 110621. Charred floral material consisted of seeds of the grass family, dropseed grass, and weedy annuals (goosefoot, flame flower, purslane, and sunflower). Reed stems were recovered as part of the roof fall debris and perennial species were represented by one probable mesquite seed fragment. The seeds of all these taxa usually mature in August or September, pointing to a late summer-early fall occupation. Mesquite was the targeted fuel wood and cottonwood/willow was probably used in the construction of the pit structure roof. Domesticated plants were absent from the archaeobotanical record at LA 110621.

Sites occupied during the Formative period show a consistent pattern of weedy annual plant use along with leaf succulents and cactus use. The absence of leaf succulents and cacti in the Phantom Palms assemblage does not necessarily mean they were not used in the past. Vagaries of preservation often prevent recovery, especially of rarely used taxa.

POLLEN ANALYSIS OF THREE POLLEN WASH SAMPLES FROM LA 110621

Richard G. Holloway

Three pollen wash samples from ground stone artifacts were submitted for analysis to Quaternary Services. Two one-hand manos and a basin metate were sampled and all three artifacts were recovered from Floor 1 of Structure 2, a surface structure. Ceramic dates of A.D. 850-1100 were suggested for the provenience.

Methods and Materials

Chemical extraction of pollen samples was conducted at the Palynology Laboratory at Texas A&M University, using a procedure designed for semi-arid Southwestern sediments. The method, detailed below, specifically avoids use of such reagents as nitric acid and bleach, which have been demonstrated experimentally to be destructive to pollen grains (Holloway 1981).

The area of the artifact sampled was washed with distilled water and lightly brushed into an envelope to drain the water. The procedure was repeated until the artifact surface and the water were clear. The sample was then dried and placed in a plastic zip-lock bag and sent to Texas A&M University for extraction. Prior to chemical extraction, two tablets of concentrated *Lycopodium* spores (batch #307862, Department of Quaternary Geology, Lund, Sweden; 13,500 ± 500 marker grains per tablet) were added to each sample. The addition of marker grains permits calculation of pollen concentration values and provides an indicator for accidental destruction of pollen during the laboratory procedure.

The samples were washed from the filter paper into glass beakers. The samples were treated with 35 percent hydrochloric acid (HCl) overnight to remove carbonates and to release the *Lycopodium* spores from their matrix. After neutralizing the acid with distilled water, the samples were allowed to settle for a period of at least 3 hours before the supernatant liquid was removed. Additional distilled water was added to the supernatant, and the mixture was swirled and then allowed to settle for 5 seconds. The suspended fine fraction was decanted through 150F mesh screen into a second beaker. This procedure, repeated at least three times, removed lighter materials, including pollen grains, from the heavier fractions. The fine material was concentrated by centrifugation at 2,000 revolutions per minute (rpm).

The fine fraction was treated with concentrated hydrofluoric acid (HF) overnight to remove silicates. After completely neutralizing the acid with distilled water, the samples were treated with a solution of Darvan, and sonicated in a Delta D-9 Sonicator for 30 seconds. The Darvan solution was removed by repeated washing with distilled water and centrifuged (2,000 rpm) until the supernatant liquid was clear and neutral. This procedure removed fine charcoal and other associated organic matter and effectively deflocculated the sample.

The samples were dehydrated in glacial acetic acid in preparation for acetolysis. Acetolysis solution (acetic anhydride: concentrated sulfuric acid in 9:1 ratio) following Erdtman (1960), was added to each sample. Centrifuge tubes containing the solution were heated in a boiling water bath for approximately 8 minutes and then cooled for an additional 8 minutes before centrifugation and removal of the acetolysis solution with glacial acetic acid followed by distilled water. Centrifugation at 2,000 rpm for 90 seconds dramatically reduced the size of the sample, yet from periodic examination of the residue, did not remove fossil palynomorphs.

Heavy density separation ensued using zinc bromide ($ZnBr_2$), with a specific gravity of 2.00, to remove much of the remaining detritus from the pollen. The light fraction was diluted with distilled water (10:1) and concentrated by centrifugation. The samples were washed repeatedly in distilled water until neutral. The residues were rinsed in a 1 percent solution of potassium hydroxide (KOH) for less than 1 minute, which was effective in removing the majority of the unwanted alkaline soluble humates.

The material was rinsed in ethanol (ETOH) stained with safranin-O, rinsed twice with ETOH, and transferred to 1-dram vials with tertiary butyl alcohol (TBA). The samples were mixed with a small quantity of glycerine and allowed to stand overnight for evaporation of the TBA. The storage vials were capped and were returned to the Museum of New Mexico at the completion of the project.

A drop of the polliniferous residue was mounted on a microscope slide for examination under an 18-by-18-mm cover slip sealed with fingernail polish. The slide was examined using 200x or 100x magnification under an Aus-Jena Laboval 4 compound microscope. Occasionally, pollen grains were examined using either 400x or 1,000x oil immersion to obtain a positive identification to either the family or genus level.

Abbreviated microscopy was performed on each sample in which either 20 percent of the slide (approximately four transects at 200x magnification) or a minimum of 50 marker grains were counted. If warranted, full counts were conducted by counting to a minimum of 200 fossil grains. Regardless of which method was used, the uncounted portion of each slide was completely scanned at a magnification of 100x for larger grains of cultivated plants such as *Zea mays* and *Cucurbita,* two types of cactus *(Platyopuntia* and *Cylindropuntia),* and other large pollen types such as members of the Malvaceae, or Nyctaginaceae families. Because corn pollen was very common in many of these samples, corn grains were tabulated during the scans only if an unequal distribution of this taxon on the microscope slide was observed.

For those samples warranting full microscopy, a minimum of 200 pollen grains per sample were counted as suggested by Barkley (1934), which allows the analyst to inventory the most common taxa present in the sample. All transects were counted completely, resulting in various numbers of grains counted beyond 200. Pollen taxa encountered on the uncounted portion of the slide during the low magnification scan are tabulated separately.

Total pollen concentration values were computed for all taxa. In addition, the percentage of indeterminate pollen was also computed. Statistically, pollen concentration values provide a more reliable estimate of species composition within the assemblage. Traditionally, results have been presented by relative frequencies (percentages) where the abundance of each taxon is expressed in relation to the total pollen sum (200+ grains) per sample. With this method, rare pollen types tend to constitute less than 1 percent of the total assemblage. Pollen concentration values provide a more precise measurement of the abundance of even these rare types. The pollen data are reported here as pollen concentration values using the following formula:

$$\mathbf{PC} = \frac{\mathbf{K} * \Sigma_p}{\Sigma_L * \mathbf{S}}$$

Where: PC = Pollen Concentration
K = *Lycopodium* spores added
Σ_p = Fossil pollen counted
Σ_L = *Lycopodium* spores counted
S = Sediment weight

The following example should clarify this approach. Taxon X may be represented by a total of 10 grains (1 percent) in a sample consisting of 1,000 grains, and by 100 grains (1 percent) in a second sample consisting of 10,000 grains. Taxon X is 1 percent of each sample, but the difference in actual occurrence of the taxon is obscured when pollen frequencies are used. The use of "pollen concentration values" are preferred because it accentuates the variability between samples in the occurrence of the taxon. The variability, therefore, is more readily interpretable when comparing cultural activity to noncultural distribution of the pollen rain. The use of the area washed also provides a mechanism for the comparison of calculated pollen concentration values between artifacts.

Variability in pollen concentration values can also be attributed to deterioration of the grains through natural processes. In his study of sediment samples collected from a rockshelter, Hall (1981) developed the "1,000 grains/g" rule to assess the degree of pollen destruction. This approach has been used by many palynologists working in other contexts as a guide to determine the degree of preservation of a pollen assemblage and, ultimately, to aid in the selection of samples to be examined in greater detail. According to Hall (1981), a pollen concentration value below 1,000 grains/g indicates that forces of degradation may have severely altered the original assemblage. However, a pollen concentration value of fewer than 1,000 grains/g can indicate the restriction of the natural pollen rain. Samples from pit structures or floors within enclosed rooms, for example, often yield pollen concentration values below 1,000 grains/g.

Pollen degradation also modifies the pollen assemblage because pollen grains of different taxa degrade at variable rates (Holloway 1981, 1989). Some taxa are more resistant to deterioration than others and remain in assemblages after other types have deteriorated completely. Many commonly occurring taxa degrade beyond recognition in only a short time. For example, most (about 70 percent) Angiosperm pollen has either tricolpate (three furrows) or tricolporate (three furrows each with pores) morphology. Because surfaces erode rather easily, once deteriorated, these grains tend to resemble each other and are not readily distinguishable. Other pollen types (e.g., Cheno-am) are so distinctive that they remain identifiable even when almost completely degraded.

Pollen grains were identified to the lowest taxonomic level whenever possible. The majority of these identifications conformed to existing levels of taxonomy with a few exceptions. For example, Cheno-am is an artificial pollen morphological category that includes pollen from the family Chenopodiaceae (goosefoot) and the genus *Amaranthus* (pigweed), which are indistinguishable from each other (Martin 1963). All members are wind pollinated (anemophilous) and produce very large quantities of pollen. In many sediment samples from the American Southwest, this taxon often dominates the assemblage.

Pollen of the Asteraceae (sunflower) family was divided into four groups. The high spine and low spine groups were identified on the basis of spine length. High spine Asteraceae contains those grains with spine length greater than or equal to 2.5F while the low spine group have spines less than 2.5F in length (Bryant 1969; Martin 1963). *Artemisia* pollen is identifiable to the genus level because of its unique morphology of a double tectum in the mesocopial (between furrows) region of the pollen grain. Pollen grains of the Liguliflorae are also distinguished by their fenestrate morphology. Grains of this type are restricted to the tribe Cichoreae, which includes such genera as *Taraxacum* (dandelion) and *Lactuca* (lettuce).

Pollen of the Poaceae (grass) family are generally indistinguishable below the family level, with the single exception of *Zea mays*, identifiable by its large size, relatively large pore annulus, and the internal morphology of the exine. All members of the family contain a single pore, are spherical, and have simple wall architecture. Identification of noncorn pollen is dependent on the presence of the single pore. Only complete or fragmented grains containing this pore were tabulated as members of the Poaceae family.

Clumps of four or more pollen grains (anther fragments) were tabulated as single grains to avoid skewing the counts. Clumps of pollen grains (anther fragments) from archaeological contexts are interpreted as evidence for the presence of flowers at the sampling locale (Bohrer 1981). This enables the analyst to infer possible human behavior.

Finally, pollen grains in the final stages of disintegration but retaining identifiable features, such as furrows, pores, complex wall architecture, or a combination of these attributes, were assigned to the indeterminate category. The potential exists to miss counting pollen grains without identifiable characteristics. For example, a grain that is so severely deteriorated that no distinguishing features exist, closely resembles many spores. Pollen grains and spores are similar both in size and are composed of the same material (Sporopollenin). So that spores are not counted as deteriorated pollen, only those grains containing identifiable pollen characteristics are assigned to the indeterminate category. Thus, the indeterminate category contains a minimum estimate of degradation for any assemblage. If the percentage of indeterminate pollen is between 10 and 20 percent, relatively poor preservation of the assemblage is indicated, whereas indeterminate pollen in excess of 20 percent indicates severe deterioration to the assemblage.

In those samples where the total pollen concentration values are approximately at or below 1,000 grains/g, and the percentage of indeterminate pollen is 20 percent or greater, counting was terminated at the completion of the abbreviated microscopy phase. In some cases, the assemblage was so deteriorated that only a small number of taxa remained. Statistically, the concentration values may have exceeded 1,000 grains/g. If the species diversity was low, counting was also terminated after abbreviated microscopy even if the pollen concentration values slightly exceeded 1,000 grains/g. Generally these samples contained only pine, Cheno-am, members of the Asteraceae (sunflower) family, and indeterminate category,

Results

For ease of comparison, Table 18 includes a list of scientific and common names of plant taxa used in this report. Table 19 provides the raw pollen counts and the calculated pollen concentration values obtained from the analysis. The individual results are presented below by field specimen number (FS).

FS 200, One-Hand Mano

This mano was generally oval and measured 11.43-by-5.7 cm and had a total area of 65.15 cm^2. The assemblage contained a total of 55 grains/cm^2, with a pollen sum of 9 grains and 275 marker grains counted. *Pinus* (12 grains/cm^2) was present in trace amounts along with *Ulmus* (6 grains/cm^2). Cheno-am (18 grains/cm^2) was low but a trace of *Prosopis* (6 grains/cm^2) was also present. *Cleome* (12 grains/cm^2) was also present.

FS 201, One-Hand Mano

The area sampled consisted of 75.36 cm^2 and the area measured 10.79 by 6.98 cm. The assemblage contained 13 grains/cm^2 total pollen concentration values. Cheno-am (8 grains/cm^2) and high spine Asteraceae (3 grains/cm^2) were present but only in low amounts. Two grains of indeterminate pollen (3 grains/cm^2) were also present.

Table 18. Scientific and Common Names of Plant Taxa Used in This Report

Family	Scientific Name	Common Name
Amaranthaceae	*Amaranthus*	Pigweed
Asteraceae	Composite Family	
	Ambrosia	burage
	Artemisia	sagebrush
	Helianthus	sunflower
	Lactuca	Lettuce
	Taraxacum	dandelion
	Chichoreae	Tribe of Asteraceae, heads are ligulate flowers
	Liguliflorae	Fenestrate type pollen
	Low Spine	spines<2.5/height
	High Spine	spines>2.5/height
Cactaceae	Cactus Family	
	Opuntia	Prickly Pear or Cholla
	Cylindropuntia	Subgenus of *Opuntia*, Cholla
	Pltyopuntia	Subgenus of *opuntia*, Prickly Pear
Capparidaceae	*Cleome*	bee-weed
Chenopodiaceae	*Chenopodium*	Goosefoot lambs quarters
	Cheno-am	family Chenopodiaceae and the genus *Amaranthus*
Fabaceae	*Prosopis*	Mesquite
Fagaceae	*Quercus*	Oak
Pinaceae	*Pinus*	Pine Family
Poaceae	*Zea mays*	Corn
Polygonaceae	*Polygonum*	Knotweed, Smartweed
Rosaceae	*Shepherdia*	Buffaloberry
Ulmaceae	*Ulmus*	Elm

Table 19. Raw Pollen Counts and Concentration Values

FS Number	200	201	301
Artifact Type	one-hand mano	one-hand mano	basin metate
Provenience	Surface Structure, Floor 1	Surface Structure, Floor 1	Surface Structure Floor 1
Pinus, raw count concentration	2 12	0 0	2 1
Quercus, raw count concentration	0 0	0 0	1 1
Ulmus, raw count concentration	1 6	0 0	1 1
Shepherdia, raw count concentration	0 0	0 0	2 1
Polygonum, raw count concentration	0 0	0 0	1 1
Prosopis, raw count concentration	1 6	0 0	1 1
Cheno-am, raw count concentration	3 18	5 8	36 19
Asteraceae hs, raw count concentration	0 0	1 2	5 3
Asteraceae ls, raw count concentration	0 0	0 0	6 3
Artemisia, raw count concentration	0 0	0 0	2 1
Indeterminate, raw count concentration	0 0	2 3	0 0
cf. *Cleome*, raw count concentration	2 12	0 0	0 0
Sum	9	8	57
Total	55	13	31
Marker	275	217	274
Maximum Potential Concentration	2.03	0.38	0.12

FS 301, Basin Metate

The area washed from this artifact was 182 cm^2 and the area sampled measured 14-by-6.98 cm. The assemblage contained a total pollen concentration value of 31 grains/cm^2. *Pinus, Quercus,* and *Ulmus* pollen were present in trace amounts (1 grain/cm^2 each). Cheno-am (19 grains/cm^2), both high and low spine Asteraceae (3 grains/cm^2 each), and *Artemisia* (1 grain/cm^2) were present but in low amounts. Additionally, pollen of *Shepherdia, Polygonum,* and *Prosopis* (1 grain/cm^2 each) were also present.

Discussion

The majority of the pollen from these artifacts consisted of background pollen types. The arboreal pollen types such as *Pinus, Quercus,* and *Ulmus* were present only in trace amounts. *Ulmus* is not native to New Mexico, but has been intentionally planted, historically, as an ornamental. Undoubtedly, this taxon represents modern contamination. The presence of small amounts of *Prosopis* and Cheno-am pollen is not unexpected in this area since both taxa were present in the flotation samples.

Cleome pollen was recovered only from the one-hand mano (FS 200) and may suggest processing of this material. Likewise *Polygonum* pollen was recovered only from the metate (FS 301) and similarly may indicate processing of this material. There was a much greater number of taxa recovered from the metate than from either of the two manos. While a greater number of taxa were present, none were present in much over trace amounts. This might suggest that taxa such as *Polygonum* were simply part of the local vegetation.

Based on the pollen taxa recovered, the question always arises, Are economic taxa absent from these assemblages because they are truly not present, or, are they present in such small amounts to have been missed during sampling? In order to assess the likelihood of their being missed, the estimated maximum potential concentration values of target taxa was computed. Since the entire slide was examined (either by count or low magnification scan of the slide) the estimated number of marker grains per slide was computed by averaging the number of marker grains per transect and multiplying this by the total number of transects examined, assuming that the first grain observed on a hypothetical second slide was one of the target taxa, the maximum potential concentration value can be computed. Thus, the number of the fossil grains is one, and the number of marker grains per slide is substituted for the number of marker grains counted in the pollen concentration formula. These data are presented in Table 19 and indicate that the estimated potential pollen concentration values fall between 0.12 and 2.03 grains/cm^2. Without examining the total of the pollen residues we can never be absolutely sure that target taxa are indeed absent from the assemblage. Given the low estimated potential pollen concentration values however, I conclude that it is more likely that the missing taxa were indeed absent from these assemblages.

Conclusion

The pollen assemblages from these artifacts were generally weak and most consisted of background pollen types in trace amounts. Some amount of recent contamination or mixing of the pollen assemblages is indicated by the presence of *Ulmus* pollen. The presence of Cheno-am and *Prosopis* pollen is not unexpected due to the presence of these taxa from the macrobotanical record. The single mano (FS 200) containing *Cleome* pollen proved to be the only clear evidence for use of the artifacts. *Cleome* pollen is insect pollinated and the pollen concentration value of 12 g/cm^2 is just too high to infer an accidental incorporation into the archaeological sediments.

CONCLUSIONS

The data recovery efforts at LA 110621 focused on refinement of the area chronology, an occupational history, and an assessment of how the site fits into the subsistence patterns that have been suggested for the Jornada Mogollon based on site activities and function. Radiocarbon (^{14}C) samples are used, in combination with architectural and ceramic data, to aid in refining the area chronology. The occupational history of LA 110621 is determined through the study of overlapping features, formal feature construction, artifact diversity, and accumulated discard areas. Subsistence and settlement patterns in the southern Rio Grande Valley are examined by inferences derived from the range of site activities and their relationship to site function, as well as the assembled data sets.

Site Chronology

The different efforts at dating the Mesilla phase of the Jornada Mogollon have varied in their assessments of the beginning and ending dates for the phase (Moore 1996). In the research design for LA 110621, Bullock (1997) stressed the need for precise dating to address site structural variability and duration of occupation. It was also hoped that precise dates would aid in the assessment of site use-life, population movements, settlement patterns, and community organization.

Precise dating of archaeological structures or features can also be achieved through the use of radiocarbon (^{14}C) dating. This dating technique is based on measurements of the amounts of specific types of radioactive carbon isotopes within organic material. Burned wood collected from the Floor 1 surface of Pit Structure 1, produced a date for the pit structure of cal A.D. 895-1115. If the "old wood" problem is taken into account, the date would probably be slightly older, but according to the ceramic assemblage, not by much. However, neither archaeomagnetic nor dendrochronology dating proved to be successful.

None of these dating techniques was successful in dating Structure 2 at LA 110621. Although the structure had burned, the shallowness of the structure had prevented the preservation of charcoal or burned wood. This made the application of both dendrochronology and radiocarbon dating impossible. The lack of an interior hearth precluded the use of archaeomagnetic dating.

A relative date of A.D. 850-A.D. 1100 was determined for Pit Structure 1 based on the recovered ceramic assemblage. A similar date was obtained from the ceramic assemblage for Structure 2. These dates fit well with our ^{14}C date of cal A.D. 898-1115.

A rectangular surface structure with a similar configuration to Structure 2 was excavated approximately 15 miles to the northwest of LA 110621 at the Northgate site (Aten 1972). This structure had a radiocarbon (^{14}C) date of A.D. 800-850, a date believed at the time to be too early for the associated ceramic assemblage (Aten 1972). If the "old wood" problem is taken into consideration for the Northgate ^{14}C date, the two structures become contemporaneous with each other.

The precise dating of LA 110621 at cal A.D. 895-1115 can be corroborated with a relative date for the site based on the comparison of the ceramic assemblage and site architecture with other Mesilla phase sites. For ceramics, this compares frequencies of ceramic types within the LA 110621 artifact assemblage with those from other Mesilla phase sites.

The ceramic assemblage from LA 110621 clearly dates the site to the Mesilla phase. The recovered ceramic artifacts exhibit the expected range of ceramic types present within a Jornada Mogollon assemblage, but not the expected ratio of utility brown ware jars to white ware bowls. This ratio is smaller than expected, but this could be a direct result of recent site modification. The only nonlocal ceramics present in the LA 110621 assemblage are Mimbres White Wares from the Mogollon area to the northwest.

Diagnostic lithic artifacts can also be used to determine a site's relative date. The most temporally sensitive lithic artifacts tend to be projectile points. Unfortunately, no projectile points, or other diagnostic lithic artifacts, were recovered at LA 110621.

Occupational History

An understanding of the occupational history of LA 110621 can be achieved through a determination of the occupational sequence of structures and features. Knowledge of the site's structure can also aid in unraveling its occupational sequence. Spatial patterns of activity and discard can reflect differences in length of occupation, site function, and group composition.

LA 110621 was originally believed to contain two physically overlapping pit structures and a midden deposit. Upon excavation, this proved not to be the case. One pit structure and one surface structure are the only features present on the portion of the site within project limits. The lack of external features at LA 110621 is at least partially due to earlier site modification through routine highway shoulder maintenance. This has both churned the original ground surface, and has also removed large portions of the cultural deposit as well as the upper portions of both structures.

Long-term habitation or seasonal sites should have a combination of artifact diversity, formal feature construction, and accumulated discard areas (middens or sheet trash deposits). Location, in areas of reliable water, is also indicative of long-term site use.

A study of Jornada Mogollon pit structures by Hard (1983) found patterns in pit structure form. His study found that pit structures are deeper in habitation sites, with the deepest located in the Rio Grande Valley. Shallower pit structures and surface structures are found to occur at short-term resource procurement areas away from the Rio Grande Valley (Hard 1983). Additional excavations in the area have confirmed this pattern (Moore 1996; Whalen 1977,1980a, 1980b, 1994a; Zamora 1993). Pit Structure 1 fits this model as a long-term habitation structure, while Structure 2 served as a specialized structure for seasonal or short-term use (Hard 1983).

Surface structures are usually considered indicative of short-term or seasonal use. However, when such a structure occurs on a long-term habitation site, this period of use applies to the task or series of tasks intended for the structure. In this manner it thus becomes a specialized structure, constructed for a specific use or function (Whalen 1977, 1994a). Specialized structures are constructed when their intended use is warranted to be important enough for the group or subgroup involved (Mishan 1973). The combination of both a deep pit structure and a specialized surface structure at the same site thus indicates long-term, multiseasonal use, even when they are utilized at the same time. A similar, slightly earlier combination of structures was found north of El Paso at the Northgate site (Aten 1972).

Although surface structures become common in the later El Paso phase of the Jornada Mogollon (Moore 1996), during the Mesilla phase they generally tend to serve as summer structures (Whalen 1977). One indication of this is their common lack of interior hearths (Aten 1972), a pattern followed with Structure 2 at LA 110621.

A single occupational episode is represented within each structure by the presence of a single floor. However, the length of these occupational episodes can vary from structure to structure. Based on the architecture of these two structures, Pit Structure 1 may have experienced a single, relatively short-term period of use. This is supported by the lack of charcoal smudging on the floor surface. The surface structure (Structure 2) seems to have also been utilized for a relatively short period of time.

How the two structures relate to each other temporally is problematic due to the lack of a precise date for the surface structure (Structure 2). Rough dates for the two structures, relative to each other, are possible through a comparison of their ceramic assemblages. However, this will only work if the time frame of use between the structures is great enough to be visible in the comparisons of the ceramic assemblages.

Both structures are dated by their ceramics to A.D. 850-A.D. 1100. While this suggests that they may have been utilized at roughly the same time, the wide range of the indicated time frame makes this only a possibility. However, the ^{14}C date from Pit Structure 1 of A.D. 895-1115 allows us to reduce the possible time frame for both structures to this same period.

A long period of occupation is also suggested for LA 110621 by the level of diversity within the artifact assemblage. Despite the modified nature of the site area, a number of activities are represented by the lithic artifacts recovered at LA 110621. These activities include the splitting of bone or wood (activities commonly associated with gravers), and both the scraping and cutting of unspecified material.

In contrast, the ceramic artifacts show a lack in the variety of forms present at this site. Specialized forms usually associated with specific tasks, such as ladles, water jars, etc., are missing from LA 110621. Although both bowls and jars do occur, the assemblage is dominated by a generalized intermediate form somewhat between these two forms in both shape and size.

Food processing is indicated by the ground stone artifacts. The spindle whorl suggests that spinning, if not also weaving, probably took place at LA 110621.

The research design called for the piece-plotting of artifacts as a way of identifying activity and discard areas. The scraped and churned nature of most of the site area limited the piece-plotting of artifacts to the interiors of the two structures.

Little patterning is evident for the artifact distribution within Pit Structure 1, due to the small number of artifacts present. Artifacts on the floor of Pit Structure 1 include a basin metate and the fragment of a two-hand mano, two lithic artifacts, and a single large corrugated sherd. While this suggests a number of possible activities for the pit structure, it also looks as if the structure was emptied prior to its abandonment and subsequent burning.

However, the large number of floor artifacts within Structure 2 indicates patterns of both form and intensity of structural use. The artifacts present within Structure 2 include six pieces of ground stone, a sherd modified into a spindle whorl, and a cache of ceramics including an almost whole pot. All of the artifacts are near the base of the walls, leaving the center of the structure clear.

The ground stone artifacts in Structure 2 are in two distinct clusters, located on opposite sides of the structure (the northwest and southeast corners). Each of these clusters contains a metate and two manos. Each pair of manos includes both a whole mano and an edge fragment. The presence of a complete ground stone tool kit of metate and manos within each artifact cluster suggests that each cluster represents one of two distinct work stations within Structure 2 (Schlanger 1991).

There are recognizable steps in the use-life process of ground stone. When ground stone artifacts become worn or broken the tendency is to horde them, possibly in the hope that they can be reused in some manner. Finally, ground stone items are discarded into a midden deposit or as sheet trash (Schlanger 1991). The positioning of these artifacts in groups within Structure 2, and their functional condition suggests they were still being used.

Additional artifacts on the floor of Structure 2 are also divided by their association with each cluster of ground stone. The spindle whorl is by the north corner of Structure 2, while the ceramic cache is located adjacent to the southeastern corner. Common ownership could be denoted for the artifacts within each artifact cluster, indicating that at least two individuals worked in Structure 2.

Although a wide range of artifacts are present on the floor of Structure 2, the main use of the structure was probably as a mealing room. Other activities are suggested by the other artifacts found on the Floor 1 surface. The whole pot may indicate storage. One artifact of note found on the floor of Structure 2 was a spindle whorl made from a large brown ware sherd. This suggests that spinning took place within Structure 2 as a pursuit of at least one of the individuals utilizing the structure.

Surprisingly there is also evidence of weaving, and possibly spinning, in the rectangular surface structure at the Northgate site. While no paraphernalia connected with either of these activities was present, intact fragments of woven fabric and cordage were recovered from the floor of that structure (Aten 1972).

The still functional artifacts in Structure 2 were found in position for possible reuse. Their presence within the structure suggests that Structure 2 was not abandoned prior to burning. Of course it is also possible that these artifacts were left in an intentionally burned structure for ritualistic reasons perhaps associated with closure or community cleansing.

Just to the north of LA 110621 is a large El Paso phase pueblo (LA 110620). The presence of this El Paso phase site adjacent to LA 110621 with its Mesilla phase structures, suggests that these may be portions of the same site. The two components represented would thus form part of a cultural continuum of long-term use of the site area. Whether this took place in the form of continuous or repeated use is not known.

Subsistence

Defining site subsistence necessitates knowing the range of on-site activities that would have taken place at that specific locale. On-site activities can be deduced from the locations and functions of site features. Descriptive information on features, combined with analysis of the associated artifacts and other cultural material can assist in determining feature type (Bullock 1997).

Information derived from the placement and functions of site features is limited at LA 110621. Only two features are present within the project area, and both of them are structures. No interior features are present within either of the structures. No extramural features of any kind are present within the project area.

Pit Structure 1 is a habitation structure. This interpretation is based on its size and depth, as well as the site location (Hard 1983). Based on the presence of ground stone artifacts, activities that took place within Pit Structure 1 include food processing. The deep basin metate present in conjunction with a two-hand mano, suggests that seed was processed in Pit Structure 1.

Structure 2 is a surface structure that may have functioned as a summer work area. A springsummer use for Structure 2 is suggested by the lack of an interior hearth. The primary use of the structure was as a mealing room, while secondary use probably included spinning. Patterns in the artifact assemblage, as well as the range and types of artifacts present, suggests that the structure was used by at least two women. Whether use of the structure was oriented by task or kinship group, is not known. Both forms of work groups are common historically among the Pueblos (White 1974).

In combination with structural information of feature-related activities, site activities can be investigated through analysis of the artifacts present. Artifacts recovered from LA 110621 include ceramics, ground stone, and lithic artifacts.

Ceramics, through the study of their forms and types, can reveal extensive information on the activities that would have taken place at a site. The ceramic assemblages from the two structures at LA 110621 are both too small to indicate more than specific artifact uses through a comparison at the structural level. The ceramics recovered from the rest of the site area, however, should potentially reveal more about the range and types of activities to have taken place.

The generalized nature of most of the ceramics recovered at LA 110621 is indicated by the form of the single whole pot recovered from Structure 2. Between a jar and a bowl in form, this pot reflects a generalized multi-use shape that could have functioned as either or a jar or a bowl. This general use container may symbolize the generalized Jornada Mogollon subsistence proposed by Whalen (1994a): a hunter-gatherer based subsistence supplemented by cultivated crops.

Lithic artifacts are the second method of identifying activities that may have been pursued at LA 110621. Specific forms of flakes are produced by different lithic material reduction strategies. Core flakes are produced on Jornada Mogollon sites as expedient and disposable tools. Biface flakes are produced during biface reduction, commonly in the production of specialized formal tools. Formal tools are produced for specific functions, although their use may not be limited to a single action. Lithic tools wear during use. Although attempts to show forms of wear to be task-specific have proved inconclusive (Brose 1975; Moore 1996), general interpretations of the range of activities represented by the lithic assemblage are possible.

Bifacial reduction, usually restricted on Jornada Mogollon sites to limited formal tool manufacture, has an extremely limited presence at LA 110621. The paradox is the greater than expected occurrence of formal tools, and the lower than expected number of biface reduction flakes within the lithic artifact assemblage. While this unusually heavy emphasis on formal tools suggests a corresponding emphasis on hunting-based activities, including not only hunting, but also possible game and leather processing, it may also represent a skewed sample based on the modified nature of the site.

Both cutting and scraping are represented in the lithic artifact assemblage. Animal processing is likely based on the existence of scrapers and cobble tools, either as butchering game or processing leather. This could include both basic leather processing or the creation and repair of garments.

For LA 110621 this suggests that although an expedient reduction strategy was pursued at the site, its focus was broadened to include a wide range of formal tools as well. This greater occurrence of formal tools in turn suggests a much greater emphasis on hunting within the subsistence strategy at LA 110621, while the low occurrence of bifaces suggests that formal tool production was not taking place at this locale. However, this view may be a by-product of the modified condition of the site.

Ground stone artifacts can also provide evidence of site activities. The presence of both one-hand

and two-hand manos and basin metate fragments are indicative of processing seed for consumption. While basin metates are the form common to Jornada Mogollon sites (Whalen 1994a), the increased efficiency provided by two-hand manos is usually associated with the processing of maize. One-hand manos are usually associated with the processing of gathered wild seed when found in combination with basin metates (Bartlett 1933; Lancaster 1986).

This suggests that maize crops were possibly grown in the vicinity of LA 110621. Cultivated crops in the vicinity of LA 110621 could have been grown either through dry-land farming techniques, or through the use of irrigated fields on the Rio Grande flood plain. Cultivated foods would have been supplemented with gathered plants, a common Pueblo practice (White 1974).

Pollen samples were collected from the surfaces of the ground stone tools. In addition, ethnobotanical samples were collected from a number of proveniences within both the pit structure and the surface structure. These studies focused on the identification of plant remains and their significance with regard to economic and subsistence practices. This form of analysis is not limited to plants utilized for food. Activities such as the weaving of baskets and matting, or the making of twine may be indicated by the results of this type of analysis. Unfortunately, due to poor preservation, no pollen was recovered from these tools.

Faunal remains represent another avenue for studying possible activities represented at LA 110621. The presence of faunal remains, especially in light of the high utilization present on the sites lithic artifacts, could indicate types and forms of faunal consumption. Unfortunately, no faunal remains were recovered from LA 110621.

Low bone frequencies in sheet trash deposits can result from both natural and cultural factors. Sheet trash deposits are subject to erosional and deteriorational forces, and to trampling and scavenging by resident dogs. The lack of a definable midden area at LA 110621 suggests that if the surface artifacts do represent sheet trash, it was a sparse deposit. However, this may be a skewed view caused by modification and removal of the site's surface by highway maintenance. Both sheet trash and midden deposits may be present at LA 110621 outside of the project area.

The site location represents an ecological edge area (Epp 1985), with both the plains to the west and the Rio Grande Valley a short distance to the east. Species expected within the region should represent the expanded variety of available animals due to the combination of ecotones present in the general site area. Known economic species present within the area of LA 110621 include deer, cottontail, and jackrabbit. Also available would have been a variety of animals and waterfowl drawn to the area by the presence of permanent water. The Jornada Mogollon at LA 110621 would have been able to take advantage of the expanded availability of this linear oasis.

The practice of hunting as part of Jornada Mogollon subsistence is well known (O'Laughlin 1980). However, the role hunting played within that culture remains to be determined. It has been suggested (Whalen 1994a), that the Jornada Mogollon practiced a hunting and gathering subsistence, supplemented with cultivated crops. The combination of long-term habitation coupled with the implements of a more generalized subsistence present at LA 110621 would support such a view. It is possible that the artifact assemblage at LA 110621 simply reflects a site-specific variation such as craft specialization or specialized food procurement. The combination of elements within the lithic artifact assemblage suggests a subsistence strategy with an emphasis on hunting and gathering, rather than the usually considered prehistoric Jornada Mogollon agriculturally dominated subsistence base. Any interpretation should also consider the possibility of skewed data resulting from the site's modified condition prior to excavation.

The possible activities represented by the artifact assemblage span the range of activities expected at a Jornada Mogollon habitation site. These include the processing of foodstuffs, spinning, and the production of stone tools.

The features and artifacts present at LA 110621 are evidence of a late Mesilla phase structural habitation site. Analysis of the artifact assemblages and structural features indicate that subsistence was probably based on hunting and the gathering of wild plants, supplemented by the possible cultivation of maize.

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APPENDIX 1. CLAY SAMPLES COLLECTED FROM THE PHANTOM PALMS PROJECT AREA

#	Location	Natural color	Refired color
1	Clay near surface puddle near Anthony, NM, Fair plasticity.	7.5YR 6/4 light brown	5YR 7/4 Pink
2	Road cut east of Santa Teresa, 0.5 m below ground surface, Good plasticity	10YR 7/3 pale brown	2.5YR 6/8 light red
3	Soil clay in agricultural field just east of Santa Teresa, Good plasticity	10YR 6/3 light yellow brown	2.5YR 6/8 red
4	Soil clay in fields just north of Santa teresa, Excellent plasticity	7.5YR 6/2 very light brown	2.5YR 5/8 red
5	Clay bank just south of Santa Teresa school, Excellent Plasticity	10YR 7/3 pale brown	2.5YR 5/8 red