MUSEUM OF NEW MEXICO

OFFICE OF ARCHAEOLOGICAL STUDIES

ARCHAEOLOGICAL AND ETHNOHISTORICAL STUDY IN THE HOSPAH-WHITEHORSE AREA: THE NM 509 PROJECT, McKINLEY COUNTY, NEW MEXICO

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ADMINISTRATIVE SUMMARY

Between November 8 and December 16, 1988, the Office of Archaeological Studies (formerly the Research Section, Laboratory of Anthropology), Museum of New Mexico, completed a data recovery program for five archaeological sites that extended into the construction corridor for NM 509 in McKinley County, New Mexico. The road construction was proposed by the New Mexico State Highway and Transportation Department (NMSHTD). Archaeological and ethnohistorical investigations were conducted for each site.

LA 59958 was a multicomponent site with a late Archaic period to early Basketmaker III artifact scatter with pit features and a middle twentieth-century Navajo homesite and artifact scatter. The prehistoric artifacts were collected and the features were excavated. Two historic period features were partially excavated, and the surface artifacts within the project corridor were recorded. The site was on land acquired by the NMSHTD from private sources.

LA 59959 was the collapsed remains of a Navajo sweat lodge with associated artifacts and artifacts from a Navajo residence located east of the right-of-way. The sweat lodge was used from the late 1940s to the mid 1960s. The site was on New Mexico State Trust land.

LA 59961 was the upright juniper bough frame of a Navajo sweat lodge and associated features. It was used during the late nineteenth or early twentieth century. The juniper poles were moved to a location outside the project corridor. The site was on Navajo Tribal Trust land.

LA 59962 was a large Navajo homestead group that included seven masonry hogan foundations and twenty associated features and refuse areas. The site was occupied from 1930 to 1955. A large sample of artifacts was recorded and two refuse areas were sample-excavated. The site was on Navajo Tribal Trust land.

LA 59963 was a rock pile with associated artifacts. A homestead unit and sheep pens were nearby, but outside the project corridor. The ethnohistorical investigation determined that children had cared for their pets at the rock pile location. No archaeological work was conducted at the location. The site was on Navajo Tribal Trust land.

The archaeological and ethnohistorical investigations of the historic components provided data for addressing issues of chronology, subsistence and economic status, and changing group size, composition, and social values for members of the Navajo Tribe from 1930 to 1960. The prehistoric component at LA 59958 was studied in terms of proposed subsistence models for the late Archaic period hunter-gatherers of the San Juan Basin in northwestern New Mexico.

MNM Project No. 41.445
NMSHTD Project No. ST-(S)-1344(203)
Navajo Nation Cultural Resources Investigation Permit No. C8805, expiration date February 1, 1989
Bureau of Indian Affairs Federal Archeological Resources Protection Act Permit No. ARPA-99-006, expiration date February 1, 1989
New Mexico State Excavation Permit No, SE-38, expiration date 8-16-89
New Mexico State Trust Land Archaeological Excavation Permit AE-33, expiration date 8-25-89.

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The project ethnohistorian would like to thank the residents of the Whitehorse area, the chapter president, Leonard Tsosie, the chapter manager, Nelson Sandoval, and Emery Chee of the BIA, Land Operations Office, for their cooperation during the interviewing process. Special thanks goes to the Cupp family for all their time and effort donated to providing information about the Whitehorse area. Finally, my appreciation and thanks goes to Lena Tully, the interpreter for the survey, without whom this research would not have been possible.

The project director would like to thank everyone involved with the project, but especially Dr. Bart Olinger, Los Alamos National Laboratory, for the generous time spent on the obsidian source identification.

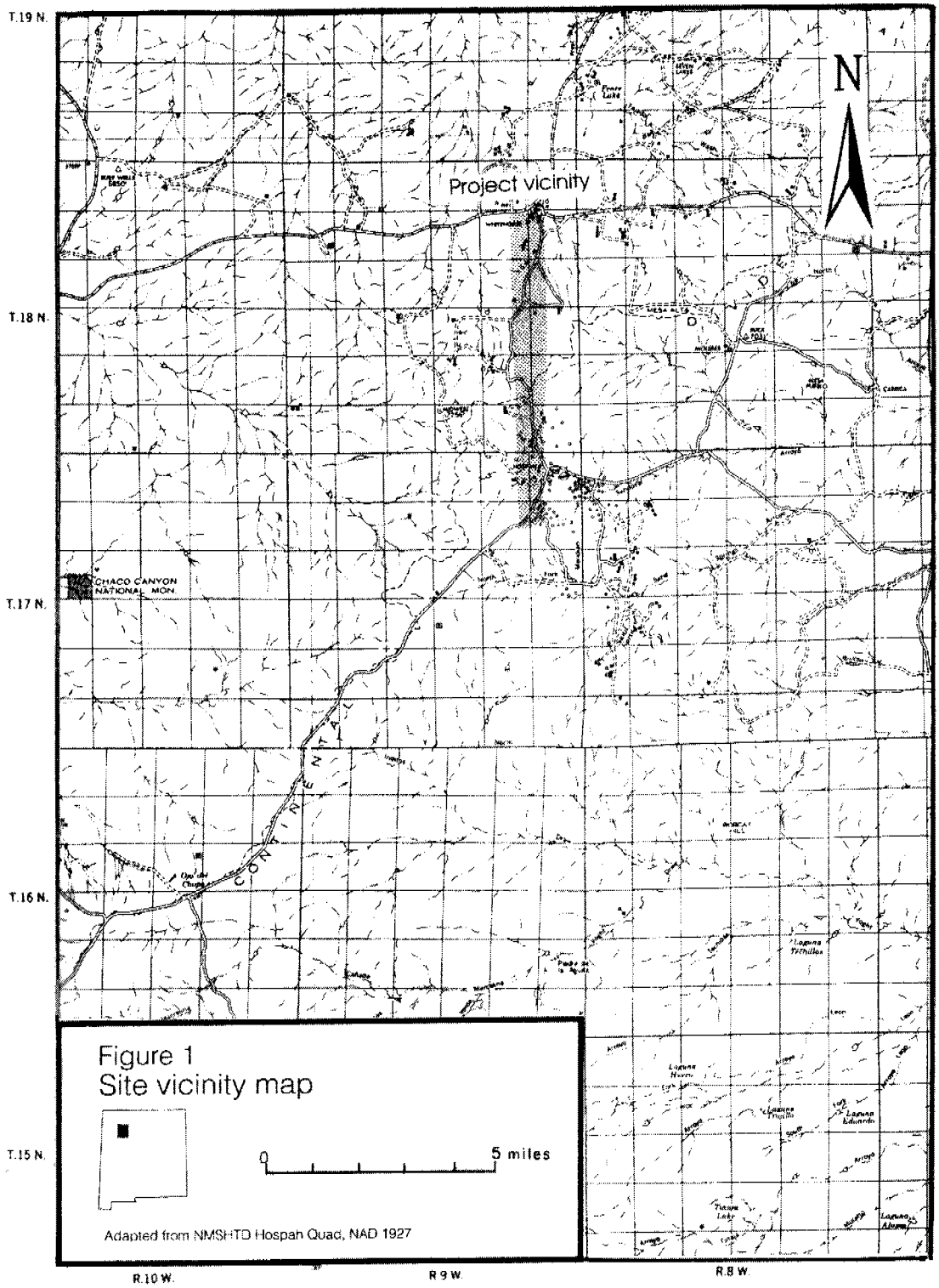
INTRODUCTION

From November 5 to December 16, 1987, the Office of Archaeological Studies (formerly the Research Section, Laboratory of Anthropology), Museum of New Mexico, carried out a data recovery program at five sites for the New Mexico State Highway and Transportation Department (NMSHTD). The five sites were located partly within the project corridor for NM 509 between Hospah and Whitehorse in McKinley County, New Mexico (Fig. 1). The NMSHTD replaced the county road with a paved state highway. The data recovery program followed the data recovery plan outlined in Post (1987). The principal investigator was David A. Phillips, Jr. The project director was Stephen S. Post, assisted in the field and laboratory by J. Scott Geister, Rhonda Main, and Guadalupe A. Martinez. The project ethnohistorian was Kathleen M. Stemmler from Flagstaff, Arizona.

The five sites were on land administered by three different agencies. LA 59958 was on land acquired by the NMSHTD from private sources. LA 59959 was on New Mexico State Trust land. LA 59961, LA 59962, and LA 59963 were on Navajo Nation Tribal Trust land. Legal descriptions for the sites are in Appendix 13 (deleted from copies in general circulation).

The data recovery effort included archaeological excavation, recording of artifacts and features, and ethnohistorical interviews of former site and area residents, and a review of documents available at the Navajo Tribal Eastern Agency offices in Crownpoint. The data recovery was conducted under the provisions of Navajo Nation Cultural Resources Investigation Permit No. C8805, expiration date February 1, 1989; Bureau of Indian Affairs Federal Archeological Resources Protection Act Permit No. ARPA-99-006, expiration date February 1, 1989; New Mexico State Excavation Permit No, SE-38, expiration date 8-16-89; New Mexico State Trust Land Archaeological Excavation Permit AE-33, expiration date 8-25-89.

The report is divided into two parts. The first part includes the description and analysis methods and results for the prehistoric component from LA 59958. The second part includes the data recovery methods, description, interpretation, ethnohistorical study, and synthesis for the five historic period sites. The Environment section provides a setting for the entire project.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Project vicinity
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Figure 1
Site vicinity map
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5 miles
Adapted from NMSHTD Hospah Quad, NAD 1927

ENVIRONMENT

The project area is in the southern half of the San Juan Basin and is described in Loose (1978a). The physiographic feature that forms the border of the southern San Juan Basin is the Chaco Slope. The Chaco Slope falls gently northward with a structural contour relief of 762 m (2,500 ft) from Crownpoint to the Chaco River. It is primarily a flat land broken by mesas, cuestas, and low terraces dissected by sandy bottomed arroyos and washes. Drainage patterns are dictated by the Continental Divide. Northern tributaries drain to the Chaco River and southern drainages to the Rio Puerco of the West. The arid to semi-arid climate is characterized by summer dominant precipitation patterns, a broad range in diurnal temperatures, and moderate to long frost-free intervals. The soils are predominantly derived from residual sandstone erosion and support a steppe-grassland with piñon and juniper on the mesa tops and slopes. Surface water is scarce, and the ground water is deep and slightly saline.

The sites are at the north end of the Chaco Slope, northwest of the Rio Puerco of the East and the Mount Taylor volcanics (Fig. 2). It is characterized by gentle slopes, narrow and broad valley bottoms, and low mesas and terraces at elevations ranging between 1,829 to 2,134 m (6,000 to 7,000 ft). The major physiographic feature is the Continental Divide, which dictates drainage patterns and to some extent weather patterns (Loose 1978a:17).

The geologic formations that underlie the modern landscape formed during the Mesozoic era and are Cretaceous sandstones interbedded with shales. During the Cretaceous period many cycles of continental and marine sedimentation occurred. The resulting strata are dominated by buff and gray sandstones interbedded with gray to black shales, most of which are assigned to the Mesa Verde group. Coal is common in this formation (Loose 1978a:17).

The soils are categorized within the moderately dark-colored soils of the desertic region and are composed of three major associations: Las Lucas-Litle-Persayo, Rock Land-Travessilla, and Hagerman-Travessilla (Maker et al. 1974b).

The Las Lucas-Litle-Persayo association occurs on gently to steeply sloping and rolling uplands of the southern end of the project area. The soils are light to moderately light colored, calcareous, and highly erodible, and they are forming predominantly in materials weathered from gray and olive shale (Maker et al. 1971).

The area surrounding Hospah is an island of Rock Land-Travessilla association. It is characterized by a rough and broken topography with great local relief manifested in steep canyon walls, escarpments, and narrow valley floors. Outcrops of sandstone and shale are common in the canyon walls and escarpments (Maker et al. 1971). Hospah is on the Continental Divide, which provides easy access north into the Chaco drainage basin or south into the Rio Puerco of the East drainage basin. No agriculturally productive land is near Hospah. The Indito and Vogt Draw area, 9.6 km (6 mi) to the southwest, may have been suitable for farming (Loose 1978b:388).

The soils near Whitehorse are of the Hagerman-Travessilla association. The topography is dominated by gentle to strong sloping uplands occasionally broken by steep and rough escarpments and gently sloping to level valley bottoms. Mesa top soils are shallow to deep, formed from sandstone residuals. The slope and valley soils are formed of alluvial and eolian sediments

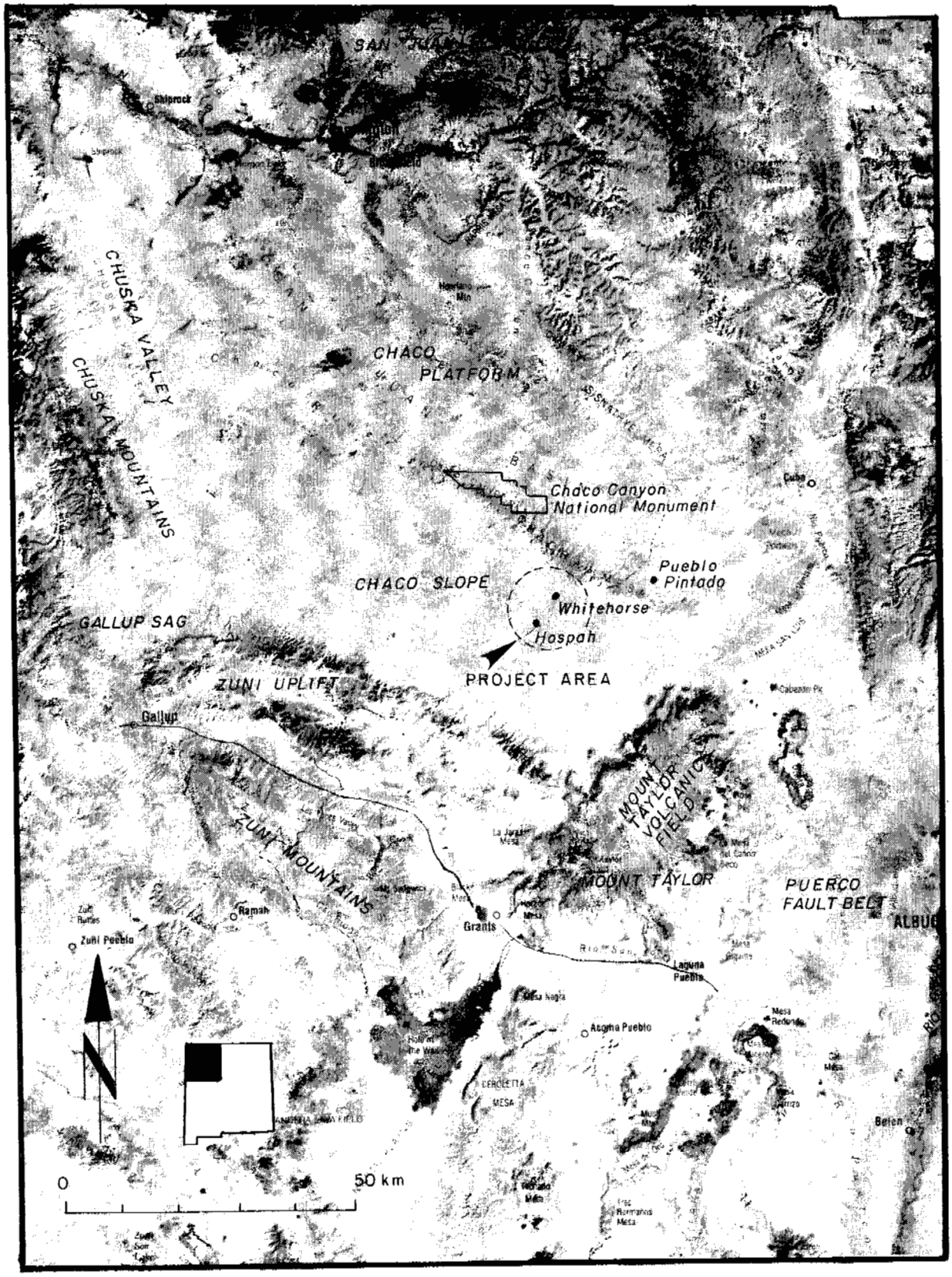


Figure 2. Regional map of land forms and towns.

of mixed origin (Maker et al. 1974b). The gently sloping valley bottoms and plains support plant species suitable for grazing.

The precipitation pattern is summer dominant, with winter precipitation providing only 25 percent of the annual total. Annual precipitation is between 178 and 256 mm (7 and 14 inches), with the Hospah area receiving more than the surrounding areas. Prolonged storms are uncommon, and short, violent storms account for much of the summer rainfall (Ferrill 1978). This rain pattern would make farming unpredictable. Water control and storage would be necessary for reliable domesticated plant growth and maturation.

The seasonal temperatures vary greatly, with a 10 degrees C (50.5 degrees F) mean recorded for Crownpoint. The temperatures on the Chaco Slope may vary slightly because of seasonal meteorological phenomena. Seasonal phenomena cause air to stagnate and allow it to heat up or cool down more than in areas of similar elevation. The average frost-free interval for Chaco Canyon is 141 days with a range between 110 and 180 days. The evapotranspiration rate ranges from 559 to 762 mm (22 to 30 inches) for the project area, and the moisture deficit ranges from 254 to 356 mm (10 to 14 inches) (Ferrill 1978).

The limited amount of surface water available for human use changes both seasonally and annually. Sandoval Arroyo heads immediately west of Hospah, with the LA 59958 ridge top forming its north edge. Sandoval Arroyo is a dry wash and would only carry water during heavy summer thunderstorms. It was probably not a prehistoric water source. If Sandoval Arroyo was a factor in site location during prehistoric times, it was likely for the plant communities it supported. Sand Springs Arroyo is 4.8 km (3 miles) to the south of LA 59958 and may have been a prehistoric water source during wetter years. It is too distant, however, to have strongly influenced the decisions that resulted in settlement at LA 59958.

The general vicinity of Hospah and Whitehorse is covered with Grama-Galleta Steppe and Snakeweed grassland. The floral association is desclimax with dominant snakeweed and lesser amounts of blue grama, dropseed, galleta, and rice grass. The mesa and terrace tops and slopes are covered with varying densities of piñon and juniper woodlands. This environment supports a limited faunal population composed primarily of small mammals, lizards, grassland adapted birds, mourning dove, quail, and raptors. Large mammals and predators are infrequent visitors to this area (Whitford 1978). The modern pollen record includes cheno-ams, cactus, sage, and high and low spine composites. Many of these plants were food sources for Archaic and Anasazi populations. Most of the economic species mature in the late summer or early fall.

THE LATE ARCHAIC TO BASKETMAKER III COMPONENT AT LA 59958

Examination of the site surface at LA 59958 revealed a previously unrecorded prehistoric component underlying and mixed with the modern Navajo component. The following section provides an archaeological context, excavation methods, feature and artifact assemblage descriptions, and interpretations using chronological, technological, functional, and spatial data.

Late Archaic to Early Basketmaker III Period Occupation of the Chaco Slope

The span from 800 B.C. to A.D. 700 includes the Late Archaic to Basketmaker III periods. During this time in the northern Southwest, and more specific to this study, the San Juan Basin and its peripheries, prehistoric settlement patterns and subsistence practices changed markedly. This period incorporated a change from a mobile, Archaic hunting and gathering settlement and subsistence pattern to a less mobile Basketmaker III settlement pattern with an increased reliance on cultivated foods (Hogan 1986; Vierra 1988). During the Late Archaic period, increased sedentary behavior combined with the maintenance requirements of early farming resulted in the construction of more substantial architecture and subsistence-related features (such as large storage pits and slab-lined hearths) (Irwin-Williams 1973). Shallow pithouses of the Late Archaic-Basketmaker II period became large, deep structures. These structures had formal interior features including benches, storage pits and bins, and hearth ventilator complexes. The pithouses and interior features were benchmarks of the Basketmaker III period. Changes in projectile point technology and the introduction of pottery making were also diagnostic of the Basketmaker III period.

Change in Late Archaic period site structure and settlement patterns were initially viewed as gradual and uniform across space and time (Irwin-Williams 1973). Recent studies of the Late Archaic period to early Basketmaker III transition from hunting and gathering to an agriculture-based economy show that the transition may have been spatially and temporally variable in the San Juan Basin and its peripheries. This evidence of variability results from the large amount of cultural resource investigations that have accompanied energy and land development in the northern and central San Juan Basin. Survey data have been collected for a large part of the San Juan Basin (Wait 1983; Reher 1977; Scheick 1981; Hogan 1986), while excavation data are more restricted to the northern San Juan Basin (Moore and Winter 1980; Kirkpatrick 1980; Simmons 1982; Vogler et al. 1982, 1983; Hogan and Winter 1983; Kearns 1988). The survey data have contributed a broad perspective on Late Archaic period to early Basketmaker III period settlement and subsistence patterns. The excavation data have been used to test models that attempt to explain change in hunter-gatherer population social and economic organization through time.

Excavations and survey in Chaco Canyon along Gallo Wash indicate that Archaic populations were common and well established by the Middle Archaic period (Simmons 1982). Nearly five times more Middle to Late Archaic period sites were identified over Early Archaic period sites (Simmons 1982:25). This pattern is also true of the Bisti-Star Lake area east of Chaco Canyon, where Middle to Late Archaic period sites were double the number of Early Archaic period sites (Huse et al. 1978:130). Wait (1983) suggests that 32 sites in the Star Lake region could date to the Late Archaic-Basketmaker II period. However, only five of the sites had diagnostic artifacts; the others were intuitively classified as late Basketmaker II. No Early or Middle Archaic period sites were identified. Even if we disregard the intuitively classified site frequency, the pattern of greater numbers of Middle and Late Archaic sites remains strong.

By comparison, five projects in the northern San Juan Basin show peak occupation during the Middle Archaic period with a decrease during the Middle to Late Archaic period. Hogan (1986:13) suggests that the Middle Archaic focus on the central and northern San Juan Basin shifted to the eastern periphery by 600 B.C. The survey data suggest that this shift included the southern and southeastern periphery as well. A reoccupation of the northern San Juan Basin occurred between 200 and 300 B.C. (Hogan 1986:13), and it included a heavier reliance on cultigens and more permanent storage and habitation features.

Closer to the project area, the South Hospah survey (Scheick 1981) had 5 Middle Archaic components and 12 Late Archaic-Basketmaker II-Basketmaker III components. This supports the pattern for the Chaco Canyon area (Simmons 1982; Huse et al. 1978) of increased Late Archaic-Basketmaker II use of the area. Only 1 Basketmaker III component was recorded. This reflects the general paucity of Basketmaker III sites in the general area, except around Chaco Canyon (Hayes et al. 1981:23). Scheick suggests that the sites reflect an emphasis on gathering and processing of grass seed. This pattern fits a forager strategy, where the daily gathered seeds would be consumed, and not stored (Binford 1980). The small number of projectile points and bifaces suggests that hunting was a secondary activity (Scheick 1981).

The more intense Late Archaic-Basketmaker II use of the area may have coincided with lower plant seed yields in the dryer, lower elevation areas on either side of the Continental Divide (Scheick 1981:131). The Hospah area would have been used as a buffer during dry years. The use was probably sporadic, resulting in sites with low artifact and feature frequencies scattered over large dune areas. This pattern is supported by the absence of sites that exhibit evidence of intensive or residential occupation. The low artifact and feature frequency can be viewed as limited activity or processing sites. Other activities with low archaeological visibility are evidenced by the over 200 lithic artifact isolated occurrences found in the project area. This large number of isolated occurrences suggests that resource procurement or extraction sites may not be as invisible in the South Hospah area as suggested for other areas (Vierra 1980).

The Bisti-Star Lake survey identified 28 late En Medio/Armijo and En Medio phase components (Huse et al. 1978:46). This was a significant increase in site numbers over previous Archaic periods. Sites were divided into campsites, special activity-temporary camps, and hunting sites. Hunting sites were isolated occurrences of projectile points. Campsites were defined as "locations of habitation where many activities would take place, campsites should reflect the greatest artifact diversity" (Huse et al. 1978:53). Two base camps as defined by Irwin-Williams (1973) were identified and may indicate fall or winter occupation (Huse et al. 1978:62). Special activity-temporary camps were "generally minimal in size and in artifact diversity, reflecting either a limited use, special activity or a temporary camp" (Huse et al. 1978:53). All Archaic period special activity-temporary camps averaged 12.2 artifacts per site over an average area of 758 sq m (Huse et al. 1978:53).

The late Armijo-early En Medio phase had six components: three were campsites, two were temporary camps, and one was a scavenged or displaced projectile point. The campsites were on stabilized dunes 250 to 350 m from a wash. The two temporary campsites were in sparse vegetation areas 4.5 to 4.8 km from the nearest wash (Huse et al. 1978:66).

The 22 En Medio phase components included 13 campsites, three temporary campsites, three hunting sites, and three occurrences of curated items (Huse et al. 1978:66). Site locations show some change from earlier sites. Five campsites are at dune ridges near washes and fit the earlier settlement pattern. Five campsites clustered on an isolated mesa near a major wash, three of which are larger and more complex campsites, and two have many hearths and slab-line cists. The latter two may be

fall or winter base camps according to Halasi (in Huse et al. 1978:67). Three more campsites show a shift to upland use with sites occurring on ridges on large mesa tops. These were the first campsites found in the upland environment (Huse et al. 1978:67). One campsite fits Irwin-Williams's (1973:12) criteria for a fall or winter camp (Huse et al. 1978:67).

An important event in the Archaic period archaeological record for the south-central and eastern San Juan Basin is the addition of corn to the subsistence mix. The earliest evidence of use of cultigens comes from the Gallo Wash excavations, where it has been associated with a radiocarbon date of 3,680 B.P. (Simmons 1982:808). This date is much earlier than suggested for the introduction of corn in the northern portion of the San Juan Basin, where its dated occurrences range between 2100 and 1600 B.P. (Vierra 1985, 1988; Hogan 1986). Despite its early introduction, corn may not have been a major dietary contributor until between 200 B.C. and A.D. 300, when climate conditions were optimal for farming in the San Juan Basin (Hogan 1986:12-13). This has led some investigators to surmise that the adoption of corn as an important food occurred at different rates across the San Juan Basin (Hogan 1986; Kearns 1988; Vogler et al. 1983).

LA 59958 Site Description

LA 59958 is at an elevation of 2,133.6 m (6,998 ft) on a low ridge that extends to the north edge of an east to west trending unnamed draw, a tributary of Sandoval Arroyo. The highest point of the ridge affords a 360 degree view, with an especially long view to the east-northeast along the Sandoval Arroyo, which drains into the Rio Puerco of the East. The Jemez Mountains are visible to the east and Mount Taylor is visible to the southeast. The horizon in all four directions is delineated by exposed sandstone faces of low mesitas or by rising tableland. The mesa tops and knoll tops are dotted with piñon-juniper, grama grass, ring muhly, clumps of prickly pear, and an occasional yucca.

The top soil of the site is loose, brown, eolian sand. It overlies light yellow-brown to brown sandstone. Sandstone is abundant and exposed on the southern slopes of the ridge. The north and west slopes are primarily deep eolian dune deposits.

Excavation of the prehistoric component of LA 59958 yielded lithic artifact concentrations and subsurface features. The lithic artifacts included debris from tool production and maintenance, evidence of tool use, and ground stone. The 19 subsurface features were mostly simple hearths and amorphous stains.

Data Recovery Methods for the Prehistoric Component at LA 59958

All the surface lithic artifacts within the right-of-way were collected in a 4-by-4-m grid system used for the historic artifact recording. The lithic artifacts were bagged and the grid designation was written on the bag.

The surface-collected lithic artifacts were counted and the frequencies plotted on a grid map. From this map, units were selected for surface stripping. Surface stripping was done with a flat shovel. The loose sandy top soil was removed in one level that ranged from 2 to 10 cm deep, depending on the depth of more compacted soils. All surface stripped soil was screened through ¼-inch wire mesh. The artifacts were put into bags labeled with the grid designation. Projectile points, bifaces, and manos were separated out as they were encountered.

Stripping revealed 18 features that were not visible on the surface. These features were flagged and left until the stripping was nearly complete. Features were excavated in a standard manner. Each feature was swept or scraped until an outline was visible. One-half of the feature was selected for excavation. Half was excavated in arbitrary 5 or 10 cm levels until the bottom was reached and the walls defined. A stratigraphic feature profile was drawn if distinct soil levels were visible. If distinct levels were present they were characterized by differences in color, texture, and charcoal content. We did not have a Munsell Soil Color Chart in the field, so colors were described as different shades of tan, brown, red, or gray. If no distinct soil strata were present, the remaining half of the feature was excavated as a level. If distinct strata were visible, they formed the basis for excavating the remaining half of the feature.

Flotation, pollen, and carbon-14 samples were collected from appropriate deposits within the feature. Flotation samples generally consisted of at least 1 liter of soil from the lower feature fill. Pollen samples were collected from the bottom or sides of the features in an attempt to minimize contamination by post-use deposits. Charcoal flecks and chunks were collected from any concentration encountered within a feature. Archaeomagnetic dating was not possible because the soil lacked sufficient clay content for sample collection.

After each feature was excavated, it was described on a field journal form. Descriptive information included location, length and width or diameter, the orientation of the measurement, depth, shape, construction, fill characteristics, and any observations that might relate to its inferred function. Each feature was photographed, drawn in plan and profile, and located on the site map.

As a final check for subsurface features, about 700 sq m, the site surface within the right-of-way were scraped with a heavy equipment blade in 10 to 20 cm levels. The sandy soil was removed until the scraped area elevation was similar to the level at which the features occurred on other parts of the site. One additional feature was exposed by the scraping.

The site area within the right-of-way was mapped with a transit, 30-m tape, and stadia rod. Both cultural and physiographic features were mapped. The limits of the site were defined by the extent of the artifact scatter.

Feature Descriptions

Surface stripping the loose eolian sand from the site surface exposed oultines of 19 prehistoric features (Fig. 3). The features were sorted into three kinds based on shape: irregular, circular, and oval. This section will summarize the feature descriptive data. Descriptive data for each feature is in Appendix 1. The ethnobotanical analysis is provided in Appendix 2. Results from the pollen analysis are provided in Appendix 3. Radiocarbon data are provided in Appendix 4.

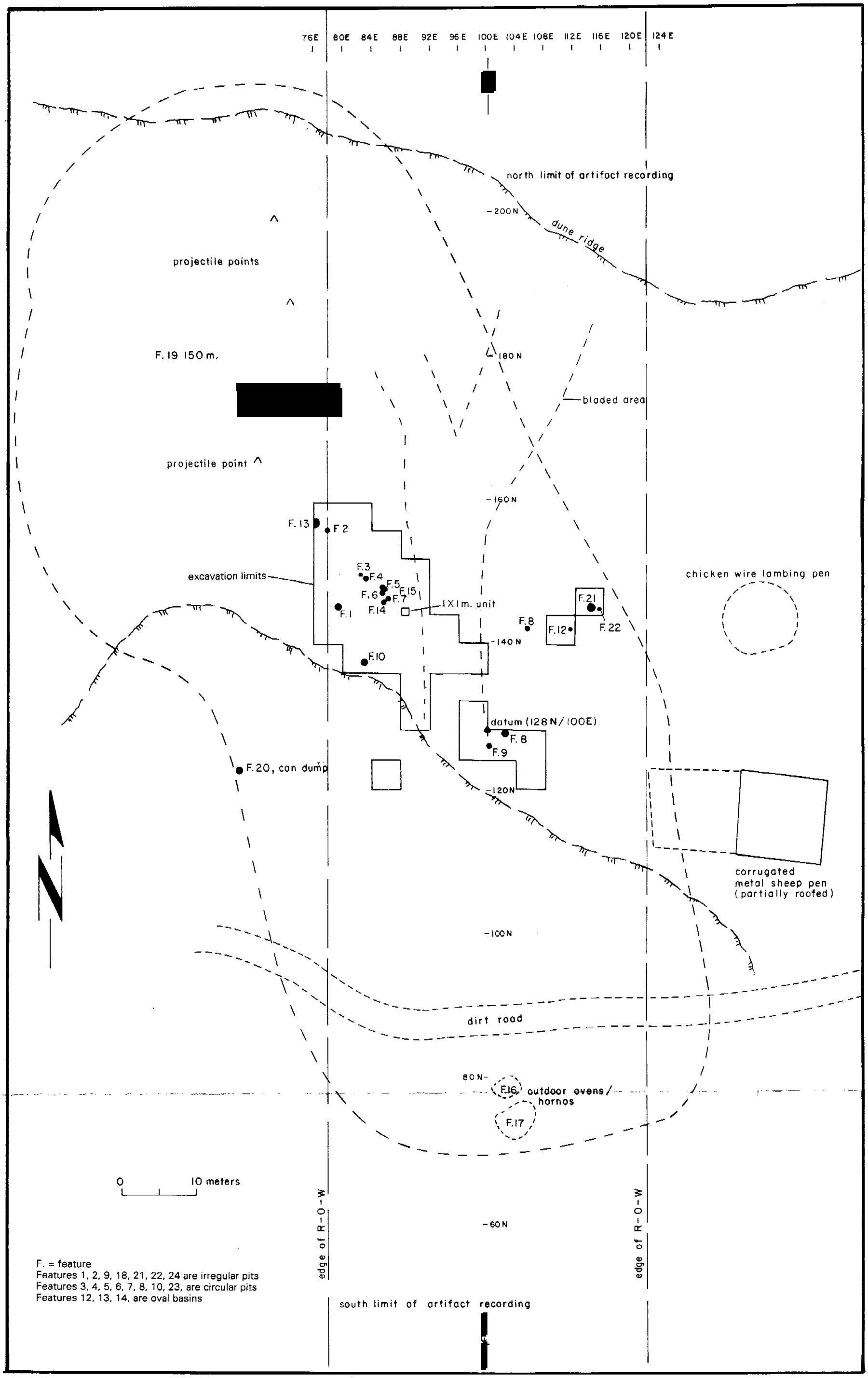


Figure 3. Site map, LA 59958.

Seven irregular pits were identified (Feature 1 [Fig. 4], Feature 2 [Fig. 5], Features 9, 18, 21, and 22 [Fig.6], and Feature 24). They were classed as irregular because they lacked a formal geometric shape and their edges were discontinuous and difficult to define. Dimensions ranged from 60 cm long and 50 cm wide to 300 cm long and 200 cm wide, with depths between 8 and 14 cm, and volumes ranging between 27.5 l and 569.9 liters. They had irregular sloping sides and irregular bottoms. All the interiors were lightly burned. Five features had very dark brown to dark gray-brown, charcoal- and ash-impregnated soil. Two features had brown to gray-brown soil with light charcoal staining and content. Five features had two or more oxidized sandstone slabs, and two features had two or more unburned sandstone slabs mixed in the fill. Only Feature 21 had a burned economic plant taxon *(Sporobolus),* but it occurred in low numbers and could have been incidental to the feature fill. Feature 2 yielded a calibrated radiocarbon date range of A.D. 233 to 466.

Nine circular or nearly circular features were identified (Features 3, 4, 5 [Fig. 7], 6, 7, 8, 10, 15 [Figs. 8 and 9], and 23). They were classified as circular if two perpendicular diameters were within a 10 cm range. Dimensions ranged from 20 cm long by 20 cm wide to 64 cm long by 54 cm wide, 5 to 20 cm deep and with volumes ranging between 3.8 to 457.8 liters. All circular features had sloping or vertical sides, usually with an even basin-shaped bottom. Two features had interiors that were hardened and heavily burned; four were lightly burned, and three showed no evidence of alteration by fire. The feature fill in three features was dark gray to gray- brown charcoal and ash stained. Three features had light gray-brown soil with moderate charcoal staining and charcoal flecks. Three features had unstained brown soil with occasional charcoal flecks. Burned sandstone fragments were mixed with the fill of three features. Unburned slabs were mixed in the fill of three features. The three remaining features had no slabs in the feature fill. Burned economic plant taxa were identified from three features, with one feature containing *Chenopodium* and *Portulaca* seeds. The occurrence of two species in the same feature suggests on-site processing and/or consumption. Six calibrated radiocarbon dates range between 396 B.C. and A.D. 119, with three dates clustered between the first centuries B.C. and A.D. and three dates as early as the fourth century B.C. (see Fig. 13). These features may have been used later than the date indicates if the "old wood problem" is considered (Schiffer 1987:308-312). Even with a 300-year lag between end of wood growth and feature use, these dates fall within the late En Medio phase of the Oshara Tradition (Irwin-Williams 1973).

Three features were oval-shaped basins (Features 12, 13, and 14). Oval-shaped features had one perpendicular diameter more than 10 cm longer than the other. Dimensions ranged between 50 cm long by 32 cm wide to 230 long by 215 cm wide, 12 to 18 cm deep, and volumes range between 22.6 and 569.9 liters. They all had sloping sides with regular bottoms. One interior was lightly burned and the other two were unburned. One feature contained very dark brown to dark gray-brown charcoal and ash impregnated soil, one had brown to gray-brown soil only lightly charcoal stained and impregnated, and one was unstained brown soil with occasional charcoal flecks. There was one feature each of oxidized slabs present, unburned slabs present, and no slabs present. All slabs were mixed in the feature fill. One feature had burned *Chenopodium* seeds in small numbers that could be incidental to the feature fill.

These three feature classes as a group have variability in size and fill composition that could be related to function. Circular features show the least variability in size suggesting a more specific function than oval-basin and amorphous-shaped features. Whether circular features were used for processing or heating is not clear because of the overall poor preservation of pollen and macrobotanical remains. *Chenopodium* is the most common economic taxon and occurs in low frequency in at least one feature of each class. The circular features yielded greater quantities and larger pieces of charcoal, as evidenced by the six successful radiocarbon dates. Charcoal abundance

Figure 4. Feature 1, irregular pit, LA 59958.

Figure 5. Feature 2, amorphous pit, LA 59958.

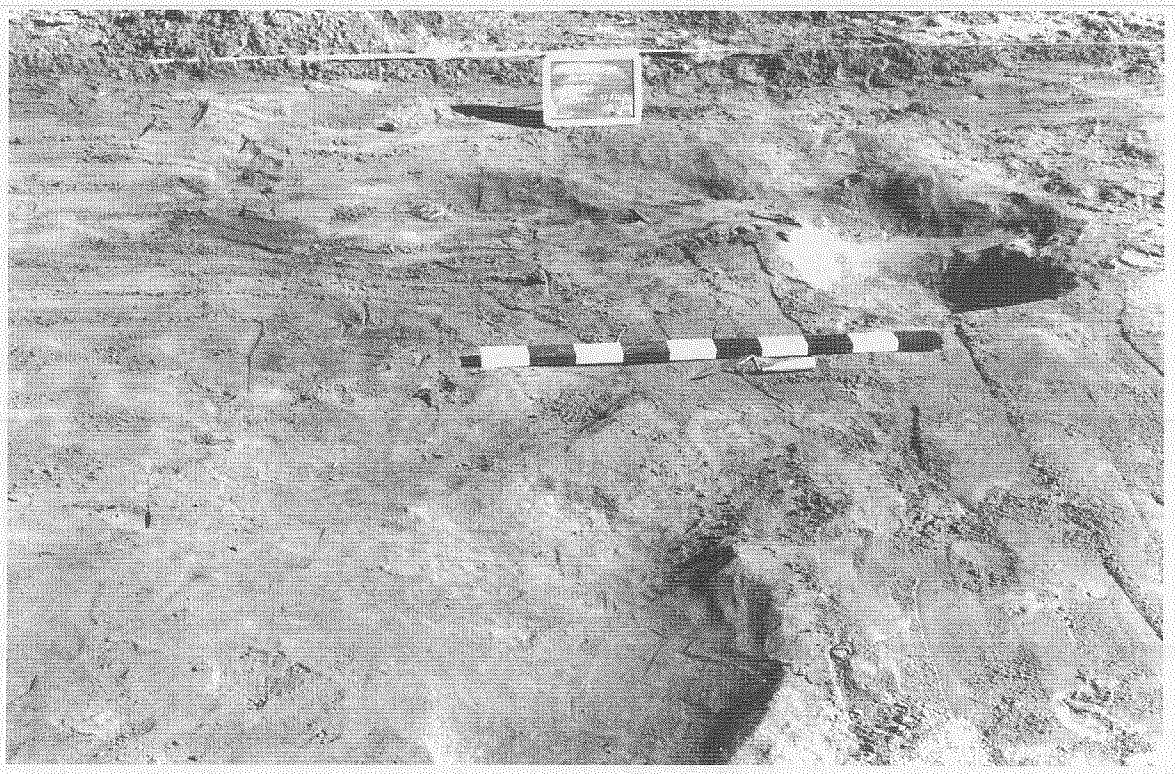


Figure 6. Features 21 and 22, LA 59958.

Figure 7. Feature 5, circular pit, LA 59958.

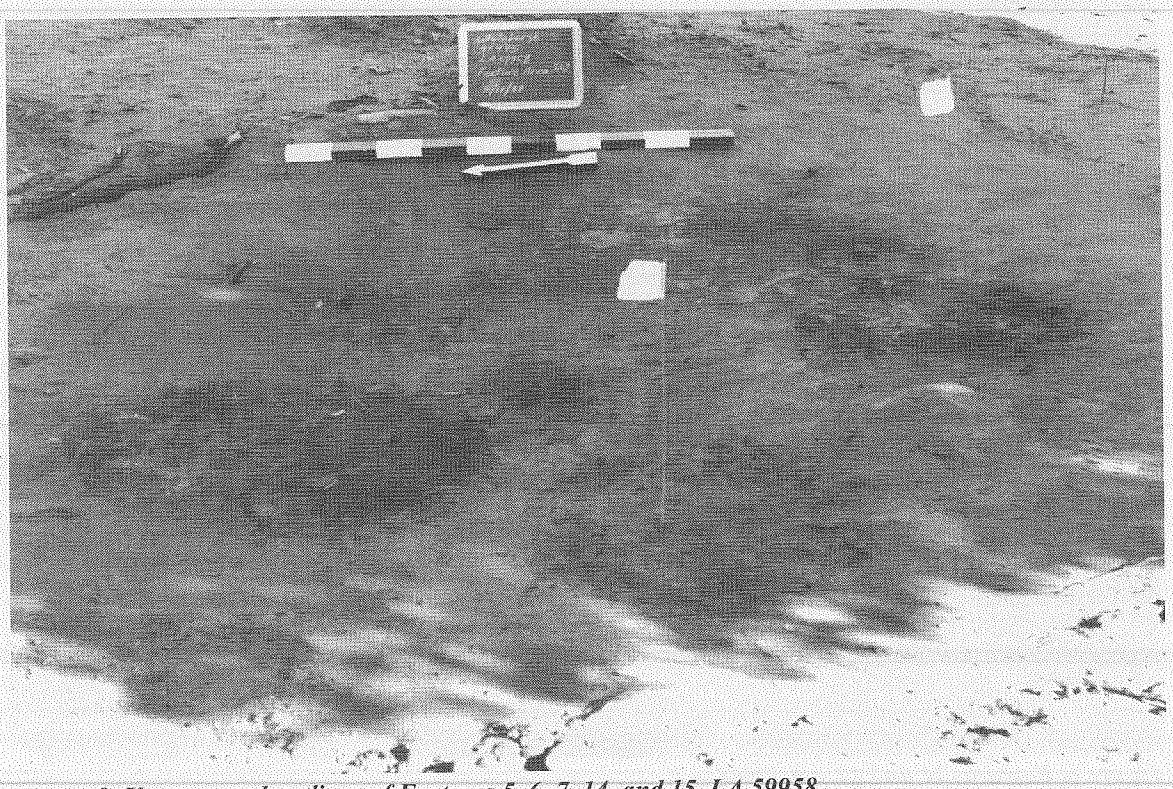


Figure 8. Unexcavated outlines of Features 5, 6, 7, 14, and 15, LA 59958.

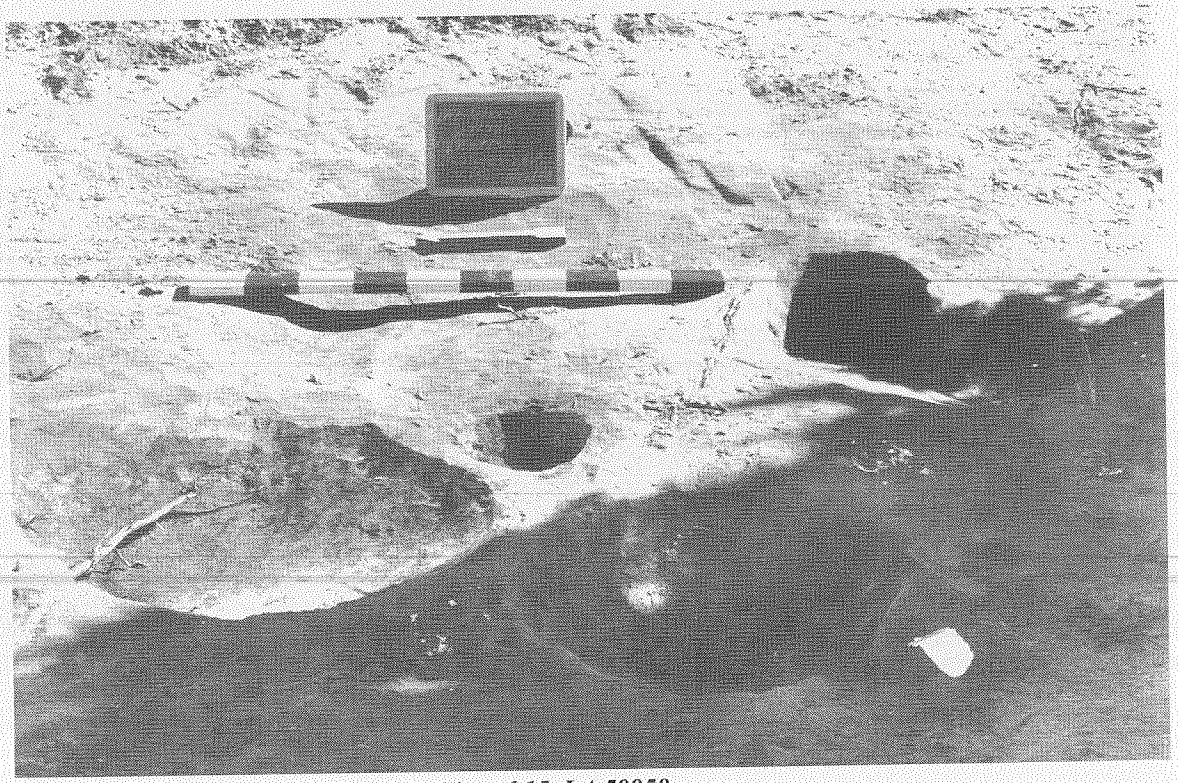


Figure 9. Excavated Features 5, 6, 7, 14, and 15, LA 59958.

in circular features could relate to incomplete burning caused by a smoldering atmosphere within the hearth. The lack of large chunks of charcoal in shallow, irregular, and oval-shaped features could result from more complete burning aided by a shallower depth and better oxygen supply. For seed processing and food preparation, open fires that quickly reduced to coals may have been better than a fire that would burn and stay hot longer. The deeper, circular pits may have retained heat better and longer. The more open irregular and oval features may have been for processing and the circular features used to heat coals for processing and for heat. Since only one radiocarbon sample collected from an irregular pit yielded a date range and no samples were recovered from oval basins, temporal differences in the features cannot be addressed.

Chipped and Ground Stone Analysis

The chipped stone artifact analysis focused on providing data that could be used to look at mobility and subsistence for late Archaic groups in the Hospah area and the southeast periphery of the San Juan Basin. Studies from the central San Juan Basin and its peripheries have attempted to model subsistence strategies and their effect on site distributions (Elyea and Hogan 1983; Vierra 1980; Moore 1980; Wait 1983). Rudecoff (1988) studied Archaic period use of the southern Chaco Slope. Rudecoff's analysis compared chipped stone data from three tested sites along the southern extent of NM 509 with Archaic period chipped stone data from the Lee Ranch project (Beal 1984). The LA 59958 chipped stone analysis results will be compared with these data.

The chipped stone analysis recorded material type and texture, core reduction type, and variables that describe tool production, use, and discard. The discussion of the results will focus on these aspects of procurement and technological behavior. OAS standardized artifact and attribute definitions were used. A list of the attributes monitored is presented as Appendix 5.

The ground stone analysis also focused on hunter-gatherer subsistence. Ground stone implements are sometimes the only source of information for plant processing that may have occurred at a site. Diachronic studies of change in grinding implements have shown a consistent pattern of more one-hand manos and basin-shaped metates in association with undomesticated plant processing. The amount of grinding wear or facial modification on ground stone may also indicate its function. The ground stone analysis was designed to look for morphological and functional differences that reflect different subsistence strategies.

Raw Material Selection

The chipped stone analysis identified 23 material types, which were placed under the broad material categories of chert, gray and tan chert, chalcedony, silicified wood, obsidian, quartzite, basalt, and siltstone. These general categories can be discussed in terms of their potential source locations and relative quality as reflected by material texture.

Chert includes eight material types: speckled, undifferentiated, fossiliferous, Chinle, Brushy Basin, clastic, and gray and tan. Undifferentiated chert is the most common, since it is used as a residual category when more specific material assignment could not be made.

Some chert sources have been described in the literature. A varied array of chert colors and textures are available from cobbles in the Ojo Alamo sandstone, San Jose, and Morrison formations,

and in the gravel deposits located throughout the area (Love 1982). The chert was primarily white or gray, which compares favorably with Rudecoff's variability (1988:59). Other colors include shades of black, brown, tan, cream, yellow, orange, pink, purple, and combinations of these colors. The undifferentiated chert from LA 59958 is primarily fine textured.

Gray and tan chert was singled out from the other undifferentiated chert because it was distinctive and abundant. It makes up 22.7 percent of all materials. It is equally fine and medium textured. This is different from the undifferentiated chert which is primarily fine textured. Gray and tan chert has not been described in the literature. It may have been subsumed under the miscellaneous chert category used in other analyses. Chapman (1977:440) suggested that percent of cortex should increase with proximity to a material source, because materials would be reduced less if they were not transported far. Cortex is rare on all materials, including gray and tan chert suggesting that all material sources are somewhat distant or that the cortex was removed at the procurement location despite transport distance.

Chalcedony is the second most common material, and it is 92.9 percent fine grained. Chalcedony co-occurs with chert in the gravel and cobble deposits (Love 1982). Its cortex percentages indicate it was brought to the site in a reduced state.

Silicified wood is the third most common material, but is considerably less common than chert and chalcedony. It is equally fine and medium textured, like the gray and tan chert. It has cortex on 26.6 percent of the debitage, which is higher than all other material types.

Quartzite also may be available in gravel and cobble deposits with the silicified wood, chert, and chalcedony. It is more medium grained and has 25.1 percent cortical debitage. Perhaps the quartzite and silicified wood were available locally and were reduced in similar manners.

The only other material present in greater than 1 percent is obsidian. The obsidian comes from sources in the Jemez Mountains (60 to 80 miles from the project area) and the Grants Ridge area (40 miles from the project area). X-ray fluorescence was conducted on 30 samples by Dr. Bart Olinger, Los Alamos National Laboratory. He attributed these samples to three sources in the Jemez Mountains and a single Grants Ridge source (Appendix 6). The Jemez Mountain obsidian came from the Valle Grande, Obsidian Ridge, and Polvadera sources.

The elemental characterizations show little correlation with macroscopic characteristics of the obsidian from the Jemez Mountains. For example, Valle Grande obsidian was clear, smoky gray, and could have feldspar inclusions and flow lines. Macroscopically this includes variability commonly associated with Polvadera obsidian. Polvadera obsidian consistently had lithic inclusions, which agrees with the macroscopic identification. Because the Polvadera and Valle Grande macroscopic characteristics overlap, we do not feel confident discussing actual percentages of each Jemez obsidian type that occurs in the assemblage. Instead, they will be referred to as Jemez Mountain obsidian in further discussions.

Grants Ridge obsidian has better correspondence between the elemental and macroscopic characterizations. It is black and opaque. We feel more confident about our Grants Ridge macroscopic identification because only one Obsidian Ridge sample overlapped after X-ray fluorescence.

Six nodules and one tool of obsidian could not be sourced by Dr. Olinger or by analysis at Eastern New Mexico University. It is transparent gray with flow lines and inclusions.

Macroscopically it is not different from the Jemez Mountain obsidian. Both analysts suggest that it could have originated from an unreported source in southern Colorado. Both analysts have extensive comparative material from the Southwest, and both had never run across this signature. If it had occurred only as nodules, I might have suggested that it was brought to the site by the historic period occupants. Because there is one tool of the material, it had to be brought to the site by prehistoric occupants.

Of the twelve biface and uniface fragments (not including projectile points), five were probably Jemez Mountain obsidian, and one was Grants Ridge obsidian. Five were fine-grained chert and one was fine-grained silicified wood. Of the projectile points, three were made from Grants Ridge Obsidian, two from material from the Jemez Mountains, seven were chert, one of which was the gray and tan chert, and two were silicified wood. All material types were fine grained or glassy. Of the 20 utilized flakes, 10 were chert, 2 were silicified wood, 1 was chalcedony, and 7 were obsidian. One obsidian flake tool was from Grants Ridge. The utilized flake and biface and uniface assemblage suggest that a wide range of fine-grained materials were acceptable for tool production. Materials available in gravel and cobble deposits were used in a similar manner to the nonlocal obsidian indicating no special preference. Based on debitage frequencies, clearly locally available chert, chalcedony, and silicified wood were used the most.

Core Reduction

Different types of core reduction are hypothesized to reflect different subsistence strategies for hunter-gatherers in the Great Basin (Kelly 1988). Nonpatterned flake removal from cores occurred in situations where local material was abundant and near foraging or collecting activities. Planned flake or biface production would be unnecessary because material was abundant. In cases, where raw material was not locally available or abundant, planned core reduction resulted in bifacial cores. Bifacial cores could be made into tools or could have served as a source of flakes, for use as tools, or tool blanks. Projected artifact assemblages that result from these two technological strategies provide a useful framework for describing and interpreting the LA 59958 assemblage.

This section includes the debitage assemblage and the miscellaneous chipped stone artifacts, including the cores, core/hammerstones, and raw material manuports or nodules.

The debitage assemblage. Chipped stone debitage is the most common lithic artifact class recovered from LA 59958. Identified debitage types include core flakes, manufacture flakes, bipolar flakes, undetermined flakes, and angular debris. A total of 979 chipped stone items were recovered (see Table 1). Core flakes, angular debris, and manufacture flakes are the most common (in that order). Undetermined flakes result from use of poor quality material, poor workmanship, or a high occurrence of post-depositional trampling. Their low number in this assemblage indicates both good workmanship and limited damage from post-depositional trampling.

Debitage type ratios. Debitage type ratios are an indicator of reduction strategy. Ratios of core flakes, manufacture flakes or angular debris can be used to determine if there were differences in how material types were reduced. Low core flake to manufacture flake ratios might indicate a greater emphasis on biface manufacture. Flake type ratios may also reflect distance from the site to a material source. Materials from closer sources may be used more expediently resulting in greater numbers of core flakes and angular debris.

Table 1. LA 59958, Debitage Type by Material Type

Count Row Pct Column Pct	Debitage Type							
Material	Core Flake	Manu-facture Flake	Bipolar Flake	Angular Debris	Uniface Flake	Undeter-mined Flake	Row Total	Flake/ Angular Debris Ratio
Chert	287 64.2 42.6	55 12.3 53.9	1 0.2 100.0	104 23.3 53.3			447 100.0 45.7	3.3:1
Gray and tan chert	191 86.0 28.3	4 1.8 3.9		25 11.3 12.0		2 .9 33.3	222 100.0 22.7	7.8:1
Silicified wood	21 46.7 3.1	2 4.4 2.0		20 44.4 10.2	1 2.2 100.0	1 2.2 16.7	45 100.0 4.6	1.2:1
Chalcedony	115 68.5 17.1	23 13.7 22.5		27 16.1 13.8		3 1.8 50.0	168 100.0 17.2	5.1:1
Quartzite	22 78.6 3.3	3 10.7 2.9		3 10.8 1.5			28 100.0 2.9	12.2:1
Basalt	3 60.0 0.4	1 20.0 1.0		1 20.0 0.5			5 100.0 .5	
Obsidian	34 54.0 5.0	14 22.2 13.7		15 23.8 7.7			63 100.0 6.4	3.2:1
Siltstone	1 100.0 .1						1 100.0 .1	
Column Total	674 68.8 100.0	102 10.4 100.0	1 .1 100.0	195 19.9 100.0	1 .1 100.0	6 .6 100.0	979 100.0 100.0	4:1

In this assemblage there are some differences between material types. Undifferentiated chert, which is mostly fine-grained and may be locally available, has a 5:1 ratio. Gray and tan chert also may be locally available and is equally fine and medium grained. It has almost a 50:1 ratio or 10 times more core flakes to manufacture flakes than undifferentiated chert. Flake type ratios in silicified wood are similar to gray and tan chert. Chalcedony approximates the undifferentiated chert ratio, and it is mostly fine-grained material. Obsidian has between a 2:1 and 3:1 ratio, which is lower than undifferentiated chert and chalcedony. The lower ratio seems to support the assumption that distance to source influences flake ratios. More obsidian may have been brought to the site as reduced cores or bifacial blanks than as cores resulting in relatively higher numbers of manufacture flakes.

The ratio of flakes to angular debris has been suggested as an index of reduction stage. During early stage reduction or unpatterned flake removal, the ratio of flakes to angular debris should be higher than later stage reduction. This is because late stage reduction and bifacial core reduction are patterned and methodical activities, which should result in fewer errors and debris. This is mainly true with fine grained, homogeneous materials, especially obsidian. Very small angular debris may continue to be produced by bifacial core and flake reduction of materials that are flawed. Late reduction stage angular debris may be smaller than ¼-inch mesh screen and may not be recovered. Because of this collection bias, flake to angular debris ratios may be useful for identifying reduction stage, but they should be interpreted cautiously.

The flake to angular debris ratio for this assemblage is 778 to 194 or 4.1 to 1. Flake to angular debris ratios by material type range from 1.2:1 for silicified wood to 12.5:1 for quartzitic materials. If manufacture flakes indicate late stage reduction, then material types with more manufacture flakes should have a higher flake to angular debris ratio. Undifferentiated chert, chalcedony, and obsidian have the greatest number or percentage of manufacture flakes, but their flake to angular debris ratios are 3.3:1, 5.1:1, and 3.2:1, respectively. These are low ratios for assemblages dominated by biface manufacture or bifacial core reduction.

At LA 66471, a nondiagnostic lithic artifact scatter near Cuba, New Mexico (Post 1992), the flake to angular debris ratio is 15:1. The primary activity at this site was inferred to be tool production and maintenance associated with hunting. At LA 66472, a late Archaic period base camp, also near Cuba, New Mexico, the flake to angular debris ratio is 3.4:1 (Post 1992). The different ratios for the Cuba sites suggest that the range of activities performed at a site may affect the flake to angular debris ratio.

Two Late Archaic period sites in the northern San Juan Basin (LA 18744 and LA 18745) with feature and artifact assemblages similar to LA 59958, have flake to angular debris ratios ranging from 2.1:1 to 4.9:1 (Vierra 1980:154-158, 173-179). These sites were characterized as limited base camps that had been occupied repeatedly through time.

These comparative data indicate that the LA 59958 flake to angular debris ratios resulted from the production of tools used in a variety of on-site activities and production of tools for future or planned off-site use. In this way, Kelly's (1988) planned and expedient technologies are represented in the LA 59958 assemblage.

Cortex characteristics. The percentage of cortex remaining on dorsal surfaces of debitage may be an indicator of the relationship between distance to material source and core reduction stages represented by a debitage assemblage. A suggested correlation between source distance and core reduction technology may be useful for understanding hunter-gatherer subsistence strategies and mobility patterns (Chapman 1977).

An explicit use of cortex and material source distance correlation was outlined by Chapman (1977) for prehistoric sites in the northern San Juan Basin. Chapman proposed that as distance from the source to the residential site or logistical site increases, the amount of cortex on debitage should decrease (1977:440). The amount of cortex removed at the raw material source would depend on the distance that a core would have been transported. Further reduction of a core and cortex removal would occur as flakes are removed for immediate use or tools or tool blanks were produced. There are two basic assumptions about cortex percentages on debitage and distance from source: (1) Where raw material has been reduced before being brought to a site, the occurrence of cortical debitage should be low. This implies that distance between the raw material source and the site made the cost

of transporting unreduced material too great; (2) on sites where the material source was near and preparation for transport at the source was unnecessary, cortical debitage should be more frequent.

In the LA 59958 assemblage, possible local and definite nonlocal materials are relatively abundant. The undifferentiated chert, gray and tan chert, chalcedony (which may be local), and obsidian (definitely nonlocal) have similar cortex frequencies (Table 2). These material types have a very low occurrence of cortex. Quartzite and silicified wood have cortex percentages that are almost double the assemblage percentage. Since obsidian is the most distant source, then the first assumption should be supported. For the other materials, which may be local, the second assumption should be supported. As Table 2 shows, distance does not appear to influence cortex percentages in this assemblage.

The two material types that have a greater occurrence of cortex, silicified wood and quartzite, have more medium-texture material (Table 3). This suggests that type of reduction for different materials may more strongly influence presence of cortex for the LA 59958 assemblage. This is partly supported by the higher percentages of angular debris for silicified wood. Greater numbers of angular debris result from early stage reduction, which often employs hard hammer percussion. Excessive angular debris for silicified wood may also result from intrinsic inclusions and fracture planes not present in other materials. Quartzite has proportionately fewer pieces of angular debris than silicified wood, but almost as many manufacture flakes as gray and tan chert. This suggests that material quality alone did not determine the type of core reduction and the resulting dorsal cortex frequency. The data suggest that for the LA 59958 assemblage, cortex was not a good indicator of source distance. Material texture also does not appear to correspond with cortex occurrence and reduction stage and therefore cannot be used to explain the differences.

Flake size. The forager-collector model predicts that different lithic reduction strategies would characterize different subsistence strategies (Binford 1983a; Vierra 1980; Kelly 1988). One indicator of lithic reduction strategy may be flake size. It is expected that as the core or tool preform is reduced, the detached debitage should also decrease in size. Biface reduction may result in large flakes being removed for use as tools or the reduction of core into a tool (Kelly 1988). Each process results in different manufacture flake size. Small manufacture flakes (less than 30 mm in length) would be expected if cores were made into bifacial tools. Larger flakes (greater than or equal to 30 mm) should predominate if manufacture flakes were produced as tools (Kelly 1988).

In the LA 59958 assemblage, the manufacture flakes are consistently smaller than the core flakes. This is true for all material types (Table 4). Mean length and width indicate that manufacture flakes result from biface tool production. Flake tools, if they were made, resulted from nonpatterned core reduction. A histogram of whole flake lengths by flake type also shows that all of the long flakes are core flakes (Fig. 10). Manufacture flakes are primarily less than 20 mm long. These data support the conclusion that bifaces were reduced as tools at LA 59958 and that longer flakes that could have been used as expedient tools resulted from nonpatterned core reduction. Additionally, if manufacture flakes were used as tools on the site, some edge modification or wear should be present. No manufacture flakes showed recognizable use, while 15 core flakes, 4 pieces of angular debris, and 1 undetermined flake were used. Utilized flake lengths are less than 30 mm, but this is partly due to the partial condition of 10 core flakes.

Table 2. Material Type by Dorsal Cortex

Count Row Pct Column Pct	Cortex (% of coverage)				Row Total
	0	10-50	60-90	100	
Material					
Chert	393 87.9 45.9	40 8.9 48.2	9 2.0 33.3	5 1.1 41.7	447 100.0 45.7
Gray and tan chert	202 91.0 23.6	15 6.8 18.1	4 1.8 14.8	1 .5 8.3	222 100. 22.7
Silicified wood	33 73.3 3.9	5 11.1 6.0	5 11.1 18.5	2 4.4 16.7	45 100.0 4.6
Chalcedony	148 88.1 17.3	13 7.7 15.7	4 2.4 14.8	3 1.8 25.0	168 100.0 17.2
Quartzite	21 75.0 2.5	5 17.9 6.0	1 3.6 3.7	1 3.6 8.3	28 100.0 2.9
Basalt	4 80.0 .5	1 20.0 1.2			5 100.0 .5
Obsidian	56 88.6 6.5	3 4.8 3.6	4 6.3 14.8		63 100.0 6.4
Siltstone		1 100.0 1.2			1 100.0 .1
Column total	857 87.5 100.0	83 8.5 100.0	27 2.8 100.0	12 1.2 100.0	979 100.0 100.0

Table 3. Material Type by Texture

Count Row Pct Column Pct	Material Texture				Row total
Material	Fine	Medium	Coarse	Glassy	
Chert	361 80.8 52.8	76 17.0 31.5	9 2.0 75.0	1 .2 2.4	447 100.0 45.7
Gray and tan chert	110 49.5 16.1	109 49.1 45.2	2 .9 16.7	1 .5 2.4	222 100.0 22.7
Silicified wood	23 51.1 3.4	22 48.9 9.1			45 100.0 4.6

Count Row Pct Column Pct	Material Texture				Row total
Material	Fine	Medium	Coarse	Glassy	
Chalcedony	156 92.9 22.8	12 7.1 5.0			168 100.0 17.2
Quartzite	8 28.6 1.2	19 67.9 7.9	1 3.6 8.3		28 100.0 2.9
Basalt	4 80.0 .6	1 20.0 .4			5 100.0 .5
Obsidian	22 34.9 3.2	1 1.6 .4		40 63.5 95.2	63 100.0 6.4
Siltstone		1 100.0 .4			1 100.0 0.1
Column total	684 69.9 100.0	241 24.6 100.0	12 1.2 100.0	42 4.3 100.0	979 100.0 100.0

Table 4. Whole Flake Dimensions by Material Type

Material	Dimensions (mm and mg)			
	Length	Width	Thickness	Weight
Chert				
core flake	16	16	4	13
manufacture flake	11	9	2	2
bipolar flake	8	10	3	1
Gray and tan chert				
core flake	21	18	5	26
manufacture flake	11	9	5	2
Silicified wood				
core flake	23	22	5	49
manufacture flake	10	8	2	2
uniface flake	11	8	2	1
Chalcedony				
core flake	15	14	3	9
manufacture flake	12	10	2	2
Quartzite				

Material	Dimensions (mm and mg)			
	Length	Width	Thickness	Weight
core flake	24	22	5	31
manufacture flake	16	12	2	1
Basalt				
core flake	10	12	4	3
manufacture flake	10	7	2	1
Obsidian				
core flake	20	15	5	16
manufacture flake	11	8	2	2
Siltstone				
core flake	40	26	8	63

The debitage data are one aspect of lithic assemblages that may be used to characterize the type of subsistence strategy that site residents practiced. If LA 59958 were a temporary base camp within a collector subsistence system, the debitage would be expected to reflect some tool manufacture and maintenance and expedient tool production (if suitable raw material were available). This seems to best characterize the assemblage. There is not a predominance of manufacture flakes, which would be expected if the site were used to stage only hunting activities. The debitage assemblage as shown by the different indices reflects a broader range of core and biface reduction. By inference, a broad range of activities can be suggested and it is likely that LA 59958 was mainly used as a temporary base camp as part of a collector-subsistence strategy.

Cores, nodules, and manuports. Four cores, six nodules, and two cobble manuports were recovered. Detailed descriptions of these items are in Appendix 7.

The four cores can be divided into an exhausted core and three core/hammerstones. Their material types include silicified wood, medium-grained quartzite, and chert. The exhausted chert core has a single unidirectional platform. The three core/hammerstones have unidirectional (n = 2) and multidirectional (n = 1) platforms. The three core/hammerstones exhibit bidirectional scarring and crushing of more than one edge or ridge indicating they were used to batter a hard material. This battering may have resulted from ground stone modification or hard-hammer reduction of lithic raw material. The low number of cores in the assemblage is interesting because it suggests that the raw materials were brought to the site in a reduced form.

Six small obsidian nodules were recovered from the north end of the site. Each nodule has between one and three flakes removed. Though the nodules are small, they may have been adequate to produce flake tools or marginally retouched scrapers or knives. What is interesting about these nodules is that they were found in close association to one another and they are from an undocumented source.

Because these nodules were found together, the first inclination would be to suggest that they were brought to the site by historic period Navajo occupants. However, there was at least one flaked obsidian tool from this source suggesting that the nodules were brought to the site by the

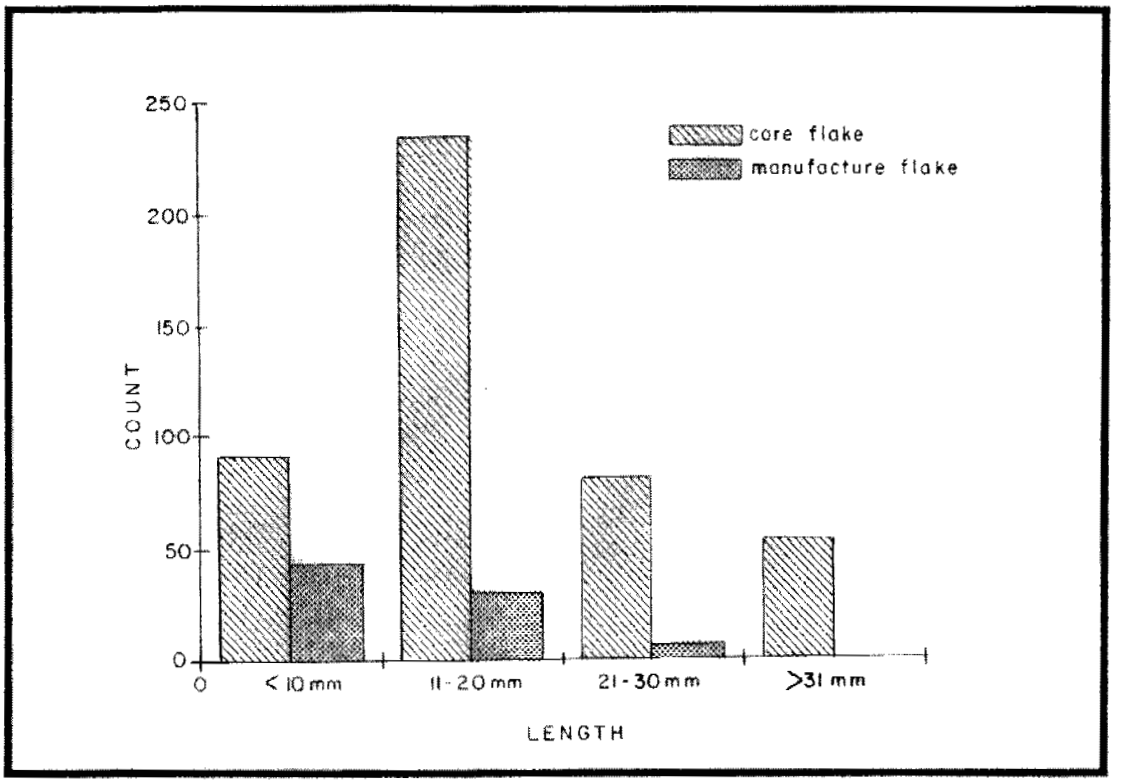


Figure 10. Core and manufacture flake length ranges, LA 59958.

prehistoric occupants.

The undocumented source is interesting because obsidian that does not source to Mount Taylor or the Jemez Mountains is very rare in the Four Corners area. The analyst suggests that these may come from an undocumented source in southern Colorado (Dr. Bart Olinger, pers. comm. 1989). Because they were found together and are from an unknown and possibly distant source, these nodules may represent a cache left by a group not familiar with the lithic materials of the area. Clearly, the late Archaic and early Basketmaker III period occupants were familiar with the Mount Taylor and Jemez Mountain sources, as evidenced by the common debitage and projectile points. Perhaps a later Athapaskan group is responsible for bringing these nodules to the site. This is speculative, but it does present some interesting possibilities.

Tool Production and Use

For the LA 59958 assemblage, tool production and use, besides the debitage, are represented by utilized debitage, projectile points, and other bifaces. Binford (1983b) has argued that the occurrence of certain tool types reflects a site's place within a subsistence system. The condition of a tool and its archaeological context further inform on the subsistence strategy. For instance, Binford (1983a:265-267) maintains that whole tools, such as hafted blades or projectile points, would not be discarded in a field situation unless the tool was readily replaced or the breakage precluded further use of the tool. Expedient tools, such as utilized flakes would be discarded as they are used up and would be expected to occur in greater numbers in field situations relative to formal tools. Therefore, the discard of whole, partly completed, and tools broken in use or during

manufacture are indicators of site activities and the site context within a greater subsistence system.

Utilized debitage. Twenty pieces of utilized debitage were identified. Fifteen were utilized core flakes, three were pieces of angular debris, and one was an undetermined flake. Material types include chert (n = 10), silicified wood (n = 2), chalcedony (n = 1), and obsidian (n = 7). Fifty percent of the utilized debitage was identified by unidirectional wear on at least one edge, one tool had bidirectional wear, and seven pieces had a combination of a retouched edge and edge wear. Five items had two utilized edges with three of the five items made of obsidian and one each of silicified wood and chalcedony. Edge angles for all edges display an almost continuous distribution from 35 degrees to 84 degrees.

The utilized debitage reflects a fairly broad spectrum of tool use as defined by the different types of edge modification and wear. As might be expected, chert is the predominant material type. A proportionally higher frequency of obsidian debitage was used over any other material type. This suggests that obsidian may have been more suitable for processing or maintenance tasks than other materials, though obsidian was not used exclusively.

The edge angle distribution is interesting because it lacks any modality. This either reflects a wide range of tasks that were performed at the site or a discard pattern of utilized debitage after different use periods. In other words, the continuous distribution may reflect use for a similar task, but for different durations, resulting in variable edge attrition. The latter conclusion is partly supported by the high incidence of unidirectional wear or retouch. Unidirectional wear and retouch suggests hide or plant material scraping.

Projectile points. For this analysis, projectile points are defined as hafted bifaces. Part or all of 14 projectile points were collected and include a Clovis point base, 1 En Medio point, 2 late Archaic points (maybe Basketmaker II), 3 Basketmaker III points, and 7 indeterminate points. Six of the projectile point types fit the site chronology as defined by the C-14 dates. The Clovis point pre-dates anything else found on the site. The Clovis point base will be briefly described and the other points will be summarized. The projectile point data are in Appendix 8. Three of the more complete points are shown in Figure 11.

The Clovis point was made from pink and white mottled fine-grained chert from an unknown source. The base width is 23 mm and 4 mm in thickness. These are the only complete measurements, since only 13 mm of the length was present. The base is concave with no evidence of fluting. The base and edges were not ground. Both faces show evidence of parallel flaking and the edges are bidirectionally retouched. No other Paleoindian materials were recovered from the site.

Of the five Late Archaic-Basketmaker III and the seven indeterminate points, only three were whole. The material type distribution is similar to the debitage with six chert, two chalcedony, and five obsidian points. Three obsidian points were made of Grants Ridge obsidian, the other two were Jemez Mountain obsidian. One chert point is gray and tan banded chert, which had very few manufacture flakes. Because the projectile point and debitage material types are similar, projectile points could have been made and discarded at the site.

In addition to the points recovered within the right-of-way, three more were recorded from outside the right-of-way (Fig. 12). The large En Medio point was made of greenish white chert and measured 43 mm long by 35 mm wide by 6 mm thick, with a neck width of 20 mm. The small

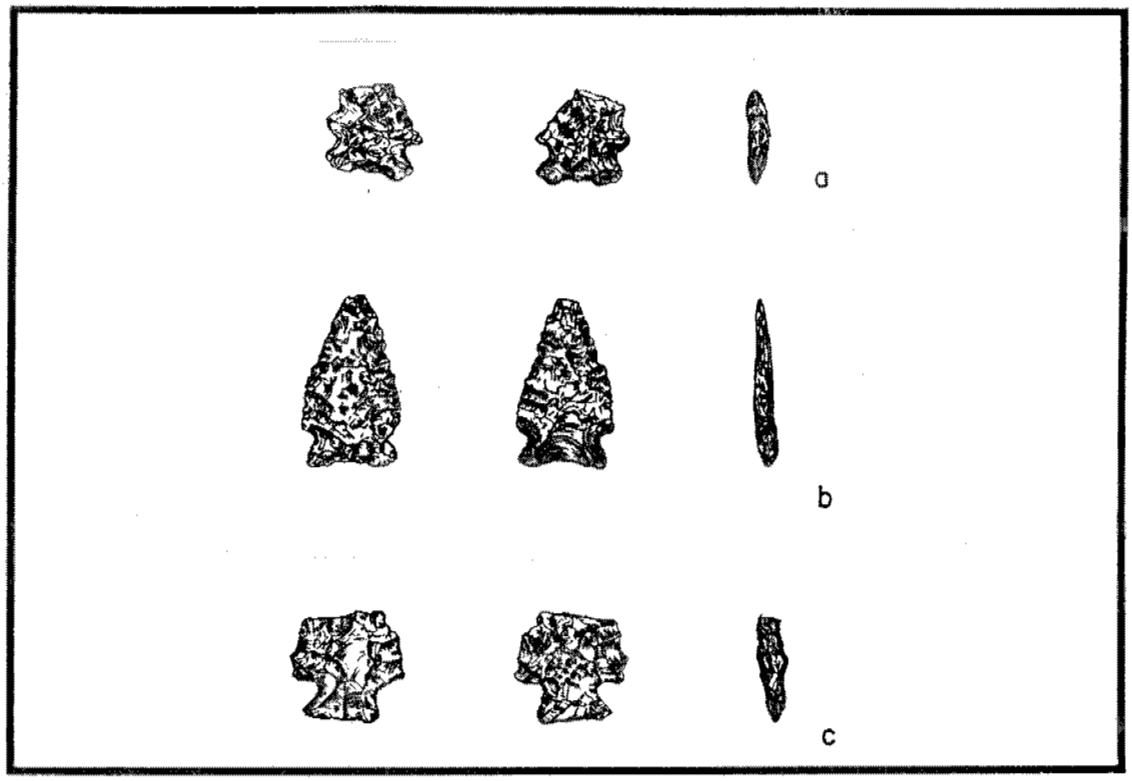


Figure 11. Selected projectile points, LA 59958; (a) Basketmaker II-III, (b) Basketmaker III, (c) Basketmaker III.

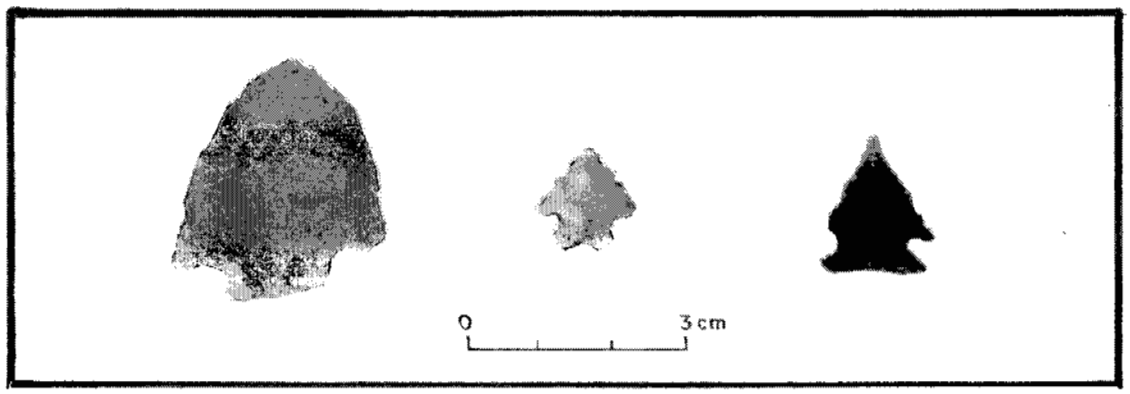


Figure 12. Projectile points from outside of the right-of-way, LA 59958.

basally and corner-notched Basketmaker III point was made from white chert and measured 19 mm long by 15 mm wide by 4 mm thick with a neck width of 6 mm. The concave base and corner-notched Basketmaker II-Basketmaker III point was made from transparent, black silicified wood and measured 24 by 19 by 4 mm with a neck width of 10 mm.

One change in subsistence technology that co-occurred with a greater dependence on agriculture was the adoption of the bow and arrow over the atlatl during the Basketmaker III period. While there is no accepted threshold date after which dart points were replaced by arrow points, most archaeologists believe it happened during the Basketmaker II-Basketmaker III

transition in the Anasazi culture area. Because the LA 59958 occupation probably spans this period, it might be informative to use Thomas's dimension index for dart and arrow points on the seven measurable points (Thomas 1978:461-472). The index is based on a correlation between shaft size and point size. Dart points tend to be larger with wider neck widths. Arrow points shrink in size with a proportional decrease in neck width. The index was derived from ethnographic and archaeological collections. Tests showed an 86 percent accuracy level for separating dart and arrow points. Thomas's dart sample included only 10 items. Because of the narrow spatial distribution of the dart data and the small sample size, Thomas cautioned against uncritically accepting the determinations derived from the equations.

The LA 59958 assemblage, though small, seems like a good case in which to use the dart-arrow equation. Table 5 shows the dart and arrow values for seven items from LA 59958, and one each from Late Archaic period sites near near Cuba and San Ildefonso, New Mexico. If the item is a dart or arrow point, it is indicated by a higher value. The greater the distance between the dart and arrow values, the more likely that the difference is real. The closer the values, the more likely there may be room for error. In the Anasazi area, the transition from dart to arrow was probably gradual and occurred at an unequal rate across space. For instance, Hogan (1986) suggests that Late Archaic populations in the northern San Juan Basin may have been slower to adopt agriculture. Perhaps this retarded acceptance of agriculture also resulted in a slower rate of change from dart to arrow points. Therefore, a reasonable expectation might be that items with close values might represent a transition between dart and arrow point use.

Table 5. Projectile Point Dimensions and Value

Point Type	Provenience	Length	Width	Thickness	Neck Width	Dart Value	Arrow Value
Basketmaker III	Outside R-O-W	19	15	4	6	4.325	5.92
Basketmaker II-III	Outside R-O-W	24	19	4	10	9.193	9.196
En Medio	Outside R-O-W	43	36	6	20	30.599	22.636
Basketmaker II-III	125-1, 144N/76E	26	13	4	12	1.893	7.02
Basketmaker II-III	136-1, 136N/88E	28	16	5	9	6.945	8.868
Basketmaker II	104-1, 164N/112E	41	22	5	12	15.95	13.734
Basketmaker II-III	133-1, 140N/88E	36	14	5	7	6.485	8.364
Chiricahua/Sudden Side Notched	LA 66472, Cuba Area	33	20	4	14	11.198	11.494
En Medio	LA 51912, near San Ildephonso	36	21	3	11	13.244	10.782

Table 5 shows some general patterns in point dimensions that reflect functional type. For instance, arrow points tend to be narrower than dart points, with specimens that are greater than 20 mm wide classified as dart points. Neck width influences classification less than blade width, with 10 to 14 mm neck widths occurring on both arrow and dart points, though the example with a 20 mm neck width is clearly a dart point.

Two items from dated Late Archaic period sites from outside the San Juan Basin were included as controls. The En Medio point from LA 51912, near San Ildefonso Pueblo, New Mexico, comes from a shallow pit structure that dates to 450 B.C. based on calibrated radiocarbon dates (Lent 1991). It has a greater dart point value providing limited support for Thomas's mathematical model. The Chiricahua/Sudden Side Notched point was recovered from a shallow pit structure near Cuba, New Mexico (Post 1992). The site has been broadly dated between 2000 and 600 B.C. by calibrated radiocarbon and obsidian hydration dating. This item shows the effect that resharpening has on Thomas's equation. The equation classifies it as an arrow point, while the site occupation predates bow and arrow use in the American Southwest. This result shows that resharpening can bias the equation towards the arrow classification.

For the LA 59958 assemblage, the Basketmaker II-III points are consistently classified by the equation as arrow points, suggesting that they are Basketmaker III points or small, narrow dart points. One Basketmaker II-III point has almost identical dart and arrow values suggesting that it could have been used as either. This morphological overlap could have accompanied a change in subsistence focus that also resulted in a gradual change in projectile point morphology. The Basketmaker III point is classified as an arrow point. The Basketmaker II and En Medio points are classified as dart points so that the typological classification is reinforced by the mathematical model. In all, Thomas's equation seems to be a good way to differentiate between dart and arrow points when typological classification is fuzzy.

Bifaces. Eleven unhafted bifaces were collected. They are primarily obsidian (n = 6) and chert (n = 4). The obsidian is mostly from the Jemez Mountains, with only one example of Grants Ridge obsidian. They tend to be small, ranging from 23 to 48 mm long and 13-16 mm wide for three whole specimens. The biface fragments were mostly broken in late stages of manufacture, which is more evidence for on-site tool production. Their edge angles range from 36 to 68 degrees suggesting the tools would have been used for a variety of tasks had they not been broken in manufacture.

Ground Stone Artifacts

The ground stone artifacts include manos and metates, and functionally, these artifacts are assumed to have been used for plant processing. Processing activities may have been most common at residential or temporary base camps. Limited processing may have occurred at resource extraction or procurement locations, if the resource had to be reduced for transport. Manos are portable tools that could have been brought to extraction loci. Metates are less portable and may have been cached at repeatedly used extraction loci or temporary or residential base camps.

There are twelve manos and mano fragments in the assemblage from LA 59958. Mano data are presented in Appendix 8. Of the nine whole manos and three mano fragments, seven are quartzite, varying from fine to coarse grained with friable to indurated textures. Four of the manos are fine to medium grained, friable sandstone. One whole mano is an indurated, medium-grained, split granite cobble. The nine whole manos range in size from 8.5 by 7.3 by 3.2 cm (364 g) to 12.6 by 8.8 by 5.4 cm (955 g). Five of these are oval-shaped with two ground surfaces, either flattened or convex. Two have more of a rectangular shape with rounded edges and only one ground surface. Eight of the manos and fragments exhibit signs of moderate to extensive use, three exhibit only minimal use. One is a possible mano blank.

Metate data are presented in Appendix 8. All six of the metates from this assemblage are large, fairly well indurated sandstone slabs. They range in size from 33 to 29 to 3.8 cm (7.2 kg) to 50 by 40 by 7 cm (15 kg). Two metates have moderate to extensively used concave ground surfaces, three have flat, moderately used ground surfaces, and one has a flat surface with minimal use.

Manos and metates are commonly found on Late Archaic sites within the San Juan Basin and along the Rio Puerco. Irwin-Williams (1973:13) lists small cobble handstones with deep-basin grinding slabs. Longer handstones and slab or trough-shaped grinding slabs occur at sites that date to the late A.D. 300s or early 400s (Irwin-Williams 1973:13).

Archaic period sites at the Navajo Mine Archaeological Program (NMAP) area had unifacially ground one-hand manos with slab, block, and basin metates. Metates only occurred at sites that were interpreted as short-term limited base camps (Elyea and Eschman 1983:65-100).

By comparison with the NMAP Archaic period sites, LA 59958 has five bifacially ground manos. The presence of unifacial and bifacial manos in the LA 59958 assemblage cannot be explained. The presence of a Basketmaker III component at LA 59958 may have some effect on how the manos were used. The grinding wear ranges from moderate to heavy, indicating that the manos were used longer or for a variety of tasks requiring different levels of grinding. The second interpretation seems more likely, since there is also a range in material texture that may relate to task requirements and staged processing (Lancaster 1983). A wider range of textures and grinding surfaces did allow for a staged or more complete processing of seeds or nuts, and might be expected at a temporary or residential base camp. Food processing for consumption, transportation, or storage would have occurred at temporary or residential base camps resulting in variability in the ground stone assemblage.

Prehistoric Component Discussion

The prehistoric component discussion uses the feature and artifact data to summarize chronology, site formation and structure, and to address the site's place in a regional context within Late Archaic period settlement and subsistence models.

Chronology

Site chronology data came from three sources: radiocarbon dating, obsidian hydration, and projectile point typology. Each of these chronometric sources yields date ranges with different resolution. The differences result from problems with the raw material selected for sampling, the analytical sample contexts, or variability introduced through an active sample life history that may have spanned more than 200 years.

Projectile points. Projectile point styles are a common source for relative dates. Survey projects rely exclusively on their presence for dating lithic artifact sites. Six projectile points were recovered and two were recorded in the field. These specimens could be fit into existing projectile point style typologies for the Late Archaic to early Basketmaker III period. One projectile point base may be from a Clovis point, which significantly pre-dates the other projectile points and the

radiocarbon and obsidian samples.

The relationship between the Clovis point base and the remainder of the site materials is problematic. Usually when such an early specimen is found on a later site the occurrence is attributed to collection and curation by later site occupants. In other words, it was collected from another site or locale and redeposited away from its original archaeological context. The Clovis point was recovered from Grid 144N/88E, which is on the periphery of the dense feature and artifact concentration in Grids 140-144N/84E. This association with an area of concentrated deposition suggests that the Clovis projectile point base may have been collected by a Late Archaic period group that used this portion of the site. The Clovis point base is not considered to represent a pre-11,000 B.P. occupation at the site for the above reason and because there were no other Paleoindian artifacts recovered from the site.

Three points are from the Late Archaic or En Medio period (800 B.C. to A.D. 400). Two points (FS 133 and FS 144) were recovered from the periphery of the feature and artifact concentrations. The other projectile point was recovered from an isolated portion of the site, 20 m from the nearest feature and outside the artifact concentrations.

Three projectile points recovered from the site and three recorded outside the right-of-way are similar to styles found on Basketmaker III (A.D. 500-700) sites. The three projectile points from within the project limits are on the periphery of feature and artifact concentrations that pre-date the projectile points. The Basketmaker III projectile points provide support for the later radiocarbon dates, which overlap into the early Basketmaker III period. Curiously, the Basketmaker III use did not include the discard of ceramics, suggesting that they were using a logistical subsistence strategy in a manner similar to the Late Archaic period groups.

To summarize, the projectile points reflect a site history with multiple occupations from 800 B.C. to as late as A.D. 700. The location of the Basketmaker III points that were spatially associated with Late Archaic period projectile points and features suggests that the occupations overlap spatially. Some undated features and spatially associated debitage may have resulted from this later occupation. This mixing of point styles cautions against assuming the features and associated debitage represent reuse or multiple occupations from a single period.

Radiocarbon dating. The radiocarbon dating was successful in that the date ranges were acceptable from the perspective of the established projectile point typologies for the Late Archaic to early Basketmaker III period (Fig. 13). All samples were piñon or juniper charcoal collected from burned features. All dates presented in this section are calibrated. Appendix 4 provides the results from the analyst.

The seven samples all fall within a 396 B.C. to A.D. 466 range, which is well within the late En Medio-Basketmaker II period (800 B.C. to A.D. 400). Since the charcoal samples are from piñon or juniper, the dates may represent the earliest potential use. The old wood problem could not be avoided because other nonwood charcoal sources were not available. This absence is shown by the paucity of burned nonwoody material in the macrobotanical samples. If the wood was scavenged, then a maximum 500-year younger date may be possible for the samples and associated contexts (Schiffer 1987; Smiley 1985). Given this skewing factor, feature use may have occurred as late as A.D. 966, which easily accommodates the Basketmaker III occupation indicated by the projectile point dates. Even with the 300-500 year adjustment for "old wood" use, the radiocarbon results can be grouped into three date ranges within this almost 1300-year span.

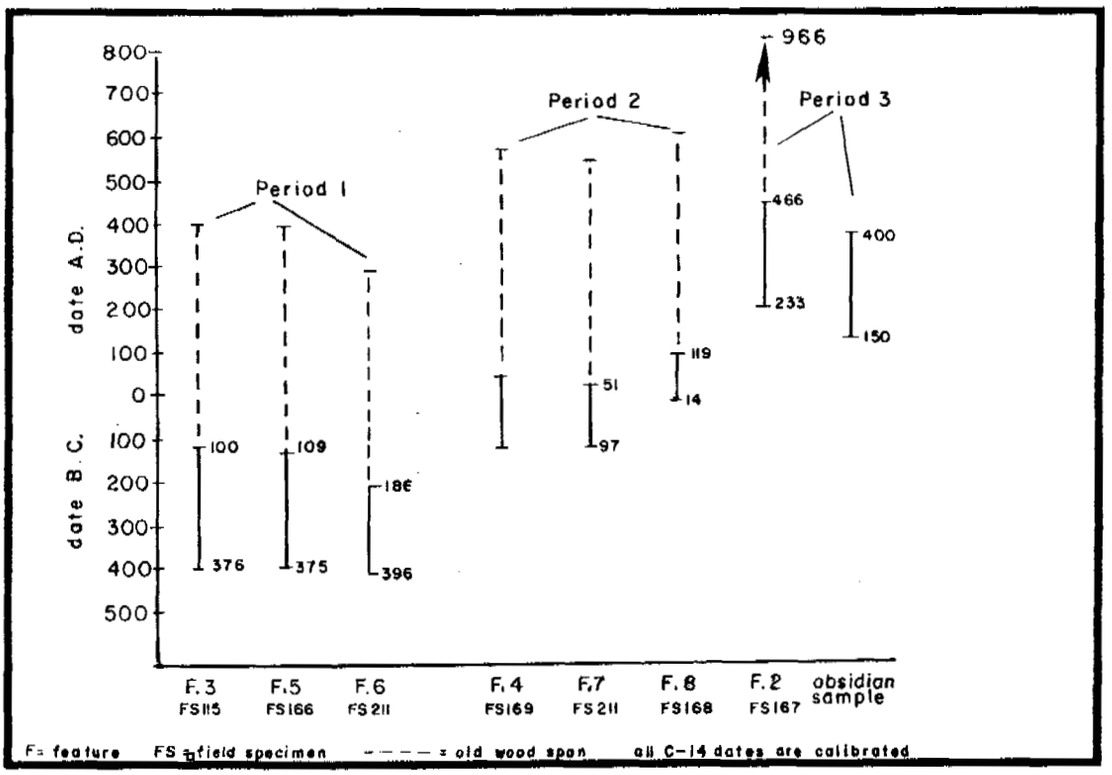


Figure 13. Radiocarbon dates and one obsidian hydration date from LA 59958.

If the old wood factor is added, the date range is from 396 to 100 B.C. or A.D. 400. The minimum 296-year span is the broadest, with the lowest precision for individual dates. This substantial overlap allows for three occupations spaced at 100+ years and it also allows further interpretation that these three features were used during a short span, suggesting reuse by the same or related group. This date cluster will be referred to as Period 1 in subsequent discussions.

The second date range has three samples with a collective date range of 96 B.C. to A.D. 119 or A.D. 619, if the old wood factor is added. The dates suggest that these features were reused within one or two generations by the same band or group. This date cluster will be referred to as Period 2 in subsequent discussions.

The third group has one date from A.D. 233 to A.D. 466 or A.D. 966, if the old wood factor is added. This radiocarbon date is supported by the Basketmaker III projectile point dates. If the old wood factor is added to the second date range, there is evidence to suggest a fairly substantial use of LA 59958 by Basketmaker III populations for hunting and gathering. This date cluster will be referred to as Period 3 in subsequent discussions.

It would be tempting to suggest that the discrete date clusters suggest hiatuses in site use. To suggest a hiatus would be to disregard the potential problem of old wood. Conceivably, old wood could account for the collective date range. Thus, the conclusion that the early and middle date ranges are evidence for reoccupation by one group is offered very tentatively. The potential for old wood use suggests that caution should be used, however the date clusters appear to provide strong evidence of at least three occupation spans, with multiple occupations occurring within each span.

Obsidian hydration dating. The obsidian hydration study sheds little light on site chronology. The correspondence containing the results from the study are presented as Appendix 9. The samples provided a wide date range with four of the seven dates earlier than the radiocarbon and projectile point dates. Because these dates are from surface or shallow subsurface contexts they may not be reliable. What they do seem to indicate is that the site has a history of multiple occupations, which is clearly shown by the feature and artifact distributions and the radiocarbon dates.

Two samples with mid-dates of 1706 ± 115 B.P. and A.D. 1602 B.P. ± 243 correspond with Periods 2 and 3 (as defined by the radiocarbon dates). However, the other obsidian hydration dates are so much earlier that the two dates that fit the scheme cannot be uncritically accepted.

Two other samples yielded the same date of 3795 B.P. ± 485 years. This date is much earlier than the radiocarbon dates and there are no projectile points that are similar to the San Jose and Armijo styles from this period. While these dates suggest a possible early component there are no corroborating dates to support this possibility.

Two samples yielded dates of 4323 B.P. ± 364 years and 5596 B.P. ± 285 years. Like the other two early dates, no other dates corroborate a San Jose or early Armijo phase occupation. The early dates may result from prolonged, periodic exposure on the site surface resulting in a thicker rime or the obsidian may have been recycled from a San Jose or early Armijo phase site.

Summary. Projectile point styles, radiocarbon, and obsidian hydration dating provided date ranges that tentatively can be separated into three clusters and are referred to as Periods 1, 2, and 3. Given problems inherent in each dating method, there is potential for substantial overlap between the three clusters. The projectile points indicate later Archaic and Basketmaker III occupations. The radiocarbon dates confirm these occupation periods, but the probability of old wood makes it just as likely that all the dated features were used during the Basketmaker III period. Obsidian hydration dates yielded the most problematic and broadest date ranges. Two samples yielded date ranges that coincide with very Late Archaic period and early Basketmaker III occupations, but the remaining samples yield dates from the Middle Archaic period. Middle Archaic period occupation is not evidenced by the feature or projectile point dates. Therefore, the obsidian hydration dates are viewed cautiously and have not been used in subsequent discussions.

Site Structure

The prehistoric component was defined by surface collection and surface stripping top soil in 4-by-4-m units. This recovery method was used because the shallow site depth combined with the modern occupation would have obscured fine-grained spatial patterns of artifact and feature associations. Examining the spatial relationships between artifacts and features is important for studying site structure and occupational history. Although the control is coarse and the artifact distributions have changed, informative patterns may remain. The spatial relationships between debitage density, discarded tools, and features will be examined. Figures 14 and 15 show the spatial relationships between these three analytical classes.

Site structure is a reflection of the occupational history. Camilli (1989) examined site occupation from the perspective of Binford's (1980) logistically organized system. The logistically organized system should result in different types of sites that reflect residential and procurement activities. Important in the logistical system is that sites may be repeatedly occupied for the same

or different purposes, such as a former residential camp being used as a resource procurement location. This pattern of reoccupation can be thought of in terms of single and multiple use.

Single use implies one occupation without a later return (Camilli 1989:18). Multiple use can be defined in terms of multiple occupation and reoccupation. Multiple occupation is reuse of an area resulting in overlapping artifact or feature distributions (Camilli 1989:19). Multiple occupation results in an accretional increase in site size. Reoccupation implies the reuse of storage, cooking, or habitation features. Reoccupations result in an increase in artifact density and perhaps greater artifact diversity and not a substantial increase in site size (Camilli 1989:19).

Using these definitions of multiple occupation and reoccupation, we can interpret the distributions illustrated in Figures 14 and 15. The contour lines were interpolated from grid data that includes surface and subsurface lithic reduction debitage. Chipped stone and ground stone tools are listed in the grids.

The artifact density contours show four possible locations of multiple occupation or reoccupation. For this analysis, the possibility of reoccupation rather than multiple occupation is suggested by features that are within a 4-m-sq area. Important for determining reoccupation episodes is that facilities are reused within in a relatively short period and that there is a high density of discarded material. A short period for LA 59958 would be less than 100 years. Multiple occupation is suggested by feature and artifact distributions that are more than 4 m apart and have decreased artifact density.

Five activity or occupation areas can be defined from the feature and artifact distributions. The following discussion explores the temporal and spatial relationships. Conclusions and interpretations are complicated by the lack of dates for some features and the possibility that some of the features and material accumulated from contemporaneous occupation by a larger group. The following discussion is based on site use by a commensal group. Limited or temporary base camp use by Archaic period commensal groups has been suggested for other sites in the central San Juan Basin (Vierra 1980; Elyea and Hogan 1983), and the upper Middle Rio Grande Valley (Chapman 1979).

The most obvious area of possible intensive reoccupation is in Grids 140-144N/80-84E as illustrated by the high artifact density and feature clusters. This area is designated as Area 1. There are seven features in this area. This feature cluster suggests reoccupation. Reoccupation implies that a group or its descendants returned to the same place repeatedly. If this is the case, then the radiocarbon dates obtained from features within this cluster should date to the same period. Period 1 is represented by Features 5 and 6. These features are very near each other and may represent reoccupation or the use of two hearths during the same occupation. Period 2 is represented by Feature 7. The clustered feature distribution and high artifact density may partly result from reoccupation during Period 1. However, the higher artifact density also results from mixing by a later occupation during Period 2.

A second feature and artifact concentration at Grids 148-152N/78-84E has fewer features than the first area and the high artifact density is more tightly clustered. This cluster is designated as Area 2. The radiocarbon dates from the features include all three occupation periods. Feature 3 dates to Period 1. Feature 4 dates to Period 2. Feature 2 dates to Period 3. This date distribution indicates that the artifact accumulation probably results from temporally discrete multiple occupations.

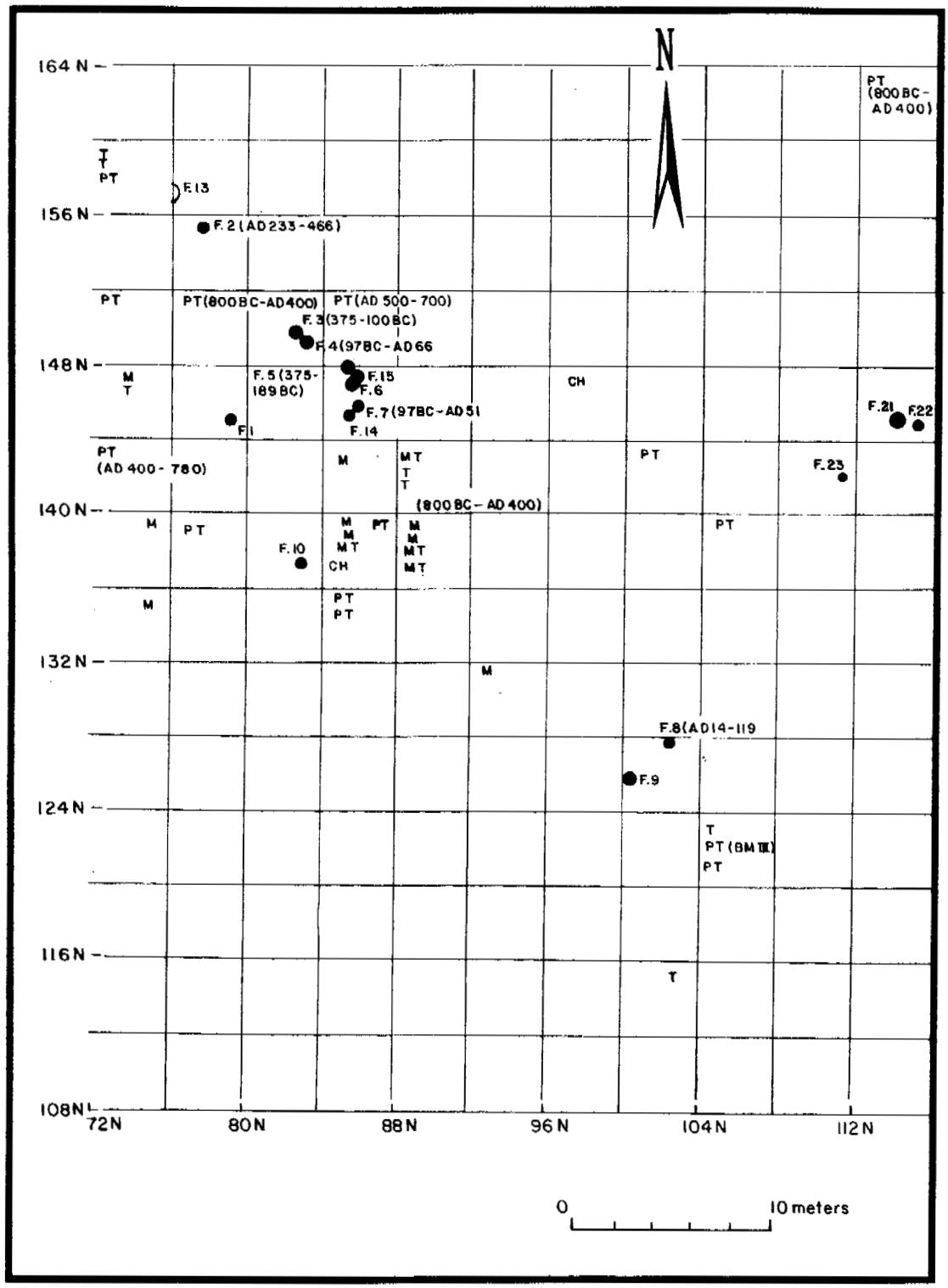


Figure 14. Artifacts and date ranges for LA 59958. T = tool, PT = projectile point, M = mano, MT = metate, CH = chopper.

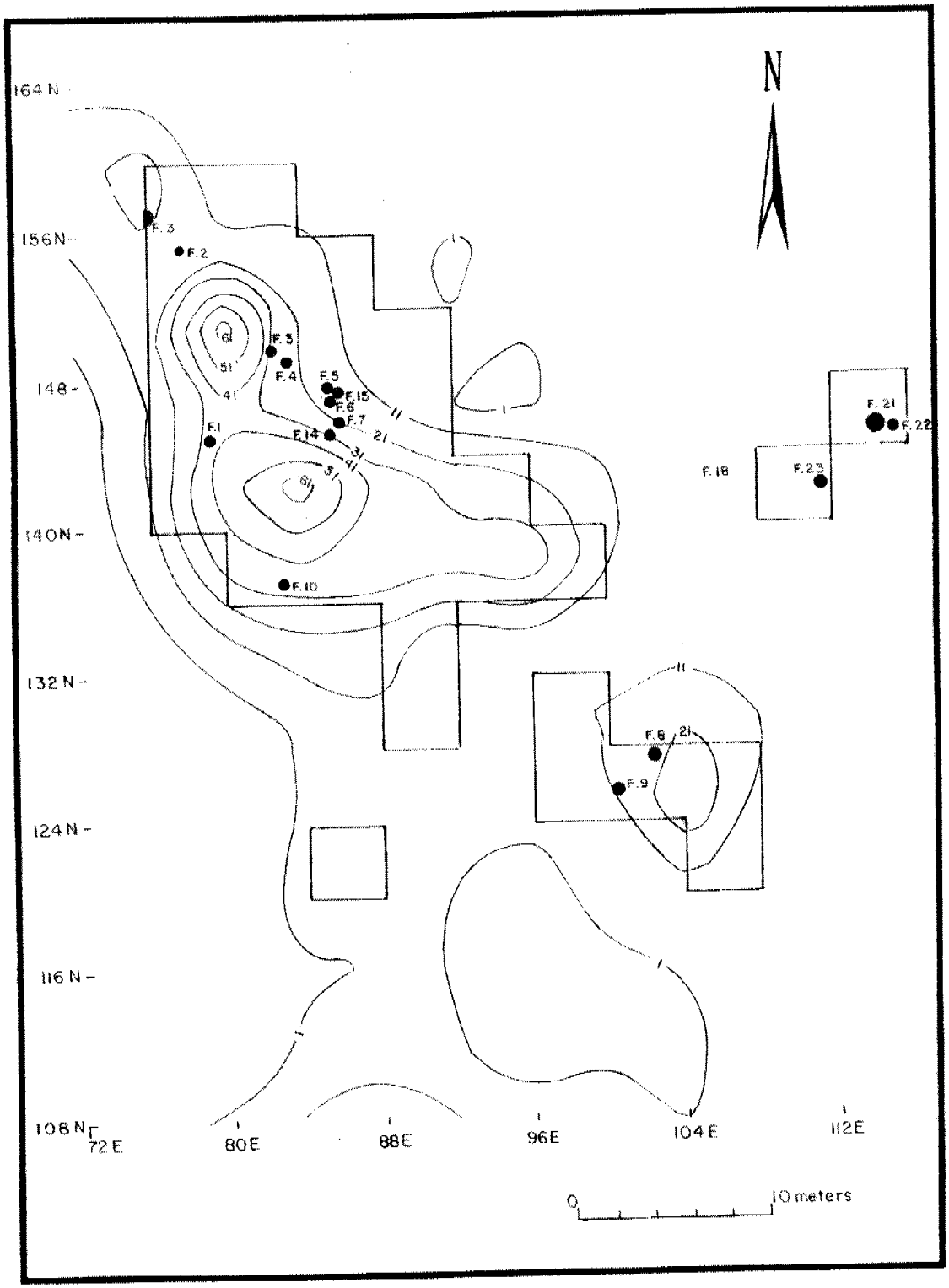


Figure 15. Debitage density, LA 59958.

The third feature and artifact concentration has lower numbers of artifacts than the first two. It was in Grids 124-128N/100-104E and includes Features 8 and 9. This area is designated as Area 3. Feature 8 dates to Period 2. This date range is closer to Features 4 and 7. These spatially discrete occupation episodes during Period 2 indicate that the site grew through multiple occupation rather than reoccupation.

Two other feature areas that include Features 12 and 23 and Features 21 and 22 suggest reoccupations because the paired features are near each other. The analysis of the other occupation areas, however, suggests that the features may be incidentally located close to each other as a result of multiple occupation instead of reoccupation. The difference in artifact density between these two areas and the first three feature and cluster areas suggests that they were used for a shorter duration or experienced fewer multiple occupations. It is also possible that these two areas reflect a change in site use within a resource procurement strategy.

In summary, it appears that the site was formed by temporally separate multiple occupations. This pattern is exemplified by the distribution of Period 2 features in three different activity areas. Only Area 3 with a single Period 2 date may result from a single occupation. The two Period 1 features in Area 1 may represent reoccupation, but the interpretation is weakened by the large date range and the possibility that the two features result from contemporaneous occupation. For LA 59958, the highest artifact density results from multiple occupation, instead of reoccupation as suggested by Camilli's (1989) model.

Another aspect of the artifact and feature relationship may provide information on site formation and the function of this site in resource procurement strategies. Tools were recovered from 22 grids. Figure 14 shows the locations of projectile points, tools, manos, and metates by grid location. The tool distributions show association with high and low density areas. Most of the chipped and ground stone tools are on the periphery of the high feature and artifact density areas. This distribution is not surprising because the tools may have had a more dynamic life history than most debitage. Through recycling, salvaging, and curation, tools may have regularly moved between the archaeological and systemic context (Schiffer 1987). Even with the potential for considerable reuse, tools were found in two instances.

Besides the dynamic property of tools within a systemic/archaeological context, it is also possible that some of the tools may have accumulated from occupations that are not related to all the feature use. Therefore, in Camilli's (1989) and Binford's (1983b) framework of site formation, the artifact densities may have accumulated through different site use resulting from a single logistical hunting and gathering strategy.

The site structure clearly results from the multiple occupation of the site over a long period by temporally distinct groups that may have been practicing a similar hunting and gathering strategy. The close spatial distribution of features and the artifact concentrations in Areas 1 and 2 initially look like reoccupations as defined by Camilli (1989), but the radiocarbon dates show that feature clusters result from at least three temporally distinct periods. Therefore, the feature and artifact clusters probably do not result from a conscious effort to reoccupy an area and reuse the facilities. The pattern supported by the radiocarbon dates and projectile point styles is multiple occupation of the site during three periods, but at different areas of the site with the construction of new facilities. This pattern corresponds to Camilli's multiple occupation, but not during a single period. Therefore, the site formed by accumulation with high artifact densities resulting from multiple occupation by temporally unrelated groups.

Regional Settlement and Subsistence

Late Archaic period and early Basketmaker III settlement and subsistence studies in and around the San Juan Basin have recently focused on defining site types and explaining site distributions in terms of flexible and mobile subsistence strategies (Vierra 1980, 1987; Moore 1980; Eschman 1983; Elyea and Hogan 1983; Hogan 1986; Fuller 1989). These studies have been heavily influenced by Binford's (1980, 1983a, 1983b, 1983c) ethnoarchaeological hunter-gatherer studies. Binford's research resulted in the formulation of forager, collector, and composite forager-collector models that could be inductively applied to archaeological data. In other words, the site distribution and variability could be fitted to expectations generated from the models.

The hunter-gatherer models suggest that there should be discrete patterns of site types and the distribution of those types across the landscape. Site structure should reflect the technological organization of economic and domestic activities. Technological organization included the construction and use of facilities and production and use of implements needed to carry out a subsistence strategy. The requirements of these economic or domestic activities were based on group size, occupation length, and the time of year. Occupation length was affected by availability and abundance of critical resources (such as the maturation schedules of wild plant resources). An archaeological consequence of the factors that conditioned settlement and subsistence was variability in artifact and feature diversity among contemporary sites. It is the assemblage variability and diversity that was used to formulate site types. The distribution of site types across the landscape were used to test the different hunter-gatherer models.

LA 59958 can be characterized in terms of site typology based on the artifact and feature assemblage. The site structure of LA 59958 can contribute to the framework for Late Archaic period population dynamics and settlement variability as outlined by Elyea and Hogan (1983).

Site types within the forager, collector, and composite forager-collector models include home base camps, limited base camps, limited activity sites, and resource extraction locales. Classification of these sites follows a reductive trajectory. Home base camps have the highest frequency and diversity of artifacts and features. Limited base camps and limited activity or task-specific sites have the lowest frequency and diversity of artifacts and features.

Home base camps imply a longer duration of occupation, larger group size, and diverse economic and domestic activities. Archaeological correlates of these home base camp attributes are facility diversity and permanence and the discard and accumulation of a diverse assemblage of activity-related implements and refuse (Vierra 1980; Binford 1980). Facility diversity would include a wide range of specific and general activity features, such as structures, storage units, and hearths and processing pits. Implement and refuse diversity would include debitage from tool manufacture and maintenance, broken or exhausted tools, and food processing tools, such as manos and metates. The distribution of features and artifacts would reflect redundant living space for each commensal unit within the larger group.

Sites that unambiguously have a large group, home base camp site structure have been rarely reported in the San Juan Basin. A possible example of this site type would be H-26-56, located along the Gallegos Wash in northwest New Mexico (Vogler et al. 1982:338-408). It was occupied during the En Medio phase (425 B.C. to A.D. 460) with multiple shallow pithouses, storage units, hearths, and a very diverse artifact assemblage. LA 59958 was not a home base camp. It lacks a large array of diverse and permanent features that are contemporaneous.

Limited base camps (Vierra 1980:355) are home base camps on a smaller scale. They would be occupied by a single commensal unit or microband. Economic and domestic activities, including clothing manufacture, food preparation and consumption, tool manufacture and maintenance would have occurred. A full range of economic activities would have produced a diverse artifact and feature assemblage. Limited base camps would be in areas that lacked the abundance of critical resources necessary to support larger groups. Storage and habitation features also may be present. In the San Juan Basin, Late Archaic period artifact diversity would include manufacturing debris from all stages of tool manufacture, use, and maintenance (abundance of early stage manufacture debris would be conditioned by raw material source proximity); discarded broken or exhausted formal tools (blades, drills, knives, hafted scrapers); utilized debitage (expedient tools); and ground stone for plant and seed processing. Feature function diversity would be inferred from size, form, fill contents, and botanical remains. Vierra (1980:355) cautions that limited base camps that have been repeatedly occupied could be confused with home base camps; home base camp inferences should include evidence of contemporaneity and environmental data that would show that an area could support a macroband.

For most or all of its periods of use, LA 59958 was a limited base camp by Vierra's definition. There are hearth facilities exhibiting morphology that is probably related to function. The artifact assemblage has elements from all stages of tool manufacture, use, and maintenance. Artifact diversity, while not overwhelming, includes expedient tools with edge angles suitable for generalized scraping and cutting use. Formal tools include complete and broken projectile points and bifaces, some exhibiting resharpening. Mano and metates for food processing are present, with differences in raw material grain size relating to different grinding stages or plant foods. The lack of storage and habitation features indicates a short occupation with food resources acquired by foraging and consumed daily. Limited base camps are very common in the San Juan Basin archaeological record. Because of their artifact and feature accumulations they are highly visible. The occurrence of abundant and diverse features has resulted in a large number of dated sites (Elyea and Hogan 1983:397) from the Late Archaic period.

Task-specific or limited activity sites result from resource procurement and limited processing. Artifact assemblages should reflect distance from the base camp and may reflect specialized functions (Vierra 1980:355). Occupation would be of short length, result in few features, limited artifact abundance and diversity, and possibly single use. Tools might have been brought to a limited activity site and left, depending on future needs and distance from the base camp. Expedient tools in small numbers might have been used if raw materials were available nearby. Limited occupation from single use would result in very limited spatial organization and a lack of multiple distinct activity areas. No storage or habitation features would be present. Late Archaic period special activity sites would be difficult to differentiate from activity sites from later periods because datable objects or samples might not be present.

To say that LA 59958 was not a limited activity site during some stage of its occupation would be inappropriate. Because there is evidence of multiple occupation spread over almost 1,000 years, the site was probably used as a limited activity site as part of forager or collector forays. This use may be masked by the stronger record of artifacts and features from limited base camp occupations. The low artifact density and feature associations for Features 12 and 23 and Features 21 and 22 may reflect limited activity or resource procurement occupation.

Conclusions

LA 59958 contributes to the understanding of Late Archaic and Basketmaker III period use of the Hospah area. Prior surveys in the area have revealed only special activity sites and isolated occurrences that may have marked task-specific or resource extraction areas. As a setting for a Late Archaic or Basketmaker III period base camp, as well as special activity sites, the evidence shows that the area was more than casually exploited for plant and animal resources. Importantly, the artifact and feature distributions suggest that the hunting and gathering strategy employed by Late Archaic and Basketmaker III populations had continuity. The three feature types, combined with an accumulation of formal and expedient tools, indicate a wide range of economic and domestic activities. These data indicate that the resources in the Hospah area sustained more than occasional foraging. The Hospah area between 400 B.C. and A.D. 500 was an important source of wild plant and animal resources. These resources supplemented budding agricultural economies that existed along the Chaco Wash or they supported a long-term composite forager-collector strategy practiced by Late Archaic and Basketmaker III period populations.

THE RESEARCH DESIGN AND DATA RECOVERY EFFORT FOR LA 59958-LA 59963

Introduction

The data recovery efforts at LA 59958, LA 59959, LA 59961, LA 59962, and LA 59963 provide data on Navajo subsistence, economic status, and social organization between 1930 and 1960. The data for this study were the material remains of the archaeological record and the archival and personal accounts of the ethnohistorical record. These two data recovery methods were applied separately to the problems. Their results were compared and integrated into an interpretive synthesis that examines the patterns in light of regional and national trends.

The data recovery efforts were organized by the site types assigned during the survey. The field phase confirmed the survey determinations, except in the cases of LA 59958 and LA 59963. LA 59958 lacked the expected hogan foundation that was tentatively identified during the survey. LA 59963 was not given additional archaeological treatment beyond the survey recording because of the information gathered during the ethnohistorical study. The site types were defined by the features and artifact deposits that were within or near the project corridor for the archaeological study. The ethnohistorical study dealt with site history as a whole and therefore was not limited to the project corridor. The archaeological information is limited to the preserved subset of the material remains, while the ethnohistorical data provide a more holistic view of the sites.

In keeping with the original data recovery plan, the archaeological and ethnohistorical studies will be presented separately. Their respective strengths and weaknesses will be evaluated. Conclusions are presented for the residential and sweat lodge sites separately as they represent different aspects of Navajo culture history.

The Archaeological Study

The archaeological study focused on field recording features and artifacts for all sites and the laboratory analysis of artifacts recovered from sample excavations at LA 59962. Homestead units and sweat lodges were the two site types that were identified. Homestead units (LA 59958 and LA 59962) included the remains of one or more hogans and associated activity and discard areas that were all or partly within the project corridor. Sweat lodges within the project corridor at LA 59959 and LA 59961 were associated with the hogans and activity areas that were outside the project corridor. Different problems were addressed using the data from each site type. Thus, this section will be divided between the homestead units and sweat lodges.

LA 59958 and LA 59962, the Homestead Units

During the survey, LA 59958 and LA 59962 were identified as having the remains of one or more masonry hogans and associated features and activity areas. The data recovery efforts confirmed the survey-based determination at LA 59962.

At LA 59958 there was a different result. A circular configuration of small to medium-size tabular sandstone blocks identified as the remains of a hogan foundation during the survey (Post 1987) was not confirmed during data recovery. No architectural remains were found within the project corridor. Sample excavation of Feature 16 produced evidence that it was probably an outdoor oven or *horno*. Ovens were usually associated with structures. Therefore, a temporary structure may have existed, but was removed, leaving no structural remains. Because structural remains were not found, there is no residential unit within or near the right-of-way with which to associate the refuse areas and surface refuse scatter. Much of the refuse reflects domestic and livestock raising activities that can be addressed by the research design. Though there are no structural remains of a residence, LA 59958 will still be included in the homestead unit analysis and discussion.

Research orientation and problems. The orientation of the study was to examine economic and social patterns at LA 59958 and 59962 from a diachronic perspective focusing on the period between 1925 and 1955. Data recovery was largely successful, except that the artifact dates and excavated deposits were not from the expected time range for LA 59958. Instead, the period studied for LA 59968 was 1965 to 1980. LA 59962 can still be studied as representative of the 1925 to 1955 period. The finer temporal divisions within the 30-year span are not strongly represented, so interpretations focus on a broader perspective.

In the "Archaeological Research: Theoretical Orientation" section from the data recovery plan (Post 1987:46-48) the theoretical and methodological orientation for the archaeological study was outlined. The study was to form propositions based on Jochim's (1976) cultural ecological study, and artifact patterns were examined as a reflection of economic and social organization. Instead of strictly following Jochim's model (1976:11) for resource procurement from the natural environment, this study focused on responses to change in the local and regional economy.

For twentieth-century Navajos, subsistence options were pastoralism, seasonal and annual wage work, and economic assistance through federal programs. Clearly, one or more options could have been available at a given time. Over the 30-year period represented by the site occupations, mixed subsistence strategies were probably the rule rather than the exception. Even if the strategies were mixed, a major assumption could still be made that changes in subsistence strategies would be reflected in the artifact patterns derived from the archaeological record. These patterns are limited to nonperishable refuse and to refuse deposited on the sites. At LA 59962, however, enough artifact variability exists to allow a study of economic status and group composition. There is less potential to address these issues with the material remains recovered from LA 59958.

Expectations for changing economic strategies are based on the historical events that affected the Navajo Nation and the United States between 1930 and 1955. The national economy between 1930 and 1960 changed from Depression to World War II boom to post-World War II depression to the 1950 to 1960 population boom and expansion. After 1930, the Navajo economy was affected by stock reduction, reduced markets and prices for wool and lamb, and increased competition for jobs (Bailey and Bailey 1986). During World War II, off-reservation war industry jobs and military enlistment were available, reducing economic pressure on the reservation and bringing income into the reservation (Bailey and Bailey 1986). The depleted sheep herds recovered because the enforcement of stock reduction was short-lived. After World War II, the unemployed workers returned to find an increase in job competition. The reservation was again returned to an impoverished state, marked by a heavy dependence on herding and stock consumption (Bailey and Bailey 1986). In the early to middle 1950s, economic recovery began again with increased federal

aid and jobs in energy and transportation. Reservation employment was low, but the new role of the tribal government in administering and developing programs eventually increased reservation employment. Gradually the economic state of the reservation improved (Bailey and Bailey 1986).

Response to economic change should be reflected in the material culture as purchasing power was affected by the fluctuation in income derived from wages, herding, and welfare. Income from these main subsistence resources would have conditioned which resources would have been used, how much of the resource was used, and when the resources could have been used. Rather than being conditioned by the natural environment, subsistence responses are seen as conditioned by the economic environment of the Navajo reservation and the United States.

It was also argued in the data recovery plan (Post 1987:47) that:

> Settlement pattern should also change in response to national and regional trends. Fluctuation in homestead unit and group size and composition during this time must have been extremely fluid. A homestead group is defined as "a nuclear family and it's married daughter's families occupying a territory(s) including the dwelling and farm and/or pasture land" (Jett and Spencer 1981). This term is used interchangeably with subsistence resident unit (York 1983:263). Evidence of groups fluidity should not only be evident in the kinds of refuse, but also in the occupational history of a site. Residences may have been occupied, abandoned, reoccupied, and finally abandoned as the basis of support of the homestead groups changed, The ability to herd and increase the herd size for sale and subsistence would depend on the availability of land and permits to graze the land and the marketability of the herd. Herd size might archaeologically be evidenced by the remains of corrals. Changes in corral size and number through time might be a reflection of how dependence on herding fluctuated and how many herds were maintained by a single homestead group. These factors may influence how many people could depend on herding economy alone. Availability of jobs, skill of the family members, age, and education will also condition who gets jobs, how much they make, and the extent of the support base. This is not likely to be directly represented in the archaeological record, but rather in the ethnohistorical documentation.

Site structure and the artifact assemblage will be used to examine changing group composition. Because only a synchronic perspective is supported by the artifact dates, examination of group composition through the artifact assemblage will not address the potential for change. The site structure and feature associations do allow an examination of changing group composition that is not tied to the changing economic environment of the Navajo Reservation and the United States. Examination of changing group composition will be restricted to LA 59962. LA 59958 lacks the architectural features and associated work areas to address group composition at any level.

The Sweat Lodges, LA 59959 and LA 59961

Two Navajo sweat lodges, LA 59959 and LA 59961, were identified within the project corridor during the survey. The field phase of the data recovery program relocated the sweat lodges. The archaeological study of the sweat lodges focused on recording the material remains. The sweat lodges were not excavated to avoid actions that might be considered disrespectful of Native

American religious practices or beliefs. As a result, the archaeological research goals and expectations were of limited scope.

The data recovery plan (Post 1987:59-61) stated basic questions that would guide the recovery effort: when was the sweat lodge used and what was the site structure? These two questions were addressed by recording and mapping artifacts and features. The material culture and site structure data are compared for differences that reflect changes in sweat lodge function and associated religious beliefs.

DATA RECOVERY AND ANALYSIS METHODS

The data recovery and analysis methods were different for the homestead units (LA 59958 and LA 59961) and the sweat lodge sites (LA 59959 and LA 59961). The methods are directed towards providing data that could be used to address the research questions.

Sweat Lodges, LA 59959 and LA 59961

The data recovery goals for the sweat lodge sites were to obtain artifact and feature attribute and distribution data that could be used to address site history and economic and social patterns. This meant that all of the artifacts and features located within the right-of-way were recorded and mapped.

Artifact recording followed the conventions outlined in the following section on Historic Artifact Analysis Methods. Each artifact was recorded by artifact attribute codes on a Fortran sheet. No artifacts were collected.

Artifact locations were piece-plotted using a transit, stadia rod, and 30-m measuring tape. A sketch map was generated in the field. The azimuth and distance for each artifact were recorded on a form. The artifacts were plotted on site maps during the laboratory phase.

Feature attributes were recorded to provide descriptive and comparative data. Dimensions including interior and exterior measurements were recorded if the feature remains were architectural. The condition of the feature was recorded with attention given to the potential for the reuse of construction materials after abandonment. The construction attributes of the features that were recorded included method and materials. Materials were examined for evidence of factory or industrial manufacture or homemade or local manufacture, such as hand-hewn versus milled lumber. If the feature was a structure, then the orientation was suggested, based on the location of a doorway. Hearth fill was examined without excavation; artifacts, condition and volume of ash and charcoal, and evidence of reuse were recorded.

The features were recorded with measured drawings, photographs, and written descriptions. Feature locations were recorded with a transit, stadia rod, and 30-m measuring tape, and the locations were plotted in the laboratory.

LA 59958 and LA 59962: The Residential Sites

LA 59958 and LA 59962 were much larger and had higher artifact densities and feature frequencies than the sweat lodge sites. The feature and artifact attribute recording was the same for all sites to maintain data comparability.

The artifact proveniencing for the residential sites was different from the sweat lodge sites. The site area within the right-of-way was gridded into 4-by-4-m squares. Starting at one end of the

site and working across the width of the right-of-way, the artifacts were individually recorded within each 4-by-4-m square. The research design originally called for 1-by-1-m recording units; this level of precision was too fine-grained given the field evidence for considerable post-depositional movement of the artifacts. The 4-by-4-m units worked well on the Navajo Indian Irrigation Project sites (Vogler et al. 1982) and were adopted for these sites. Artifacts, such as splinters of wood, tire fragments, and small, nondiagnostic glass or metal fragments were counted within each grid. This information was translated into the attribute codes in the laboratory. This was a time-saving procedure that minimized the effort expended to record redundant information that often occurs at twentieth-century sites.

The ash-can-glass and can-glass dumps were recorded as single units. This means that artifacts within each of these concentrations were recorded without grid assignments, since the feature was the important provenience and analytical unit.

Two historical features at LA 59958 wre partially excavated. These features (16 and 17) were amorphous rock piles that might have been outdoor ovens or hornos. The features were drawn and mapped, then an excavation unit was placed across the feature to obtain a cross section of the construction and fill. The excavation unit for Feature 16 was 1-by-3 m and the unit for Feature 17 was 1-by-4 m. The units were excavated in arbitrary 10-cm levels until sterile fill was encountered. No artifacts were recovered from either feature. The excavation and recording procedures followed those described for the sample of Feature 2 and 9 at LA 59962.

Two ash-can-glass dumps (Features 2 and 9) at LA 59962 were partially excavated. The feature outline was defined by the limits of the refuse scatter, and approximately 25 percent of the feature area was excavated. Feature 2 was sampled with a 1-by-4-m unit and Feature 9 was sampled with a 1-by-3-m unit. The sample excavation units were excavated in 10-cm levels to a depth where the ash and refuse deposit stopped. All of the fill removed from the sample excavation units was screened through ¼-inch metal mesh screen. All artifacts from each excavation level were collected in bulk and separated in the laboratory. The excavation units were profiled and the stratigraphy described. After the excavation was finished, the excavation units were backfilled.

Upon completion of the artifact recording, all features were recorded, as described previously. A site map was generated with a transit, stadia rod, and 30-m measuring tape. All features within the right-of-way and main grid lines were plotted. Features outside the right-of-way were located on the map if they were to be integrated into the site interpretation.

Disposition of the Artifacts and Documentation

The artifacts from the excavation units from LA 59958 and LA 59962 were cleaned and separated by material. These artifacts were bagged, and after analysis they were submitted to the Archaeological Research Collection for permanent storage.

The field and laboratory documents, including the field notes, drawings, maps, photographs, the laboratory records, and an inventory of the artifact collections were submitted to the Archeological Records Management Section, New Mexico State Historic Preservation Division, Santa Fe. These records are available for future research or analysis.

Historic Artifact Analysis Methods

The data recovery efforts for the NM 509 project yielded historic artifact data from three Statehood period (1912 to present) sites: LA 59958, LA 59959, and LA 59962. Surface artifacts from all three sites were recorded in the field, and artifacts were recovered from subsurface contexts from partial excavation of two ash and refuse areas (Features 2 and 9) from LA 59962. These field and laboratory artifact data were analyzed to address problems relating to site history and economic and social patterns.

The artifact analysis focused on recording artifact attributes that would provide chronological and functional information. The attributes were compiled from manufacturer information and were based on assumptions about how artifacts were used in everyday life by site residents. Manufacturer information includes dates when techniques were used, how artifacts were made and out of what materials, and the intended use of the artifact. Assumptions by the archaeologist about how the artifact was used are partly based on the manufacturer information, contextual information, and on current patterns of use.

This analysis was organized so that field and laboratory data would be comparable. It was designed with both structure and flexibility in mind. Structure was required to organize the myriad of artifact types that might be expected on post-1930 historic sites. Flexibility allowed for all artifacts to be classified in some manner, despite size, condition, or material. To this end, all analysis categories were open-ended and could be expanded to accommodate variety.

The recording or analytical structure revolved around a three-tiered functionally based hierarchy. The hierarchical structure is divided in ascending order of specificity into Category, Type, and Function. The analysis structure is not based on material type or manufacturing technique. Instead, it required the analyst to make a decision about the intended artifact function. Duran and McKeown (1980) and Gilpin (1982; 1983) felt that the actual use of an object would be culturally conditioned and probably not accurately defined by the analyst. The archaeologist would bring a bias into the study that might mask other more culturally appropriate uses. Because of pre-twentieth-century occupations at Navajo Indian Irrigation Project (NIIP) sites, the level of acculturation had to be considered. It is a reasonable assumption that some Navajos who were unfamiliar with goods or who had different needs might have used them in a manner other than originally intended.

By 1930, as many Navajos became more reliant on manfactured goods, differences between actual and intended use probably decreased. This Whitehorse Project analysis assumption does not deny the possibility of ethnically determined use, but places less emphasis on its occurrence. For the most part, the artifacts recovered from the Whitehorse sites were probably used at least as initially intended. Although the potential for cultural bias is recognized, it is considered to have a small effect on the assignment of function.

The broadest functional class was Category. There were 10 Categories including Unassignable, Subsistence/Production, Food, Indulgences, Domestic Routine, Household Equipment, Construction/Maintenance, Personal Effects, Entertainment, and Transportation. Artifacts were placed in these categories based on their subsistence or economic function. The categories were selected and defined to allow comparison with other studies, even when the exact content categories may differ.

The intention was to provide mutually exclusive categories, but it was recognized that some overlap in assigning artifacts to one or another category was inevitable. Here, the assumed primary function of an artifact determined its category assignment. There is also the problem of whether an artifact was used as originally intended. For instance, a glass canning jar may have been used for canning, but also may have held small hardware in a shed. Again this issue was addressed by assigning the artifact to its assumed primary functional category. The content of these categories will be briefly described. The actual category content as determined by the analysis is presented in Appendix 10.

Within each category, artifacts were classified by type and within each type, they were classified by function. Type as the intermediate class, divided category into more specific groups. For instance, the Household Equipment category was subdivided into appliances, furniture and furnishings, lighting and lamps, storage, etc. Type really reflects the more specific classification of function. Type is an attempt to order the extreme artifact variability found on twentieth-century sites.

Function is really the individual artifact type, such as nail, sardine can, pencil, stove door, and automobile fan belt. This level of classification exhibits the greatest variability and is the most difficult to organize for analysis. By placing function under type the analyst can look at specific subassemblages that relate to different activities conducted at the site. Function is also used in this analysis to assess the relative contributions that each category made to the assemblage. For instance, if the Construction/Maintenance category seems inordinately larger compared to other assemblages, the analyst can look at function to see what artifacts are contributing to the high frequency and adjust the interpretation accordingly. The following is a brief discussion of the ten categories that structure the analysis.

Unassignable was the broadest and probably the most used category. It exemplifies the methodological goal of flexibility. Unassignable was used when an artifact could not be confidently assigned to another category. The Unassignable category was used to include extremely fragmented artifacts in the analysis. Whole objects that could have had a variety of uses (like caps or wire handles), for which a primary function could not be assigned, also were placed in Unassignable. Similarly, containers that could have held food, an indulgence, or a personal effect were classified as Unassignable. While the heavy reliance on this category reduced the sample for interpretation, it served to limit artificial inflation of artifact frequencies within certain categories.

Subsistence/Production was one of the least represented categories. It included tools and hardware that were used in farming, ranching, or hunting. Some Unassignable artifacts like metal straps, leather straps, and buckles could have been assigned to this category. Also, some hardware from the Construction/Maintenance category also may belong to this category, particularly fencing wire, staples, and baling wire. This category had the greatest potential for recycling, because it could include durable and expensive items. Recycling may have contributed to the low frequencies found in the Subsistence/Production category.

Food, as expected, was well represented. The Food category included both foodstuffs and foodstuff containers. The foodstuff containers were bottles, jars, and cans. Containers were very important for dating. Bottles often have partial dates on their bases, maker's marks that are datable, or manufacturer information that is datable.

Can sizes have a wide range of use dates and they often are associated with a particular foodstuff, such as sardine cans or condensed milk cans (see Table 17). Subsistence data may be gleaned from can sizes. Can sizes may reflect the relative economic well-being of a consumer. Small cans may reflect limited money for buying quantities of food. They may reflect a logistical strategy, with the purchase of smaller quantities necessary because there was no way to keep the uneaten food. Small cans may reflect group size. For example larger volume cans would not be expected in an assemblage resulting from the eating habits of one or two people. Finally, can size may reflect the selection offered by trading posts or off-reservation stores. One or more of these factors may have operated simultaneously or interchangeably during a site occupation and the formation of a refuse area. It may be difficult to separate out these different factors in trying to assess the economic or social status of site residents.

The Food category included the discarded animal bone. Few animal bones were recorded on the surface of the sites. Concentrations of bone fragments were recovered from the sample excavation of ash and refuse areas at LA 59962 (Features 2 and 9). The bone recovered from the ash and can and glass areas, was only a part of the actual bone discarded at the site. Larger bones may have been split and consumed for the marrow or given to the dogs. A detailed report of the faunal analysis is provided in Appendix 11.

Attempts to assess the residents' economic condition by looking at the discarded foodstuffs and containers are affected by at least one very important factor: many foods are consumed and leave no evidence (Ward et al. 1977:267). Foods that fall into this class would be the bulk foods that were stored in sacks and bought in large quantities, as well as fresh fruits and vegetables. Bulk foods that were sources of starch, carbohydrates, and protein included dried beans and flour. An estimate of caloric requirement and intake should factor in a percentage that could be attributed to the "invisible foods."

Indulgences were foods that were not necessary for subsistence. These included soda, alcohol, tobacco, and candy. While these products have little nutritional value, they may have been an important part of the diet in an economic sense. Presumably, indulgences would be purchased after enough food for survival had been secured. If this were the case, then the frequency of indulgences might be an indicator of economic security. A high percentage of specific indulgences compared to other food items might indicate behavior that is counter to common sense. Alcoholism is not rational behavior, and the consumption of alcohol may overshadow the fulfillment of basic subsistence needs.

Similar to other food containers, alcohol and soda containers provide valuable dating information. Maker's marks, production techniques, and manufacturer information are all temporally sensitive to some degree. This inserts a cultural bias into the archaeologist's ability to date historic sites precisely: the more artifacts from the Indulgence category that are recovered the better the date range might be.

The *Domestic* category included cooking and eating utensils and objects used for maintaining a household. Although this category was very broad, it was not well represented in any of the assemblages. Recycling or reuse may be common for some domestic items. Things like pots and pans and metal cooking and eating utensils may have had a use life that extended beyond the end of the occupation. Cooking and eating utensils may be kept and used for more than one generation. Therefore, some items that are discarded may originate from an earlier period. Dish and glass ware also may have had a long use life and depending on the economic status of the site

resident, a slow rate of replacement. Duran and McKeown (1980:1082-1084) suggest that use of ceramic versus enamel ware may indicate both an increase in purchasing power and a change in local trading post inventory. NIIP sites generally yielded small numbers of artifacts from the Domestic category (Vogler et al. 1982).

The *Household Equipment* category included artifacts not associated with food consumption and preparation. This category included stove parts, furniture, lighting accessories, and storage equipment and accessories. Most of these items should have a long use life. Disposal and breakable parts like batteries, clasps, and lantern mantels, should be more common than durable stove and lantern parts. Most of these items would be necessary for basic home life. An absence of these items would indicate either poverty or a very short occupation.

The *Construction/Maintenance* category included parts of tools, equipment, and materials used in the construction and maintenance of structures or enclosures. Construction/Maintenance category artifacts may be an indication of the size of the homestead, the length of occupation, and relative economic status, as indicated by sheer quantity. The recovered artifact assemblage would have been depleted by materials salvaged for use in the construction of a new hogan.

The *Personal Effects* category included clothing, adornments, grooming items, and medicine. This category may be an indicator of economic well-being and level of acculturation. These artifacts are another source of a wide range of datable artifacts. The level of acculturation and this measure of economic well-being may be closely tied. Use of Euro-American products for personal care instead of traditional Navajo items should have increased through time as more goods were available and the social norms that promote the use of the goods were accepted.

Concern for illness among Navajos may be reflected by the traditional and commercial methods they used. Kluckhohn and Leighton suggest that Navajos were open to trying new methods of healing (1974:52). While traditional methods for treating illness might continue, the use of commercially available remedies might supplement the traditional treatments for minor illness or pain, if money were available. The perceived source of the sickness also may affect the curing method used. Illness believed to be caused by witchcraft would always require a traditional curing ceremony.

The *Entertainment* category included items that were not necessary for subsistence or construction or personal care or use. Examples from the Entertainment category are toys, writing equipment, and books. Duran and McKeown (1980:1101-1102) suggest that toys could be an indicator of level of acculturation. Level of acculturation would be reflected in the variety and source of the toys. Pre-World War II sites had fewer noncommercially made and more homemade toys. During and after World War II, as wage work became more common, fewer homemade toys were recovered, and the variety of toys increased. Homemade might have been more common when there was less money. Steady wage work might have brought more toys into the household, and therefore more would be discarded.

The *Transportation* category is subdivided into the mode of transportation: wagon and automobile/truck are the two major classes. The use of wagons or motor transportation is temporally and economically important. Wagons are expected to be most common on sites that pre-date 1950. In some areas of the Navajo Reservation wagons continued to be an important mode of transport into the 1960s (Bailey and Bailey 1986:266-268). Before 1930, even wagons were not common on the Navajo Reservation, with horseback being the main method of transportation. In

the 1940s, an estimated 1 of 50 families owned a car or truck, by the early 1960s, one in three families owned a car or truck (Kluckhohn and Leighton 1974:71; Bailey and Bailey 1986:268). Ownership of a car or truck by a pre-1950 family would suggest a fair amount of affluence. Although a one-time purchase, cars require gas, oil, parts, and maintenance. Keeping a vehicle running would require a substantial investment.

Besides the functionally based identifications, manufacturer information and technological and morphological attributes were recorded. Some of the attributes were expected to yield information for dating and on the economic status of site residents. Manufacturer information included maker's marks, labels, and product names. Morphological attributes include shape, color, size, and volume, for example. Technological attributes such as seal, closure, and manufacturing technique have been thoroughly described in the literature (Fontana et al. 1962; Vogler et al. 1982; Duran and McKeown 1980).

Manufacturer's brand name or company merits additional discussion because of how it was recorded. The manufacturer's brand name or company when used for cans, bottles, jars or other containers could come from either the container or the contents. Logically, they could have been divided into two categories. Unfortunately for this study, product and container manufacturer name were recorded as the same variable. Thus, if an artifact had both a brand name and a container manufacturer's name, the one that contributed the most useful dating and subsistence information in the context of this analysis was recorded. Usually, this would be the brand name, which often included the name of the contents, or at least contents could be inferred, because the product is still in use. Future analyses would benefit from the use of two variables to record this information.

Dimensions and volume were recorded for artifacts when they were important for dating, function, or as subsistence data. Whole can measurements were taken as outlined in Duran and McKeown (1980) and Gilpin (1982). This method entailed recording the height and diameter of a can in sixteenths of an inch. A can that was 4¼ inches high and 4 inches in diameter, was recorded as 404 by 400. This method of measurement proved fast and easy to record in the field, once the crew members became accustomed to the measurement increments of sixteenths of an inch. It also conforms with can industry standards that are available in the literature. If a bottle, jar, or can volume could be determined or was printed on the artifact it was recorded. Actual measurements of bottles, jars, and other artifacts were not routinely recorded. Pot and pan sizes were estimated, when possible.

The condition of the artifact was recorded as fragment type or portion. Unidentifiable was used for those artifacts that were so fragmentary that the portion could not be discerned. If the whole artifact was present it was recorded as whole. Whole meant that if a shoelace eyelet was present it was recorded as whole, not meaning that a whole shoe was present.

Artifact Dating Methods and Criteria

Artifact dates were derived from a variety of sources that relate to manufacturers, manufacturing techniques and standards, brand names, and methods of opening or sealing containers. Primary and secondary sources were employed to compile these dates. A list of artifacts, dates, and sources are presented in Tables 6 and 7. Artifact manufacture dates were combined to infer occupation date ranges for the site and formation date ranges for refuse areas. Dates for hogans and associated features were derived by associating them with the nearest refuse area. Except for the excavated assemblage from Features 2 and 9, feature dates are derived from surface artifacts.

Table 6. Artifact Manufacturer Technique and Product Dates

Can Dates for Manufacturers and Techniques		
Rectangular hole-in-top can	1972-present	Gilpin 1982:593
Spot soldered hole-in-top can	1910-1933	Gilpin 1982:596
Sanitary can	1920-present	Fontana et al. 1962
Condensed milk can	1900-present	Rock 1984:9
Condensed milk-Pet	1898-present	
Condensed milk-Borden (h-i-t)	1908-1940	
Condensed milk-Borden (sanitary)	1940-present	
Condensed milk-Carnation	1899-present	
Sardine can	1975-present	Berge 1968:261
Key strip opener	1895-present	Fontana el al. 1962
Key strip, rectangular can	1972-present	Gilpin 1982:612
Key strip, round can	1930-1960	Gilpin 1982:612
Beer cans	1935-present	Ward et al. 1977:238
Beer cans, flat top	1935-1965	Rock 1980
Beer cans, all aluminum	1959-present	Rock 1980
Pull tabs	1960-1972	Rock 1980
Punch top opener	1935-present	Rock 1984:9
Other Metal Artifact Dates		
Shoe or boot eyelet	1874-present	
Safety pin	1900-present	
Clothing rivet	1872-present	
Continuous thread cap	1924-1989	Berge 1980:43
Band-aids	1913-1989	
Glass Container Manufacturers, Brand Names and Techniques Dates		
Glass and Bottle Manufacturers		
Owens Illinois of Toledo	1929-1954	Toulouse 1971
Knox Glass Bottling Co.	1932-1953	Toulouse 1971
Brockway Glass Co.	1925-present	Toulouse 1971
Obear-Nestor Glass Co.	1915-present	Toulouse 1971
Knox Glass Co. of Miss.	1932-1953	Toulouse 1971
Alexander H. Herr & Co. (AHK)	1944-present	Toulouse 1971
Oil City Glass Bottle Co.	1930-1952	Toulouse 1971
Maywood Glass Co.	1930-1960	Toulouse 1971
Brockway Glass Co.	1925-present	Toulouse 1971

Owens Illinois, Dura-glass	1940-1978	Toulouse 1971
Owens Illinois Pacific Coast	1932-1943	Toulouse 1970
Brand Names		
Nehi Soda	1924-present	Riley 1958
Nesbitt's Soda	1924-1970?	Riley 1958
7-Up	1928-present	Riley 1958
Royal Crown Cola	1935-present	Riley 1958
Pepsi	1901-present	Riley 1958
Coca-Cola	1894-present	Riley 1958
Ponds Cold Cream	1913-present	
Vicks	1938-1953	
Techniques		
Crown caps	1894-present	Fontana et al. 1962
Applied labels	1934-present	
Flat glass	1917-1989	Douglas and Frank 1972:45
Purple glass	1880-1917	
Aqua glass	1880-1910	
Amber	1914-1934	
Ceramics		
Edwin Knowles China Co.	1910-1948	Kovel and Kovel 1986:135
Miscellaneous		
Carbon core batteries	1917-1963	Ward et al. 1977:255
Marbles	1938-1955	Ward et al. 1977:256

Changes in site structure were examined by looking at the range of artifact dates for each feature. One factor that influenced the reliability of the interpretation of the artifact was the span between an artifact's initial use and its discard. Some artifacts may have had a short use life with discard occurring shortly after the contents are consumed or the item was used. In modern society, an example of an artifact with a short use-life is a paper towel. Usually, it is discarded immediately after use. An example of an artifact that has longer use life is a jar, which after its contents are emptied, may be used to store other things. For instance, jars are used to hold nails and solvents in most modern American garages or work shops. Other artifacts should not have regularly left the systemic context during the period of occupation, but they still appear in the artifact inventory. The most common example would be the "return for deposit" bottle. Though not a common item today (except in states that have passed bottle and can deposit bills), most pre-1960 soda bottles could be returned for cash. This fact would would not have been lost on site occupants, so it is not surprising deposit bottles are rarely associated with residential occupations. Each feature date inference must consider the artifact date ranges and the possible implications of the artifact's inferred life span.

Table 7. Can Dimensions and Manufacture Dates

Diameter (mm)	Height (mm)	Beginning Date	End Date
208	208	1948	1980
211	410	1931	1980
211	400	1930	1980
215	315	1930	1980
300	404	1930	1980
300	404	1930	1980
303	405	1931	1980
306	406	1931	1936
306	409	1931	1980
308	408	1931	1936
400	304	1970	1980
400	411	1920	1980
404	306	1940	1980
404	414	1925	1939
404	700	1925	1980
500	508	1916	1947
604	700	1916	1980

(based on Duran and McKeown 1980 and Gilpin 1982, 1983)

EXCAVATION AND ANALYSIS RESULTS

The following sections detail the results of the excavations and analysis. The data are presented as descriptions with interpretation offered as appropriate. The analysis and interpretations of research problems will be addressed using the site and artifact assemblage data in a subsequent section.

LA 59958

Site Description

The historic component at LA 59958 is on land acquired by the New Mexico State Highway and Transportation Department from private sources. The site is 132 m north-south by 250 m east-west, encompassing 25,500 sq m. The site area within the project corridor was 132 m north-south by 48 m east-west, encompassing 7,920 sq m.

Observed features within the project corridor included three animal pens, one possible collapsed horno, a rock discard pile, two concentrated trash areas, and a diffuse refuse scatter across the site. The site was originally thought to be a homestead, but evidence for this did not materialize during the field investigation. Instead the site had a variety of food, domestic, transportation, and construction maintenance items concentrated in small and large dumps and the animal husbandry features.

The site is on a low ridge that extends to the north edge of an east to west trending unnamed draw, a tributary of Sandoval Arroyo. The highest point of the ridge affords a 360 degree view, with an especially long view to the east-northeast along the Sandoval Arroyo, which drains into the Rio Puerco of the East. The Jemez Mountains are visible to the east and Mount Taylor is visible to the southeast. The horizon in all four directions is delineated by exposed sandstone faces of low mesitas or by rising grassland, terminating in mesa tops with the sandstone exposures facing away from the site. The mesa tops and knoll tops are dotted with piñon-juniper, grama grass, ring muhly, clumps of prickly pear, and an occasional yucca.

The top soil of the site is loose, brown, eolian sand. It overlies light yellow brown to brown sandstone. Sandstone is abundant and exposed on the southern slopes of the ridge. The north and west slopes are primarily deep eolian dune deposits.

Feature Descriptions

Seven historic features were recorded within the project corridor. Many more features were present outside the project limits. These were not recorded. Examination did not alter the interpretation of the site. Some artifact data were recorded from the larger refuse areas outside the project limits to supplement the surface artifact data collected from within the project corridor.

Feature 16. Feature 16 was one of two low mounds of burned and fire-cracked tabular sandstone, in Grid 80N/120E, northwest of Feature 17 (Fig. 3). Its dimensions were 2.75 m east-west by 2.3 m north-south by 20 cm deep (Figs. 16 and 17). The sandstone in Feature 16 was in larger pieces and

mounded higher than the sandstone associated with the similar Feature 17. A 1-by-3 m trench exposed a cross section through the mound that showed the sandstone extending from 5 to 25 cm below the surface; no intact structural components were present. The feature matrix was slightly darker than the soil outside the feature, and pieces of burned juniper were present. The feature may have been a historic horno or another feature related to cooking.

Feature 17. Feature 17 was a moderately sparse oval scatter of burned and fire-cracked tabular sandstone rubble. It may have been associated with Feature 16, which is immediately to the northwest. Feature 17 measured 4.5 m east-west by 3 m north-south (Figs. 16 and 18). A 1-by-4-m trench exposed a cross section of the feature. Immediately below ground surface was a dark lens of charcoal-stained soil, a dense concentration of burned tabular sandstone, and extensive charcoal. This lens extended to 19 cm below surface at the feature midpoint, and tapered upward in both directions. A C-14 sample was collected from the deposit, though it seemed recent in age. One piece of amber glass was recovered in the trench. No intact structural remnants were observed. The feature may be accumulated discard from use of Feature 16, which may have been an horno or it may be the remains of an earlier horno that had large parts scavenged to construct Feature 16.

Feature 19. Feature 19 was a 20-by-30-m trash dump. This dump was 150 m west of the main portion of the site. Based on the large size of the accumulation, this trash dump may have served more Hospah residents than those who lived on the ridge. Items within the dump included bicycle and tricycle parts, 1960s vehicle parts, dinette chair frames, bottles, food and beverage cans, enamelware, a coffee pot, and a saucepan. Most of the material appeared to have been deposited after 1960.

Feature 20. Feature 20 was a 4-m-diameter trash area immediately east of the right-of-way. Items within the dump included a teaspoon, two pennies (1962 and 1969), six bottle bases, pop-top soda cans, a lard bucket, 171 evaporated milk cans, and game tokens. This deposit was formed in the late 1960s or early 1970s.

Feature 25. Feature 25 was an in-use sheep pen with enclosed stalls and an open-air corral. The stalls and corral measured 12.08 m east-west by 12.35 m north-south. The pen was constructed of metal posts and rails (average height: 1.5 m), milled lumber (two-by-twelves), and boxwire fencing. The gate was made of metal posts and two-by-twelve-inch lumber. Stalls within the enclosure were divided with one-by-four milled lumber. Materials used to cover the pen walls and to roof the stalls included corrugated tin, an old trailer door, plastic, and tar paper.

On the west end of the sheep pen, by the back side of the stalls, there were two corner posts and two support posts that once were part of another open pen. Judging by the placement of the posts, the dismantled pen would have measured 12-by-12 m.

Feature 26. Feature 26 was a 10.2-m-diameter sheep corral that was used until shortly before the road project was initiated. The round corral was constructed of 15 metal and wooden posts (average height: 1.5 m) and boxwire fencing. The posts were placed at an average distance of 2 m apart. An old bedspring was used for the gate.

Feature 27. Feature 26 was a partly disassembled sheep corral that measured 10.6 m in diameter. The corral had nine upright wooden posts spaced 1 m apart. Other construction material had been removed and possibly reused for the enclosed sheep pen (Feature 25). There was a large piñon tree in the center of the corral that provided shade.

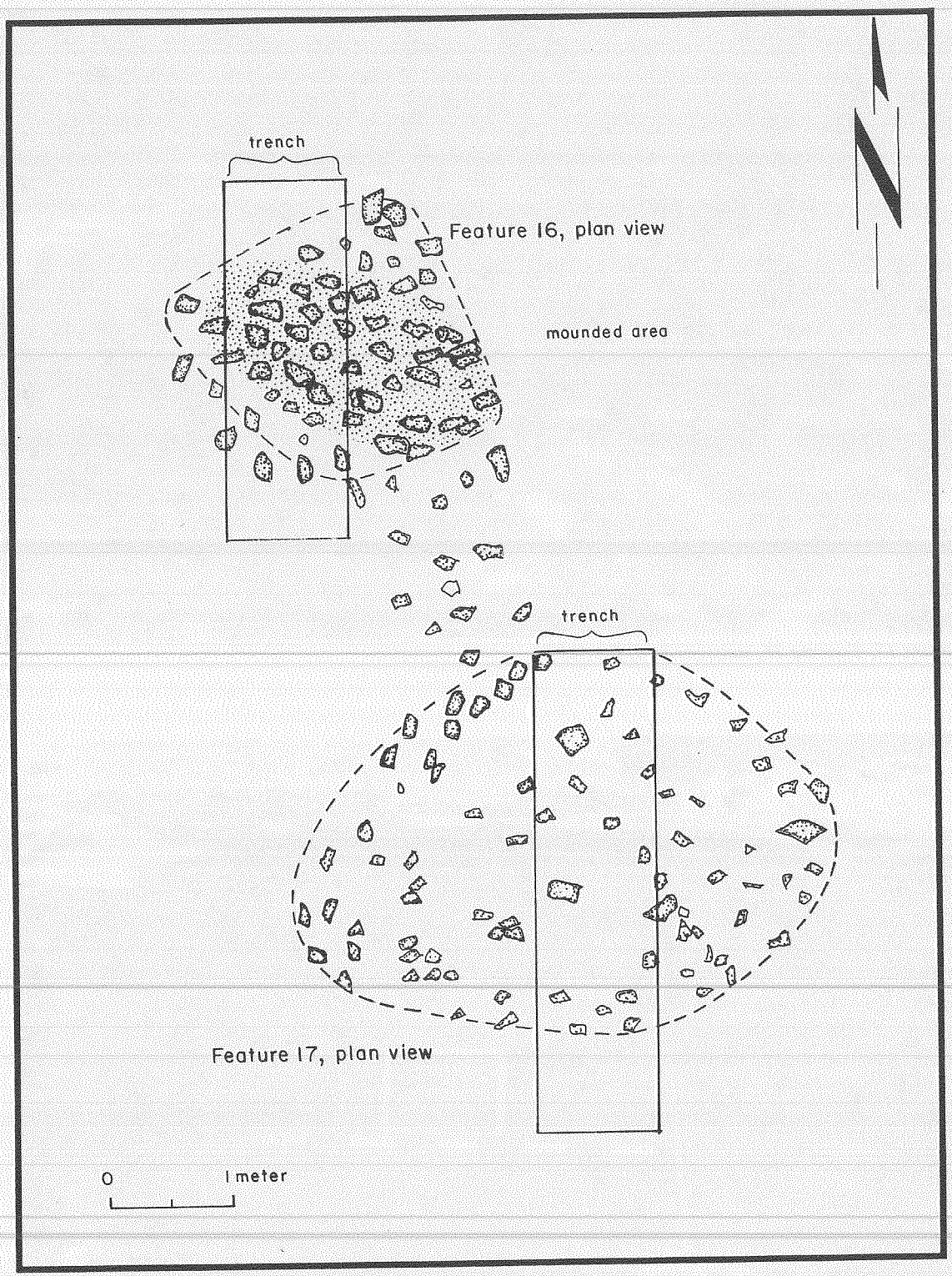


Figure 16. Plan view of Features 16 and 17, LA 59958.

Figure 17. Feature 16, unexcavated, LA 59958.

Figure 18. Feature 17, unexcavated, LA 59958.

Material Culture

This section describes the historic artifact assemblage. The artifacts within the project corridor were recorded as described in the Data Collection Methods section. Artifact recording outside the right-of-way focused on temporal and functional attributes that could be used to supplement the systematically recorded assemblage. This description will focus on the artifacts systematically recorded within the right-of-way.

The Artifact Assemblage

The systematic artifact recording covered a 9,600 sq m area. The artifacts were mostly in the central portion of the site between Grids 92 and 182 North. The artifact scatter was dispersed and mostly of low density, with two artifact concentrations in the Grids 120-124N/76-80E area (Fig. 3).

A total of 281 artifacts was recorded from within the right-of-way. Table 8 shows the artifact distribution by category. The Food and Indulgences categories were the most common and combined for 64.4 percent of the assemblage. Since no ash dumps were excavated, the predominance of these categories is not unusual.

Table 8. Artifact Category Frequencies, LA 59958

Category	Frequency	Percent
Unassignable	32	11.4
Subsistence/production	9	3.2
Food	86	30.6
Indulgences	95	33.8
Domestic	1	.4
Household Equipment	2	.7
Construction/Maintenance	37	13.2
Personal Effects	7	2.5
Entertainment	4	1.4
Transportation	8	2.8
Total	281	

Table 9 shows the type distributions within each category. The two main type contributors are soda pop and canned goods. The other category classes have type classes that reflect a residential and maintenance occupation, including furnishings, hardware, automobile/truck items, medicinal items, personal care, and toys.

The function class further illuminates the content of the Food and Indulgence classes. Almost 75 percent of the artifacts from the Food category class are condensed milk or juice cans. Only a

minority of items reflects consumption of nonliquid foods. The condensed milk may be associated with animal husbandry and the feeding of lambs, rather than human consumption. If the condensed milk cans were moved to the Subsistence/Production category, it would become a major contributor to the assemblage, and perhaps more accurately reflect the site activities. The Indulgence class includes soda pop containers, but they may have been consumed during herding activities or as part of other activities that occurred on the ridge, like car or truck maintenance.

Table 9. Artifact Type Frequencies, LA 59958

Type	Frequency	Percent
Unidentified	32	11.4
Unidentified	1	.4
Hunting	8	2.8
Canned goods	82	29.2
Condiments	2	.7
Glass containers	2	.7
Unidentified	10	3.6
Soda pop	85	30.2
Glassware	1	.4
Furnishings	2	.7
Hardware	20	7.1
Building materials	13	4.6
Electrical	3	1.1
Storage	1	.4
Clothing	3	1.1
Grooming items	1	.4
Medicine	3	1.1
Toys	4	1.4
Automobile/trucks	8	2.8
Total	281	

The assemblage had few of items that might be related to a residential or household occupation. Most of the refuse reflected use of the ridge top within the right-of-way for livestock and transportation maintenance.

Artifact Dates

A total of 117 datable artifacts were recorded from within the right-of-way (Fig. 19). They represent

the minimum occupation span of 1965 to 1972. This date range is derived from the manufacture dates for pull-tab cans. Pull-tab cans were concentrated in two refuse areas with the remainder lightly scattered across the site. These soda cans may reflect dumping by Hospah residents and not the residential use of LA 59958. If the 1965 to 1972 date range is put aside, then another minimum occupation span ranges from 1948 to the present. The early date for this range comes from the latest initial product manufacture or technique implementation date.

Because of the possibility of dumping, the artifact dates from within the right-of-way are ambiguous. They show a restricted minimum occupation span, but the appropriateness of the span to the structural features at the site is questionable. Two refuse areas located outside the right-of-way provide additional dates. Feature 20 had four bottle bases with dates ranging between 1959 and 1970 and two pennies with 1962 and 1969 mint dates. These six dates support the shorter span from the soda pop cans. Feature 19 was a very large domestic refuse area with a refrigerator, kitchen stove parts, car parts, broken furniture, and enamel pots, pans and dishes. Sixteen different can sizes were recorded. The cans did not conform to available can industry standard data and could not be used for dating. A 1960 to 1965 Ford truck cab and assorted parts correspond to the date range from the right-of-way artifacts and Feature 20.

Summary

The data recovery efforts at LA 59958 were to focus on aspects of site history, subsistence economic status, and residential group composition and size. Data recovery revealed that the surface historic scatter and refuse concentrations could not be directly associated with a particular residence.

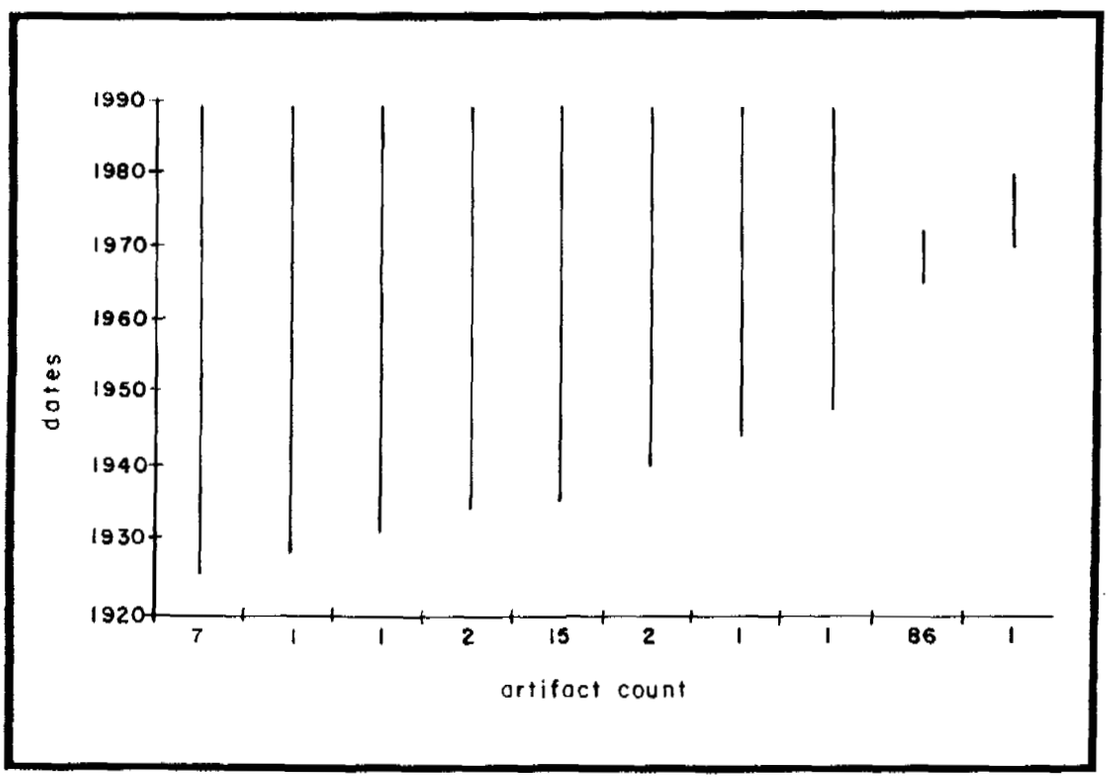


Figure 19. Historic artifact manufacture dates, LA 59958.

At the time of the survey in May 1987, there was a house trailer located to the north of the LA 59958. The modern occupation house trailer did not have much bearing on the features and artifact patterns at LA 59958, although it probably accounted for some refuse accumulation at Feature 19, a large refuse area. The sheep pens or corrals were in current use, but were recorded as part of the site. Use of the sheep pens or corrals and the adjacent site area for livestock raising activities also could have contributed to a part of the artifact assemblage and distribution.

Since the livestock raising was a recent and ongoing activity, the artifacts it produced should have and did yield post-1970 dates. The period from 1965 to 1972 was best represented, which was later than the period to be addressed by the data recovery efforts. Also, most of the surface provenience animal bone, wood scraps, tar paper, and corrugated metal was probably discard from the corral and pen construction and maintenance.

Lack of a residential focus and the potential for multi-occupation artifact mixing limit the questions that can be addressed. However, the data are relevant to some of the research questions, such as when was the abandoned portion of the site occupied and what was the economic base of the residents and how did it change through time?

The archaeological study recognized two potential sources for temporal information: diagnostic building styles or components and temporally sensitive artifacts. Without architectural features that pre-date 1960, temporally sensitive artifact attributes remain the only data source. Dates for LA 59958 were obtained from 117 artifacts. The minimum date range was 1965 to 1972. The 40 artifacts that have beginning manufacture dates before 1960 have manufacture spans that extend into the present. These artifacts provide weak evidence to support the assumption of a pre-1960 occupation. Therefore, there are no reliable temporal data that can be used to identify a pre-1960 occupation. The research design objective of looking at changes in subsistence from 1930 to the mid 1950s cannot be met. Instead we can place the site in a more modern context in terms of the Hospah area economy in the 1960s and 1970s.

What was the economic base of the residents and how did it change through time? This question was primarily intended to address changing subsistence in response to the regional and national trends of the 1930s to the mid-1955s. It follows that if the temporal data do not indicate an occupation for that period, then changing economy for that period cannot be examined either. The economic data that were collected do reflect aspects of 1960s and 1970s subsistence. Changing patterns in work habits, monetary sources, and consumer behavior are reflected in the assemblage from within the project corridor and the artifact concentrations outside the project corridor. Therefore, the economic base of the residents will be examined as it relates to the 1960s and 1970s.

Site Description

LA 59959 was a collapsed or dismantled Navajo sweat lodge probably associated with a standing masonry hogan with a cribbed log roof located east of the right-of-way. The collapsed sweat lodge and associated features were within an area 23 m north-south by 26 m east-west, encompassing a total of 598 sq m (all within the right-of way) (Fig. 20). The recorded features were a depression, a cut lumber door frame, a pile of rough sawn lumber (probably used for construction of the sweat lodge), a hearth, a burned rock discard pile, cut lumber, and associated artifacts (Fig. 20).

Most of the 76 piece-plotted artifacts were domestic refuse from the hogan and trash dump, and not utensils used with the sweat lodge itself. Two towels, two cans (possibly used to hold water to make steam), nails, shingles, and other construction materials may relate more directly to the construction and use of the sweat lodge. The hogan, which is outside the project area, is 20 degrees northeast of the sweat lodge, and 170 m distant. There is an outhouse outside the project area that is between the hogan and the sweat lodge.

The site is on the east slope of a low knoll at an elevation of 2,133.6 m (7,000 ft). Vegetation is primarily sagebrush and tall grasses with occasional juniper and piñon trees.

Feature Descriptions

Feature 1. Feature 1 was a sweat lodge depression and door frame base (Figs. 20 and 21). The depression measured 2-by-2 m at its widest point and was 15 cm deeper than the modern ground surface. On the north side of the feature are four tabular sandstone slabs that were the foundation for the door frame.

The sweat lodge was disassembled leaving only the depression. It was probably constructed of a combination of milled lumber and rough cut juniper, judging from the piles of boards and juniper limbs nearby. Wind and water have filled in the depression so that its original shape and depth are uncertain.

Feature 2. Feature 2 was a pile of five ax-cut lengths of juniper branches. The branches ranged in length from 117 to 127 cm (40 to 50 inches). The cut juniper was probably part of the sweat lodge superstructure. No evidence of how the branches were attached to one another or covered were found.

Feature 3. Feature 3 was a roughly circular hearth that measured 1.25 m in diameter. The hearth fill had small- to medium-size burned sandstone and basalt rocks, charcoal, and charcoal-stained soil. The functional interpretation for the hearth is based on its proximity to the sweat lodge. Its proximity suggests that it was used to heat the rocks used in the sweat lodge. It may have been used relatively recently as indicated by the surface charcoal, ash, and nails in the hearth. Perhaps elements of the abandoned sweat lodge were burned leaving nails in the hearth, or the nails could be from other construction scrap wood that was burned in the hearth.

Feature 4. Feature 4 was a burned-rock discard pile located near the sweat lodge. The discard pile measured 2 m north to south by 1.5 m east to west. Approximately 50 sandstone rocks and 30 basalt

rocks were visible on the surface. The average size of the rocks is shown in Table 10.

Table 10. Ranges for Burned-Rock Dimensions, Feature 4, LA 59959

Size	Sandstone	Basalt
Small	6 by 7 cm	4 by 5 cm
Medium	10 by 15 cm	8 by 10 cm
Large	18 by 22 cm	10 by 14 cm

Feature 5. Feature 5 was a pile of milled lumber and the sweat lodge door frame. The milled boards were one-by-sixes, one-by-tens, and one-by-twelves, and they ranged in length from 20 to 36 inches. The door frame measured 20-by-34 inches and was constructed of four one-by-six boards, nailed together in a rectangular shape. The three widest boards (one-by-twelves) were scattered to the south and may not have been part of the sweat lodge structure.

Material Culture

The 76 recorded artifacts were assigned to the Unassignable, Food, Indulgences, Construction/ Maintenance, Transportation, and Personal Effects categories (Table 11). As mentioned before, artifacts that originally were associated with sweat lodge use include cans, nails, towels, and wood or lumber. Items that were from the hogan occupation include scattered beer or soda cans, glass fragments, car or truck window glass, and scraps of rubber and plastic. There was a light scatter of refuse on the ground between the hogan and sweat lodge, but no there were no concentrations. This suggests that much of the domestic refuse was probably hauled to a dump. The artifacts are typical of the mid-twentieth century, but could not be assigned to a specific decade.

Table 11. Artifact Frequency by Category, LA 59959

Category	Frequency	Percent
Unassignable	5	6.6
Food	19	25.0
Indulgences	2	2.6
Construction/Maintenance	27	35.5
Personal Effects	1	1.3
Transportation	22	28.9
Total	76	100.0

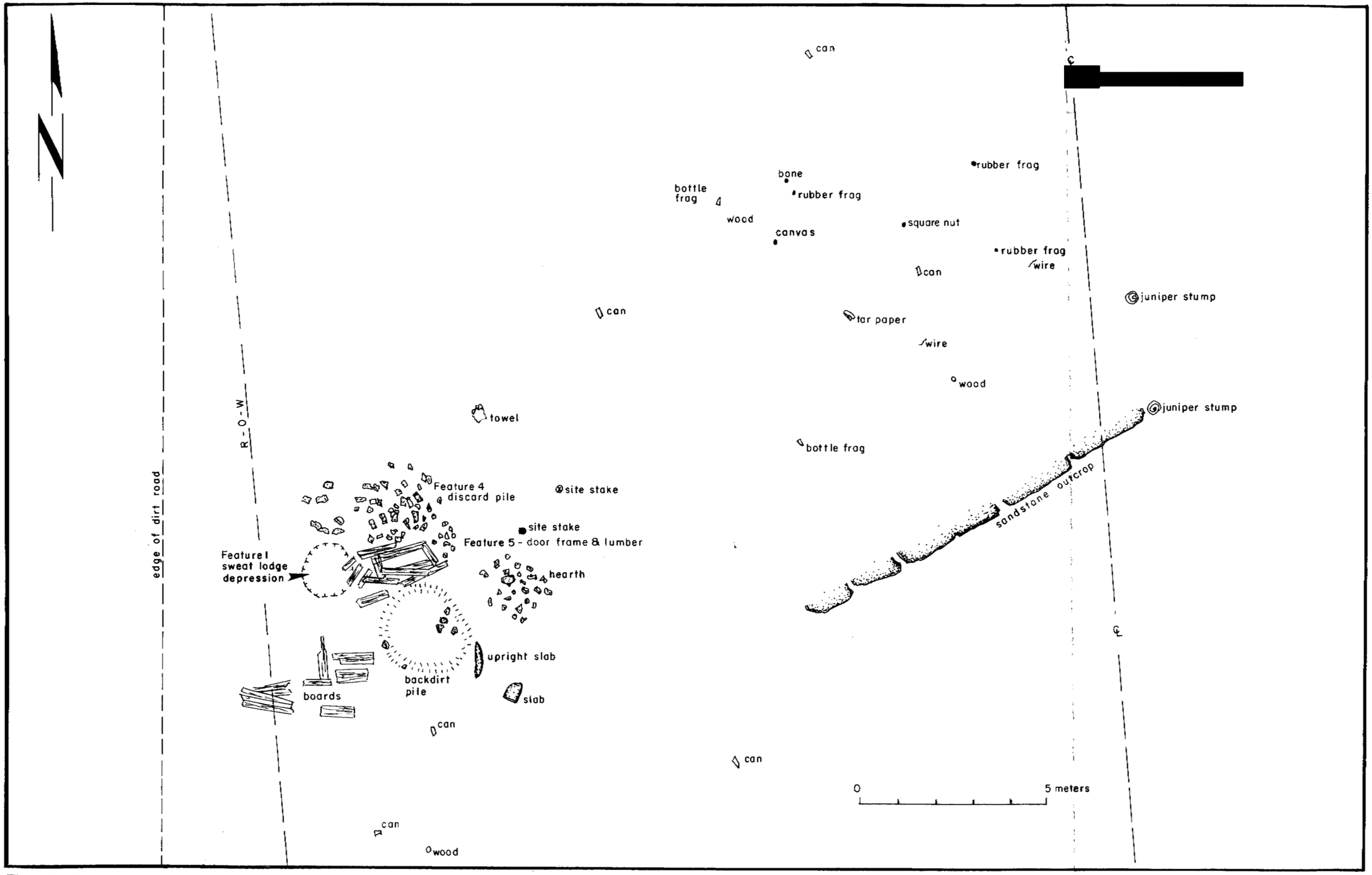


Figure 20. Site map, LA 59959.

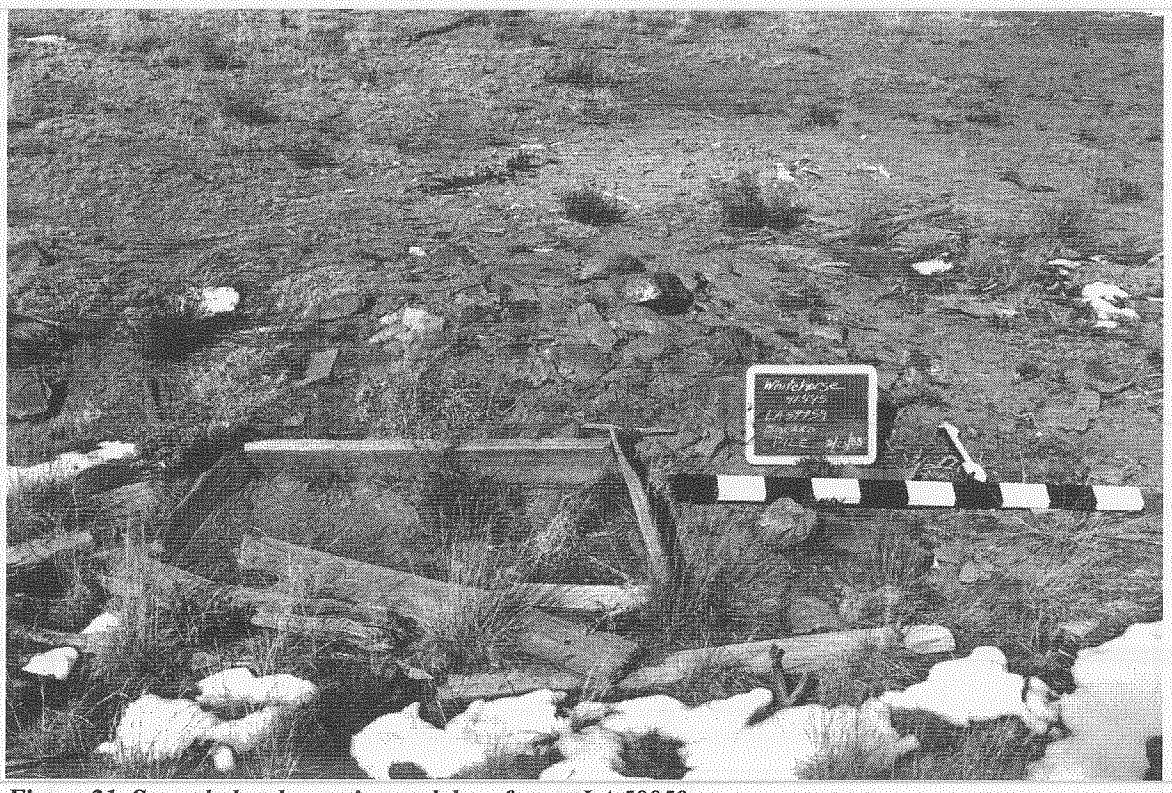


Figure 21. Sweat lodge depression and door frame, LA 59959.

LA 59961

Site Description

LA 59961 was a homestead unit with a sweat lodge and a Mesa Verde phase prehistoric sherd and lithic artifact scatter (Fig. 22). The site is 60 m north-south by 100 m east-west, encompassing 6,000 sq m. The portion of the site that was within the right-of-way was 60 m north-south by 30 m east-west, encompassing 1,800 sq m. Land status is Navajo Tribal Trust land.

The site was at the western tip of a sandstone mesita on a gentle, south-trending slope and an elevation of 2,090 m (6,860 ft). The sweat lodge was built on soft, loose, sandy soil that was on top of sandstone bedrock. The vegetation included snakeweed, rabbitbrush, grama grass, and scattered juniper trees. There is a remnant of a hogan that was built into the south side of the mesita, out of direct line of sight from the sweat lodge.

The Mesa Verde phase component of the site was a sherd and lithic artifact scatter that was located outside the right-of-way. This component was documented during the survey and will not be addressed in this report.

The early 1900s component consisted of the exposed slab walls of a hogan, a sweat lodge, and a very light scatter of historic glass and metal artifacts. The sweat lodge and its associated compo-

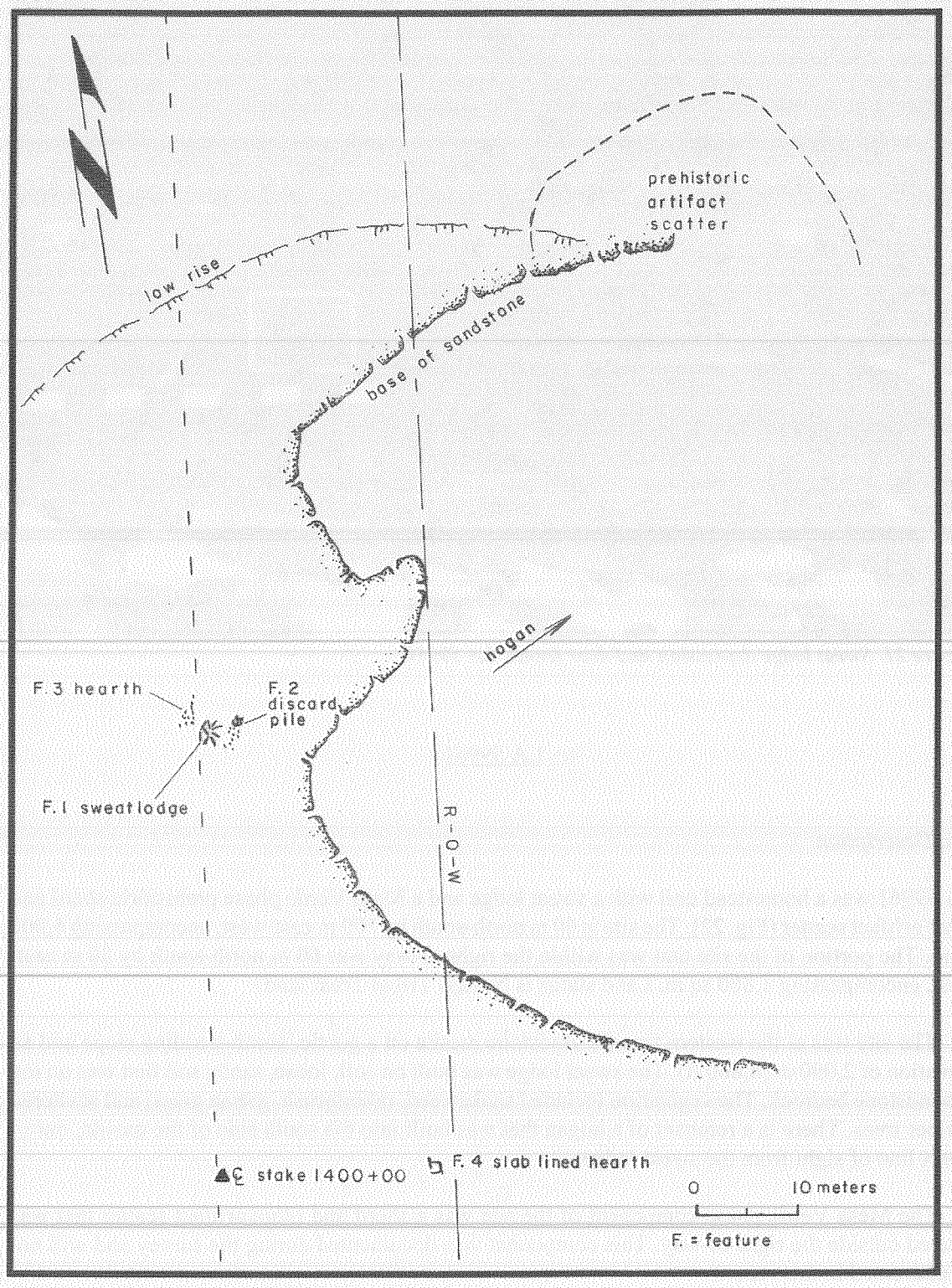


Figure 22. LA 59961, site map.

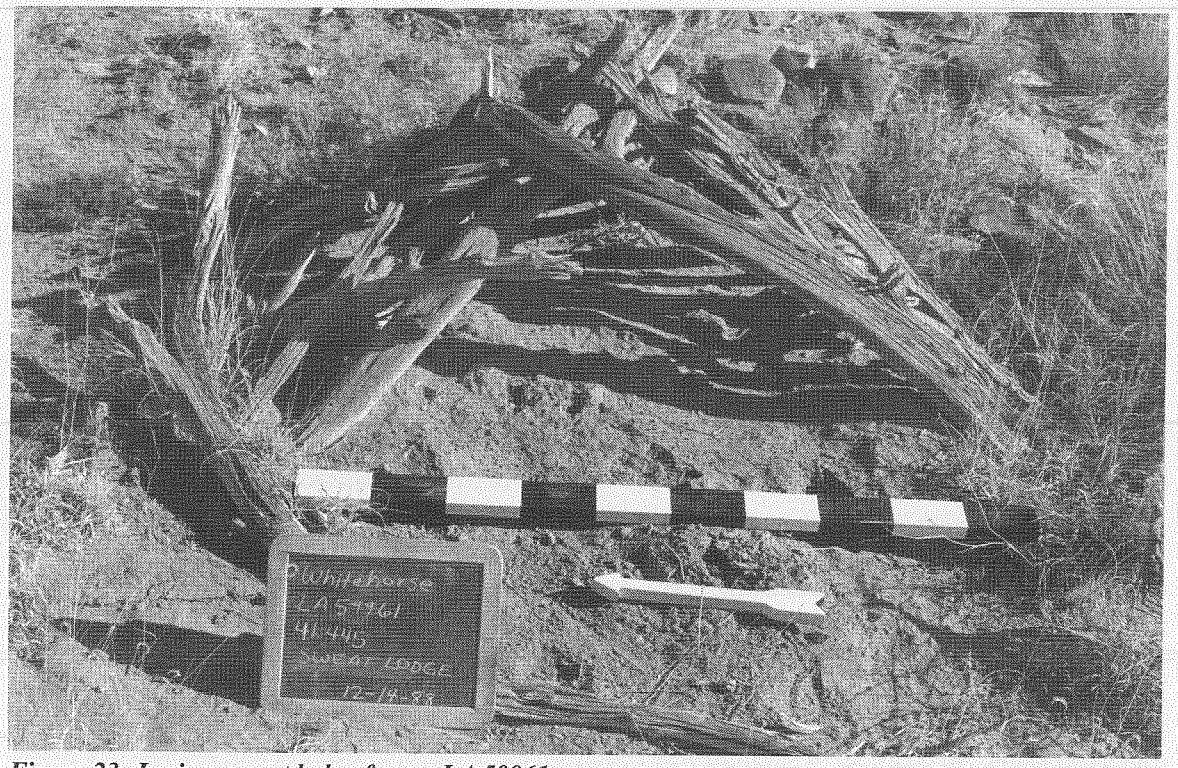


Figure 23. Juniper sweat lodge frame, LA 59961.

Figure 24. Rectangular hearth, LA 59961.

nents and a rectangular slab-lined hearth (identified during the data recovery phase) were within the right-of-way.

Feature Descriptions

Feature 1. Feature 1 was the partly buried remains of a sweat lodge (Figs. 22 and 23). The remaining structural component was a cone-shaped juniper bough frame supported by a forked juniper bough. The 21 boughs range in length from 0.7 to 1.0 m and were buried deeply in loose sand. The interior dimension was 0.9 m in diameter. A considerable deposit of loose eolian sand had collected around and within the lodge.

No artifacts were associated with the sweat lodge from which to estimate its age. The lack of nails or milled lumber suggests that it may pre-date the twentieth century.

Feature 2. Feature 2 was a hematitic sandstone discard pile with rocks ranging in size from 14 by 14 cm to 25 by 30 cm. The discard pile was 1.5 m in diameter and 15 cm high. The discard pile was near the sweat lodge remnant.

Feature 3. Feature 3 was a hearth located 1.7 m northwest of the sweat lodge remnant. The hearth was roughly circular and measured 0.8 m in diameter. The hearth fill contained burned sandstone rocks and slabs. No charcoal or staining was visible on the surface, indicating that the hearth had not been used in the recent past.

Feature 4. Feature 4 was a rectangular slab-lined hearth located 42 m south of the sweat lodge (Fig. 24). It measured 0.7 m north-south by 0.67 m east-west. The interior of the hearth was filled with loose eolian sand. There was no charcoal or stained soil visible within the hearth. The age and association of the hearth is unknown. There were no artifacts near the hearth from which age could be determined.

Summary

The archaeological investigation of LA 59961 was limited to recording features within the right-of-way. Close examination of the area around the sweat lodge hearth remnants did not yield any artifacts that could be used for dating. No additional recording of features outside the right-of-way was conducted during the data recovery efforts. Consequently the information collected during the initial inventory was not supplemented. New details about the site history were gathered during the ethnohistorical study and will be presented later in this report.

LA 59962

Site Description

LA 59962 was an abandoned Navajo homestead unit with seven masonry hogan foundations, seven collapsed or dismantled hornos, an indeterminate rock pile, nine ash or trash concentrations, a

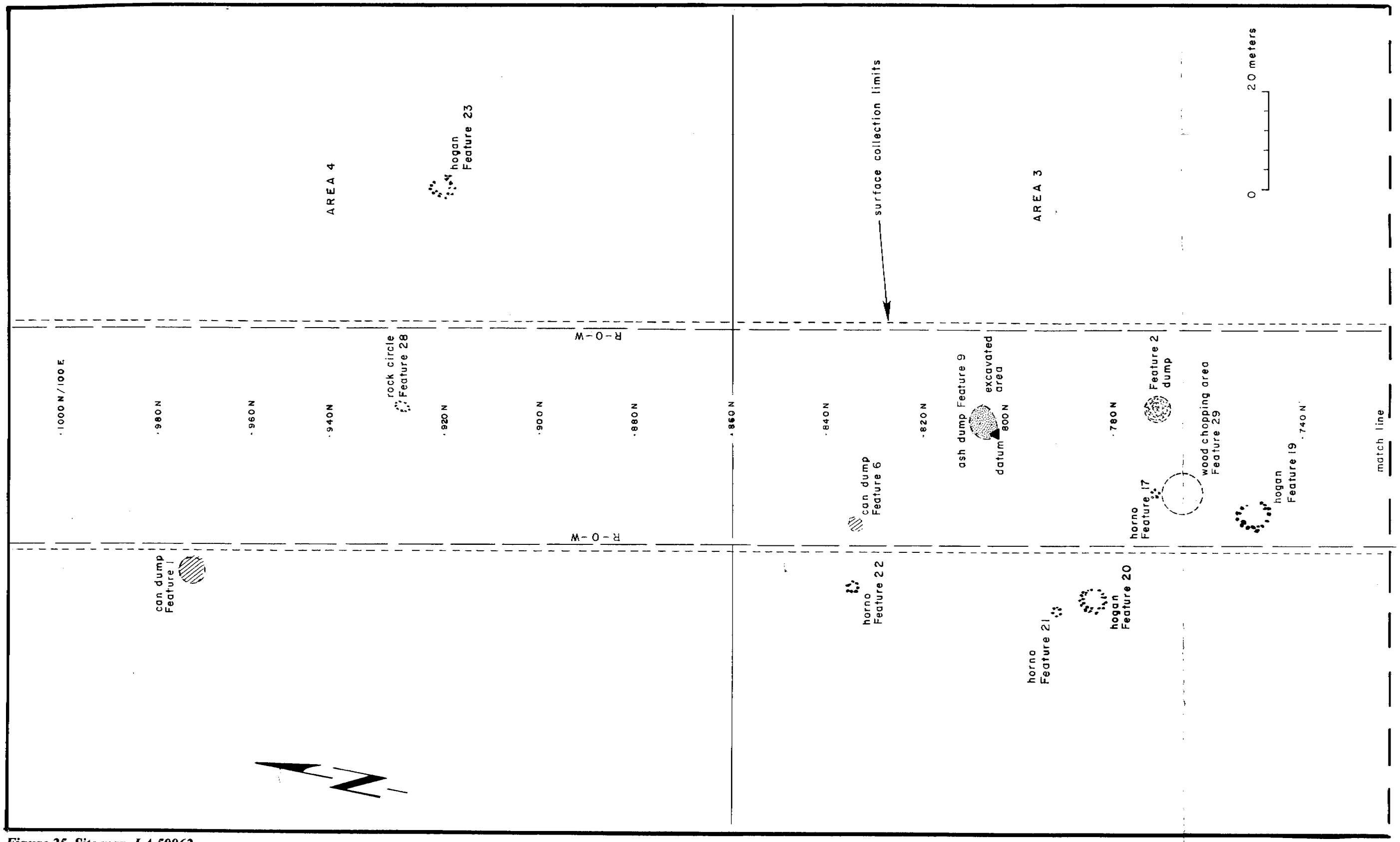
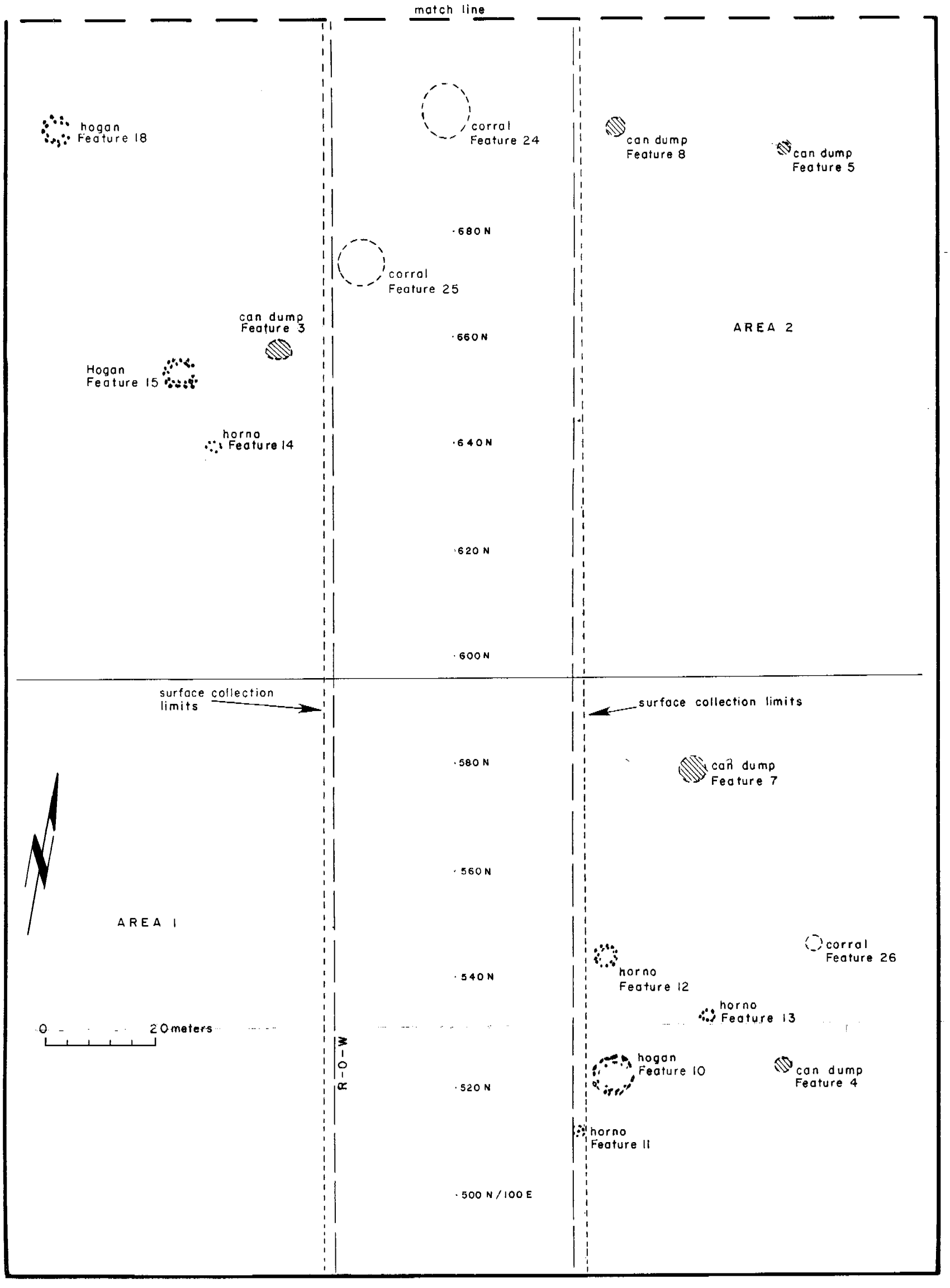


Figure 25. Site map, LA 59962.

Figure 25. Continued.



wood chopping area, and three corral remnants (Fig. 25). These remains appear to date from 1930 to 1950. The site encompassed an area of 504 m north-south by 160 m east-west or 80,640 sq m. The portion of the site within the right-of-way was 504 m north-south by 48 m east-west covering 24,192 sq m.

The site was on a gentle, north-sloping plain that rose gradually to the south, east, and west at an elevation of 2,060 m (6,757 ft). Site elevation increased by 7 to 8 m in the 504 m distance from the north to the south end of the site. The vegetation was primarily grama grass and snakeweed with four or five juniper trees within the site area. Juniper was more common on the low ridges surrounding the site.

Features and artifacts have been trampled by grazing cattle. Large construction materials have been salvaged and removed from the site. Subsurface trash areas remained in good condition.

Feature Descriptions

Twenty-seven features were identified from surface indications. As listed above, the features included hogan foundations, collapsed hornos, ash-can-glass dumps, can-glass dumps, corral outlines, and woodchopping areas. These features will be summarized in terms of these broad classes. More descriptive detail is supplied for the features with architectural components. Refuse areas will be described in detail according to their content in the Material Culture section. Individual structural feature descriptions are in Appendix 1. After the features have been described, spatial relationships or site structure will be examined.

Hogan Foundations

Seven hogan foundations were recorded. None of the hogan foundations were excavated. All observations are based on surface indications. Table 12 summarizes the basic descriptive information. Representative examples of the foundations are shown in Figures 26 (Feature 12), 27 (Feature 18), and 29 (Feature 23).

The seven hogan foundations were evidenced by circular or roughly circular concentrations of tabular sandstone blocks. The foundations were contiguous arrangements of larger blocks outlining all or part of the structure. Besides the foundation outline, rubble was scattered on both sides of the foundation. Except Feature 23, there were no standing wall remnants. Stone hogans are common in the eastern reservation, while many-legged and cribbed-log hogans are common in the central and western reservation (Jett and Spencer 1981). The distribution of construction techniques reflects the relative availability of wood or stone for construction. In the Whitehorse area tabular sandstone blocks are abundant, while suitable or affordable wood may have been less available. Vogler et al. (1982:1424) found that masonry hogans were more common after 1930 in northwestern New Mexico. The presence of masonry hogans at LA 59958 is consistent with this observation.

The array of collapsed blocks within and around Feature 12 were evidence that the walls had stood six to eight courses high. Of the foundation and rubble areas, all but Feature 15 had large blocks in low numbers that were too heavy to carry off and small blocks (10-15 cm largest dimension) in higher numbers. Generally, medium-sized blocks, those with a dimension greater

Figure 26. Feature 12, hogan foundation and rubble, LA 59962.

Figure 27. Feature 18, hogan foundation and rubble, LA 59962.

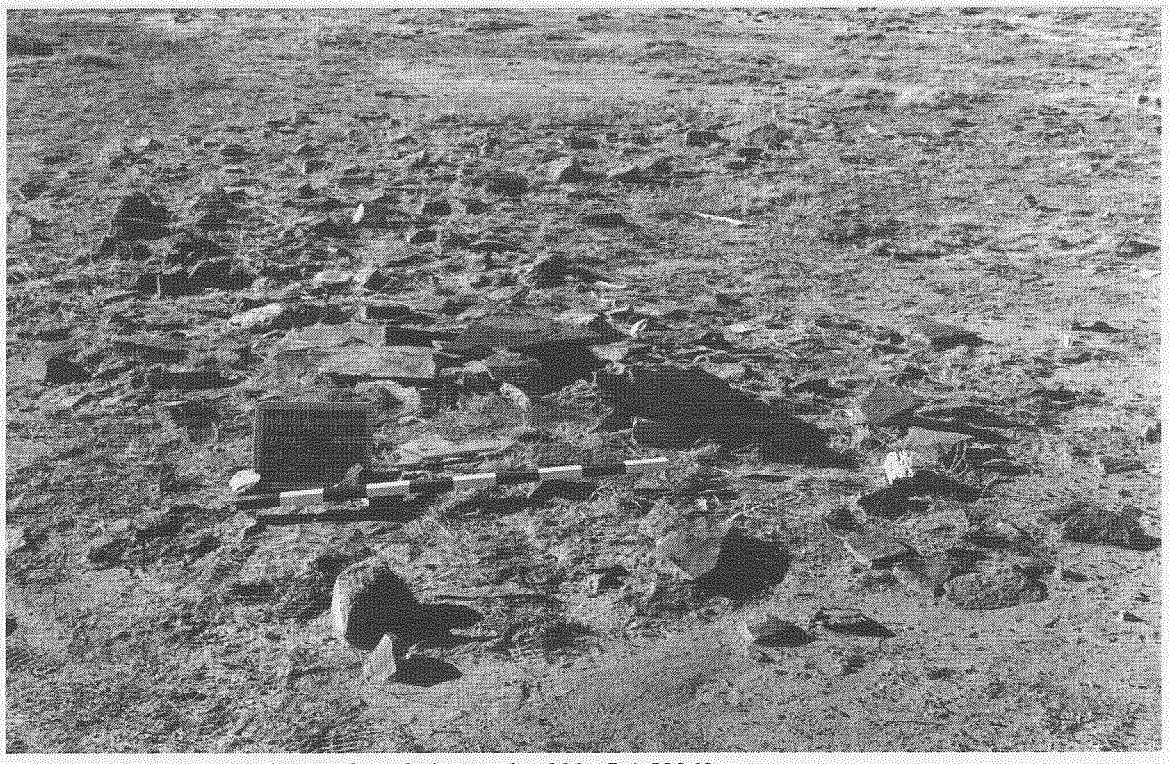


Figure 28. Feature 23, hogan foundation and rubble, LA 59962.

Figure 29. Feature 17, collapsed horno, LA 59962.

than 20 cm, but not too large to carry were in the minority. This was an indication that the rock component of the walls had been salvaged to build nearby structures.

Aside from the foundation remnant, which in Features 20 and 23 was minimal, there were few indications of the original structural components. Features 12, 18, 19, 20, and 23 had one or more juniper boughs inside the sandstone rubble ring. These boughs were not very large and probably were not a major component of the hogan's roof. Other artifacts found inside the hogans were not associated with the hogan occupation, so possibly the juniper boughs were deposited after the hogan collapsed.

Breaks in the foundations of Features 10, 12, 15, 18, and 19 are interpreted as entrances. The doorways are oriented due east in Features 10, 15, 18, and 19, and southeast in Feature 12. The east orientation for the entrances is a common attribute (Kent 1984; Jett and Spencer 1981). None of the hogan foundation interiors were excavated, so no information can be offered on their internal structure. The artifacts found within the rubble concentrations were interpreted as secondary deposits and not directly associated with the use of the hogan.

Features 10, 12, 15, 19, and 20 were associated with other features, such as collapsed hornos, corral rings, ash, can or glass dumps, or woodchop piles. Features 18 and 23 were not associated with features although Feature 18 may be associated with Feature 15 and its features. Kluckhohn and Leighton (1974:88) observe that "Every Navaho establishment includes more than a single structure." Kent (1984) and Kelley (1986) have demonstrated that archaeological evidence for a wide array of features may be lacking or indiscernible from a general site refuse scatter. Many of these features would have been made of nondurable or portable materials that leave no traces. Therefore, an activity area defined by a hogan, horno, and refuse concentration probably had other features as well.

Hornos

Seven sandstone rock concentrations were recorded as possible collapsed hornos. Feature 13 is shown in Figure 29, as a representative example. These concentrations contain small- to medium-sized rocks that are usually in a low mound. All of these rock piles are close to hogans. Because the rock piles were not excavated, they can only be suggested as hornos. They were identified as such because of the restricted scatter of sandstone, the low mound, and their proximity to hogans. Feature 13 had two upright slabs that were probably an oven door. It was the best case for an horno. The other six features are similar to Feature 13, except that they lack a door remnant.

The seven possible collapsed hornos had sandstone concentrations ranging in size from 1.6 by 1.5 m to 2.8 by 2.0 m. The sandstone rocks were usually in a circular or semicircular mound. The rocks were generally medium or small with no dimension greater than 40 cm. There was no evidence of burning within the concentrations, and the rocks were not oxidized. The lack of burning is negative evidence suggesting that the rock piles were not ovens.

The possible hornos were usually located near a hogan foundation. The average distance was 8.5 m with a range from 3 to 15 m. Their orientation relative to the hogan foundation was not patterned. The possible hornos were located to the southwest, southeast, northeast, or northwest of a hogan foundation. This range of orientations is different from the southern orientation of hornos recorded at other permanent Navajo camps (Vogler et al. 1982:1428; Kent 1984).

Table 12. Hogan Characteristics, LA 59962

Feature	Interior (m)	Exterior (m)	Area (sq m)	Condition	Orientation (degrees)	Associated Features
10	4.5-5.0	7.0	18.0	Collapsed; scavenged	90	F.11, horno; F.4 can dump; F.26, corral
12	5.0 x 5.3	7.0 x 6.25	21.0	Collapsed; scavenged 6-8 courses evident	120	F.13, horno; F.7, can dump; F.26, corral
15	5.0	6.0 x 8.0	20.0	Collapsed; scavenged	90	F.16, horno; F.14, horno; F.3, can dump; F.25, corral
18	4.75	5.1	18.0	Collapsed; scavenged	90	northwest of F. 15, hogan
19	4.5	3.0 x 4.0	16.5	Collapsed; scavenged	90	F.17, horno; F.2, ash area; F.29 woodchop
20	4.0	6.3 x 6.0	12.5	Collapsed; scavenged	not determined	F.21, horno; F.9, ash area
23	5.0	6.3 x 7.0	19.5	Collapsed, heavily scavenged	not determined	none

Ash-Can-Glass and Can-Glass Dumps

Four ash-can-glass and five can-glass dumps were recorded and the artifact data are presented in Table 13. Features 2 and 9 were partly excavated, a fact that is reflected in the higher artifact counts. These two types were distinguished by the presence of ash or charcoal that was visible on the surface. Physical descriptions of the individual features are provided in Appendix 1. Artifact content of each feature is presented in the section on Material Culture.

There were four ash-can-glass dumps (Features 2, 6, 7, and 9). These features ranged from 2.8 to 5.4 m in diameter. Excavation of parts of Features 2 and 9 suggest they could be as deep as 30 cm. The excavations also revealed that the surface artifacts did not accurately reflect the total dump assemblage. Average distance from an ash, can, and glass dump to a hogan foundation was 39 m, ranging between 28 and 64 m distant. Intuitively, ash dumps would be expected to associate with stove or oven locations. Feature 6 was 64 m from the closest hogan, contradicting the intuitive pattern. These four dumps have lower numbers of can or glass fragments than other artifact types when compared with can-glass dumps, which lacked high numbers of other artifact types. The artifact frequencies range from 30 to 3,129 items with Features 2 and 9 having the greatest numbers of artifact and the most diverse assemblages.

The five can-glass dumps include Features 1, 3, 4, 5, and 8. They ranged in size from 1.4 to 5.4 m in diameter. Artifact frequencies ranged from 64 to 149. The depth of the deposits is not known because none of these features was excavated. Bulkier and more hazardous items were probably discarded away from the primary activity areas, like the immediate area around the hogan and horno (Kent 1984:171). Distances from the can and glass dumps ranged from 16 to 100 m with three of the dumps 64 or more meters distant.

Corral Outlines

Features 24, 25, and 26 were identified as probable corral outlines that were delineated by a lack vegetation on their interiors. Feature 24 was 11.5 m in diameter, Feature 25 was 7.6 m in diameter, and Feature 26 was oval, measuring 10.5 m north-south by 7.6 m east-west. Feature 24 had part of an upright post at its east edge. The only surface artifacts found within the corrals were a fencing spool from Feature 25 and glass fragments in Feature 26 that were probably deposited after the corral was abandoned. All the corrals were near hogans except for Feature 24, which was equidistant to Features 16, 18, and 19. Feature 25 was near Feature 15, and Feature 26 was near Features 10 and 12. Corrals in these three areas suggest that the occupants kept a small flock of goats and or sheep throughout most of the occupation period. Spatial association between the corrals and hogans suggest that as the hogans were moved, so were the livestock.

Miscellaneous Rock Pile

Feature 28 was an oval sandstone rock pile that measured 3.4 m north-south by 2.2 m east-west. There were no structural rock alignments and no other elements were visible. A few of the rocks were up to 40 cm in length, but most of the rocks ranged in length from 10 to 20 cm. Four of the rocks exhibit some fire-oxidation, as they appear yellowish pink in color. Artifacts associated with the feature included a "D" size battery core, metal screw-top jar lid, a fruit or vegetable sanitary can lid, and a irregular-shaped aluminum piece. The function of the rock pile is unknown, although similar rock piles excavated by Kent (1984) and Vogler et al. (1982) were exterior hearths. The exterior hearths were interpreted as extramural work areas.

Wood-Chopping Area

Feature 29 was a concentration of juniper wood chips that measured 10 m in diameter. It was the only wood chopping area used long enough to accumulate a substantial amount of debris. The area was located between two hogans, Features 19 and 20, suggesting that all three features were contemporaneous. Presumably wood heating was important throughout the site history. The absence of other wood-chopping areas near other hogans is odd. There was no evidence of wood processing or storage at the other hogans though they were associated with hornos, and there was no evidence of alternative fuels such as coal.

Summary

The twenty-seven features were not randomly scattered throughout the site (see Fig. 25). Feature clusters relate to individual household locations and perhaps to supra-household organization. Based on a subjective appraisal of feature clustering, the site can be divided into four areas from north to south. These areas are shown in Figure 25.

The most obvious pattern is evident in Areas 1, 2, and 3. All three areas have two hogans with associated hornos, refuse areas, and corrals. In all three areas, one hogan is larger. Areas 1 and 2 have single ash dumps, while Area 3 has an ash dump for each hogan. Area 3 is also different because it has the only obvious wood-chopping area.

Areas 1 and 2 are almost identical in feature content and spatial patterning. The presence of only one ash area and a single corral suggests that the occupants shared domestic activities. It is possible that cooking and heating occurred in one hogan as a shared activity. Because the two areas are so similar, they may have been built and occupied by the same family, with one set of hogans and hornos dismantled for building the next set of structures.

Area 3 had two hogans each with an extensively used ash area. This departure from the pattern observed in Areas 1 and 2 suggests that a sharing of cooking and heating no longer occurred.

Area 4 differs because the hogan foundation is not associated with other features. The rock pile and can dump within the general vicinity of Feature 23 are not near the foundation. Area 4 may have been used for special purposes that required some separation from domestic activities.

Material Culture

Historic Artifact Assemblage

A total of 4,743 artifacts (excluding the faunal remains) was recovered or recorded from surface and subsurface contexts. Field recorded surface artifacts not associated with features totalled 984. Surface and subsurface feature artifacts totalled 3,759, with Features 2 and 9 accounting for 2,686 and 531 artifacts, respectively, or 67.8 percent of the total assemblage. The high artifact numbers from Feature 2 and 9 reflect the importance of subsurface contexts at Navajo sites.

Table 13 shows the artifact frequencies by category. Unassignable is the most common category, followed by Construction/Maintenance, Food, Personal Effects, and Indulgences. The large number of Unassignable artifacts reflects the fragmented condition of many artifacts. Scraps of metal, rubber, cloth and other materials, and glass and can fragments were placed in the Unassignable category when a confident assignment could not be made. In this way artificial inflation of category frequencies was minimized. Faunal remains are described in Appendix 11 and are not included in this discussion. That data will be incorporated into the research design discussions.

One way to view the artifact diversity is by material type. Twenty-four material types or combinations of material types were recorded (Table 14). The most common material types, as expected, were metal and glass (Table 14). They make up 90 percent of the assemblage. Only rubber and plastic items contribute more than 1 percent. These numbers reflect the importance of durable goods for packaging foods and the use of hardware for building hogans, corrals, and outbuildings. Preservation undoubtedly affects the artifact frequencies, with metal and glass lasting the longest.

Surface and Feature Artifact Assemblages

From the nonfeature surface grids, 984 artifacts were recorded. They were recorded over an area covering 20,000 sq m for an average density of 5 artifacts per 100 sq m. This translates into a light artifact scatter. Nine of ten category classes were present, with only the Subsistence/Production category missing from the surface artifact assemblage.

Table 13. Category by Feature, LA 59962 and NIIP Sites

Feature	1	2	3	4	5	6	7	8	9	surface	Total	H-27-15	H-27-116
Category													
Unassignable	6 9.4	1324 42.3	23 35.4	78 52.3	2 15.4	9 30.0	113 74.8	6 8.6	283 48.0	457 46.4	2301 43.9	4 .6	97 3.4
Subsistence/ Production		5 .16							3 0.5		8 .15	2 .3	19 .7
Food	45 70.3	613 19.6	23 35.4	55 36.9	9 69.2	18 60.0	15 9.9	60 85.7	73 12.3	280 28.5	1191 22.7	499 71.5	2313 81.7
Indulgences	5 7.8	51 1.63	6 9.2	2 1.3		1 3.3	9 6.0		20 3.37	77 7.8	171 3.26		
Domestic Routine		32 1.02		2 1.3	1 7.7				6 1.0	15 1.5	56 1.07	56 8.0	115 4.1
Household Equipment		48 1.53					1 .7		15 2.5	1 .5	65 1.24	7 1.0	27 1.0
Construction /Maintenance		870 27.8	2 3.1				5 3.3		135 22.8	67 6.8	1079 20.6	114 16.3	144 5.1
Personal Effects	4 6.3	103 3.3	3 4.6	8 5.4		1 3.3	6 4.0		36 6.1	35 3.6	196 3.74	12 1.7	65 2.3
Entertain- ment		39 1.25		2 1.3			1 .7		18 3.04	9 .9	69 1.3		9 .3
Transportation	4 6.3	44 1.4	8 12.3	2 1.3	1 7.7	1 3.3	1 .7	4 5.7	3 0.5	43 4.4	111 2.1	4 .5	41 1.4
Total	64	3129	65	149	13	30	151	70	592	984	5247	698	2830

Table 14. Material Type by Feature, LA 59962 and NIIP Sites

Feature	1	2	3	4	5	6	7	8	9	Surface	Site Total	H-27-15 Temporary Sheep camp	H-27-116 Permanent sheep camp	H-22-14 Entrpreneur permanent camp
Material														
Unidentified		1 0.03							1 0.17		2 0.04			
Metal	48 75.0	1730 55.3	25 38.5	56 37.6	12 92.3	18 60.0	18 12.0	68 97.1	158 26.7	402 40.9	2535 48.3	212 30.4	878 25.3	9.9
Glass	11 17.2	786 25.2	26 40.0	83 55.7	1 7.7	6 20.0	116 76.8		317 53.5	435 44.3	1781 33.9	231 33.1	1982 57.1	75.9
Ceramic		21 0.8		2 1.3					3 0.51	13 1.32	39 0.74	52 7.5	94 2.7	0.9
Rubber	5 7.8	93 2.97	13 20.0	4 2.7		6 20.0	8 5.3	1 1.42	11 1.9	62 6.3	203 3.87	1 0.1	26 0.75	0.2
Plastic		19 0.6					3 2.0		15 2.5	13 1.32	50 0.95	1 0.1	3 0.09	0.2
Carbide		1 0.03	1 1.5				1 0.66			1 0.1	4 0.08			
Shell		3 0.1							1 0.17	1 0.1	5 0.1	1 0.1	2 0.06	
Graphite		1 0.03							1 0.17		2 0.04			
Emery									1 0.17		1 0.02			
Calcimine									10 1.69		10 0.2			
Pearl		1 0.03									1 0.02			
Plant									1 0.17		1 0.02	3 0.4	13 0.37	0.4
Wood				3 2.0			1 0.66			18 1.83	22 0.42		3 0.09	

Feature	1	2	3	4	5	6	7	8	9	Surface	Site Total	H-27-15 Temporary Sheep camp	H-27-116 Permanent sheep camp	H-22-14 Entrpreneur permanent camp
Material														
Clay		13 0.4					2 1.32		2 0.34	17 1.72	34 0.65			
Multi-Class		17 0.5		1 0.6			2 1.32	1 1.42	10 1.69	21 2.14	52 1.01	3 0.4	1 0.03	0.2
Stone													86 2.48	
Bone		443 14.2							61 10.3		504 9.6	193 27.7	383 11.0	11.8
Total	64	3129	65	149	13	30	151	70	592	983	5246	697	3471	

Unassignable category artifacts are the most common, reflecting the pattern found for the site assemblage. Unidentifiable bottle fragments make up 63.1 percent of the Unassignable category. The remainder is miscellaneous, glass, can, and hardware parts. The Food category is the next most common. Cans and can fragments make up 96.9 percent of the category. Can contents include vegetables, fruits, condensed milk, and coffee. Combined, the Food and Unassignable categories are 74.7 percent of the assemblage.

The Indulgences category is made up of soda/alcohol bottles and cans, and chewing tobacco containers. Placing soda bottles into the Indulgence category could be an erroneous value judgment. Soda may have been preferred over water, if the water from on-site storage was stagnant or brackish. In this sense soda would not be an indulgence but would be a necessity to maintain body fluid levels.

Domestic and Household Equipment categories represent only 1.6 percent of the assemblage. Their low percentage suggests that they were infrequently discarded as site scatter, that they were discarded as part of formal refuse areas, or that they have a long duration in the systemic context.

Construction/Maintenance category contains nails, bolts, wire strands, a battery core, and a 55-gallon drum part. The Personal Item category contained shoe parts and personal items like face cream. The Entertainment category comprised toy parts. Finally, the Transportation category has rubber auto tires and motor coil strands.

The following describes the artifact assemblages from the ash-can-glass and can-glass dumps. The information from these features will be used to address questions of changing subsistence practices and economic status of the site occupants.

Feature 1 is a can-glass dump. Recorded artifacts included five category classes, with the Food category most common. Low frequencies occur in the Indulgence, Personal Effects, and Transportation categories (see Table 13). Only 64 artifacts were recorded. The low number of artifacts suggests a short period of use for the refuse area. Without subsurface data, however, a short period of use cannot be substantiated. This refuse area could have resulted from short-term domestic dumping.

Feature 2 is the most complex refuse area. Artifacts were recorded from the surface and collected from three arbitrary excavation levels. A total of 2,686 artifacts was retrieved from all contexts: 260 from surface; 1,003 from Level 1; 1,177 from Level 2; and 246 from Level 3. Table 15 shows the frequency distribution of categories by level.

Artifacts from the Unassignable category comprise 49.3 percent of the Feature 2 assemblage. The large number of Unassignable category artifacts reflects the condition of the artifacts. Most of these artifacts were fragmented and burned, as though they had been in a stove. Burning the artifacts may have made them brittle, further encouraging fragmentation, decreasing their identifiability, and increasing the artifact total.

A surprisingly large contributor is the Construction/Maintenance category. If this were only a domestic activity dump, less construction would have been expected. Nails and staples are often reusable. They enter the archaeological contexts when they cannot be removed from the wood or a structure burns and collapses in place. The large number of nails and fencing staples in the burned refuse could come from the use of scavenged construction or scrap lumber as fuel. The wood could

Table 15. Feature 2, Category Frequencies by Level

Context	All Feature	Surface	Level 1	Level 2	Level 3
Category					
Unassignable	1324/49.3	102/39.2	453/45.2	543/46.1	226/91.9
Subsistence/ Production	5/ 0.2		5/ 0.5		
Food	170/ 6.3	23/ 8.8	97/ 9.7	50/ 4.2	
Indulgences	51/ 1.9	15/ 5.8	17/ 1.7	17/ 1.4	2/ 0.8
Domestic Routine	32/ 1.2	10/ 3.8	12/ 1.2	10/ 0.8	
Household Equipment	48/ 1.8		12/ 1.2	33/ 2.8	3/ 1.2
Construction/ Maintenance	870/32.4	74/28.5	352/35.1	434/36.9	10/ 4.1
Personal Effects	103/ 3.8	18/ 6.9	34/ 3.4	48/ 4.1	3/ 1.2
Entertainment	39/ 1.5	7/ 2.7	14/ 1.4	18/ 1.5	
Transportation	44/ 1.6	11/ 4.2	7/ 0.7	24/ 2.0	2/ 0.8
Total	2686/100.0	260	1003	1177	246

have come from dismantled structures at the site or it was obtained as scrap from a construction or demolition site. Scrap wood might have been easier to obtain than the dead wood that was available on the surrounding mesa tops.

Although not contributing the most artifacts, it is very apparent that Feature 2 was a domestic refuse area. A wide range of artifacts from the Domestic Routine, Personal Effects, and Entertainment categories are absent from other refuse areas, but were present in Feature 2. The artifact variability is astounding--114 different function classes were identified. Besides the more common items, there were parts of watches, clocks, hair curlers, eyeglasses, toys, and pencils. The artifact dates suggest that the deposit accumulated over an eight- to ten-year span.

Table 15 shows that 2,426 of the 2,686 artifacts are from subsurface contexts. The large number of subsurface artifacts indicates that excavation of refuse areas will provide significantly greater artifact frequencies and variety than is evident on the surface.

Levels 1 and 2 were very similar in artifact content. Level 1 has all ten category classes and Level 2 only lacked one category. Unassignable and Construction Maintenance were the most common from both levels. The Food category has the only percentage difference that is greater than 5 percent. There are 32 type classes, Level 1 has 21 and Level 2 has 26. While the category classes are close, it appears Level 2 has a greater variety of artifacts by type. This is true for the Indulgence category, which has alcohol, tobacco, and candy present. In the Transportation category, Level 1, has wagon parts and Level 2 has the auto or truck parts, suggesting that both modes of transportation were used simultaneously. More hardware is from Level 1 and more building material from Level 2. The difference is in nails and staples. The nails are from level 1 and the staples are from level 2, suggesting different sources for stove wood through time.

Level 3 had 58.1 percent unidentifiable metal artifact fragments. This high number is similar to Level 2, suggesting that these two levels are part of the same general deposit. The far fewer unidentifiable metal artifacts from Level 1 and surface suggest the deposits may have different formation histories. Further evidence of similarity between Level 2 and Level 3 is the Indulgence category, which is mostly absent from the upper level.

Feature 3 was an ash-can-glass dump, northeast of a stone hogan foundation (Feature 15). From the surface, 65 artifacts were recorded. They fit into six categories, with Food and Unassignable the most common. The Unassignable category is mostly bottle fragments. The Food category includes baking powder, lard, condensed milk, meat and coffee cans, which are typical subsistence items. The association of Feature 3 with the hogan foundation suggests the refuse is from household activities. The low artifact numbers suggest it was used for a shorter time than Features 2, 4, or 9. Excavation would undoubtedly provide more information about the refuse area.

Feature 4 was a can-glass dump, east of a stone hogan foundation (Feature 10). It had 149 surface artifacts from 7 categories. Unassignable and Food are the most common categories. Low numbers from the Domestic, Personal Effects, and Entertainment categories indicate the dump contained refuse from household activities. On the surface, Feature 4 is like Feature 2 or 9 in terms of numbers and range in artifact content.

Feature 5 was a can-glass dump, isolated from any architectural remains. Only 13 surface artifacts were recorded. They have a minimum date range of 1931 to 1936. Artifacts come from four categories with Food (primarily cans) totaling 69.2 percent. The low artifact number suggests the dump was used for a short period. The limited range of artifact types may have resulted from activities not associated with the hogans or reflect a limited reliance on manufactured goods during the early part of the occupation. The artifact dates suggest that it may have been used before the hogans were built.

Feature 6 was a can-glass dump located north of, but not closely associated with, a stone masonry hogan foundation (Feature 20). Only 30 surface artifacts from five categories were recorded. The Food category comprised 60 percent of the total, including meat, vegetable/fruit, and condensed milk cans. Because Feature 6 is 64 m from the nearest hogan it cannot be confidently attributed to residential use.

Feature 7 was a can-glass dump, 40 m northeast of a stone hogan foundation (Feature 10). This feature is not closely associated with a structure, but it has an artifact distribution similar to the household dumps (Feature 2 and 9). Eight categories have a total of 151 artifacts. Unassignable comprises 74.8 percent of the total, with bottle fragments the most common. Without the Unassignable category, Food, Indulgences, Construction/Maintenance, and Personal Effects are well represented.

Feature 8 was a can-glass dump, 32 m west of another small can and glass dump (Feature 5). Only three categories are represented, with Food, as cans, comprising 85.7 percent of the total. Canned foods include meat, vegetable/fruit, condensed milk, coffee, and juice cans. These are staple foods that would be expected at a residential or camp site. The lack of personal or household items and the distance from a residence suggests that this dump resulted from a nonresidential occupation. A beginning date of 1940 indicates that the dump was not formed before the primary residential occupation. If the dump post-dates the 1953 date derived from the site date range, it probably is between 1953 and 1965, since there were no pop-top cans in the assemblage.

Feature 9 was an ash-can-glass dump, 15 m northeast of a stone hogan foundation (Feature 20).

A 1-by-3-m excavation unit bisected the dump. Artifacts from all ten categories were recovered from surface and subsurface contexts. The artifact density was not as high as found in Feature 2, but the range of artifact types is very similar. The Unassignable category comprised 53.3 percent of the assemblage. Bottle and jar fragments were 73 percent of the Unassignable category. Construction/Maintenance made up 25.4 percent of the assemblage, with nails and window glass combining for 74 percent. Personal Effects included clothing fasteners, footwear, and hair care items. Toys and writing equipment were present in low numbers, like Feature 2. The Food category had only 2.3 percent compared to 6.3 percent for Feature 2. On the other hand, bottle fragments increase to 38.5 percent in Feature 9 from 23.6 percent in Feature 2. This may come from a change in purchasing habits. This aspect of the study will be explored later.

Artifact Dates and Site Occupation History

Date ranges could be assigned to 493 artifacts. Manufacture dates and references are provided for selected artifacts in Table 6. Artifacts that could be assigned one or more date range based on different criteria were assigned the narrowest date range (Fig. 30). The greatest assigned range was from 1870 to 1980 or 110 years. The shortest range was from bottles with a single date (for example, 1952). Broad date ranges commonly span 1920 and 1980. These broad ranges can be attributed to long-lived brand names or manufacturing techniques that have not changed (such as sanitary cans or wire cut nails or the one-piece automatic bottling machine). Calculation of the minimum span occupation is most affected by the artifacts with narrow date ranges. The minimum occupation span gives a range when most of the dated artifacts could have been in use. A high number of broad-range artifacts can extend the possible occupation considerably. For instance, several artifacts made until 1970 could suggest that an occupation continued until that time or that the site was reoccupied and refuse facilities or activity areas were reused.

Datable artifacts were recovered from nine refuse areas and the surface artifact scatter. The surface scatter includes artifacts that were spatially associated with hogans or hornos, but were not deposited while the feature was in use. Figures 31, 32, and 33 show the artifact date ranges for surface artifacts and Features 1 through 9. The artifact count is the number of artifacts with a particular date range. The lines drawn across the date ranges represent the minimum period that accounts for all the datable artifacts or the minimum occupation span as used in Vogler et al. (1982). The artifact date distributions will be discussed and applied to the occupation history.

The date range for the surface artifacts was calculated from 138 artifacts. The broadest possible range is from 1910 to 1980. The minimum span that could account for all the datable artifacts is 1925 to 1970. If the 1970 to 1980 artifact (a can that was probably discarded after the primary occupation) is discounted, then the minimum occupation span is 1925 to 1953. The 1953 date (shown as a 1953-1957 date range) allows a minimum occupation span of 1925 to 1953. Only 12.2 percent of the datable artifacts were made during this time range; 30.2 percent could have been made before the minimum span; and 87.8 percent could have been made after the minimum span. These percentages suggest that some of the occupation could have occurred before or after the minimum span. These dates also reflect the long manufacture history of artifacts like cans and nails, for example. If we include the earliest date when most artifacts could have been in use, the estimated occupation span is 1915 to 1954. We might tentatively discount the early date because glass colors (like amethyst or aqua) that date roughly between 1880 and 1920 are absent from the assemblage. The latest beginning manufacture date for a product is 1953. No new products were introduced into the surface artifact scatter after 1953. Thus, a 1925 to 1953 span may be most appropriate.

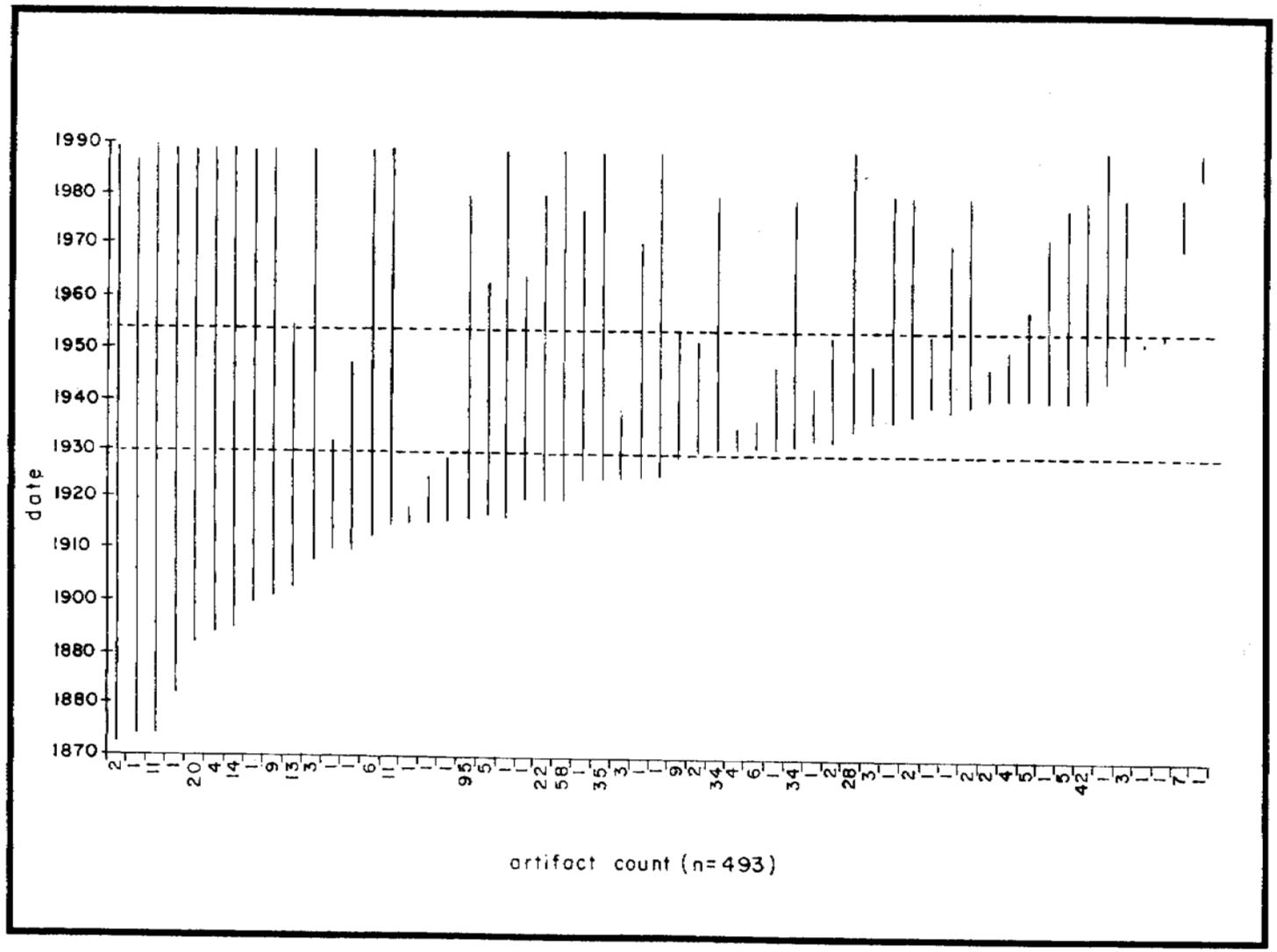


Figure 30. All artifact manufacture date ranges for LA 59962.

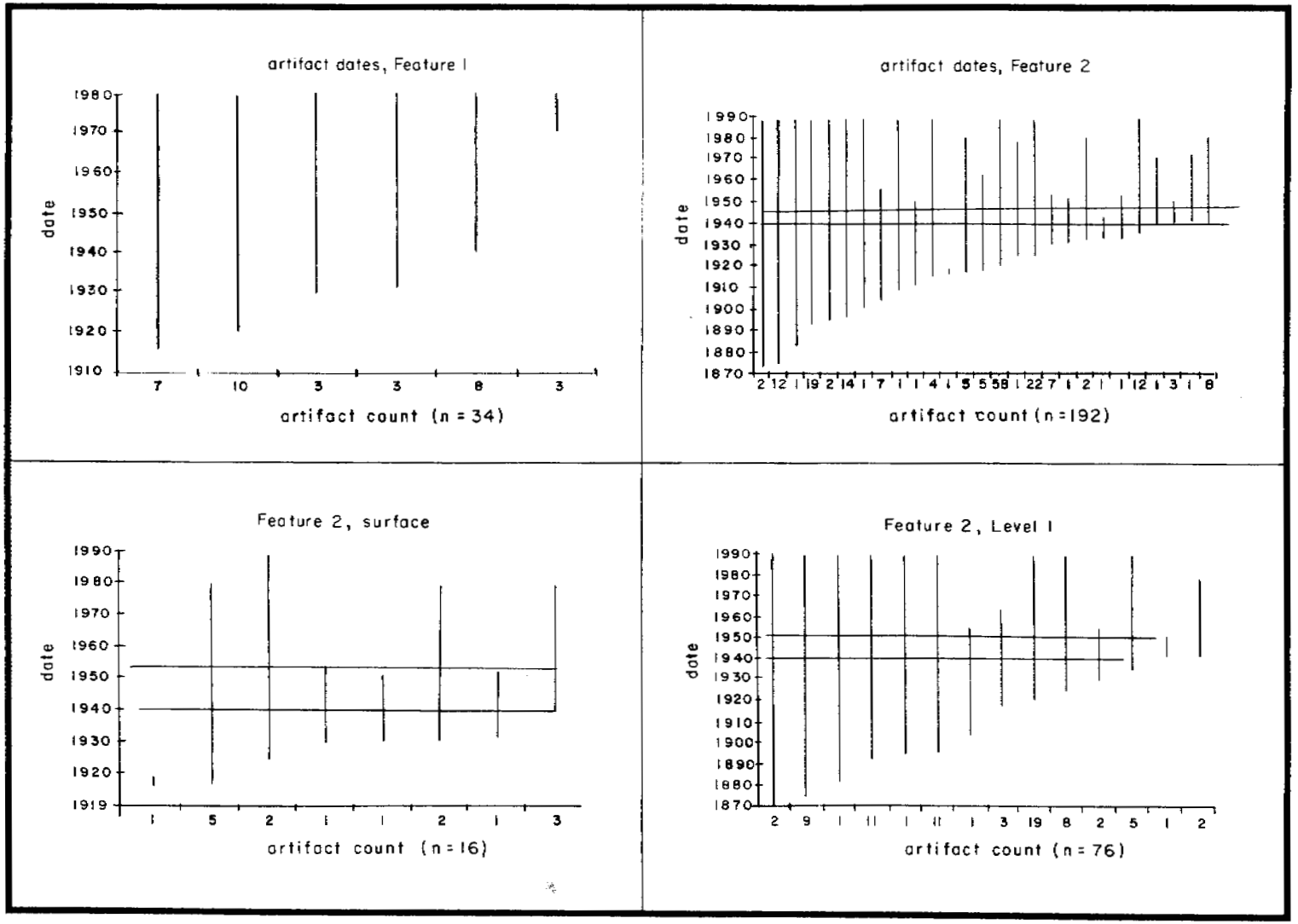


Figure 31. Artifact manufacture date ranges, Features 1-2, LA 59962.

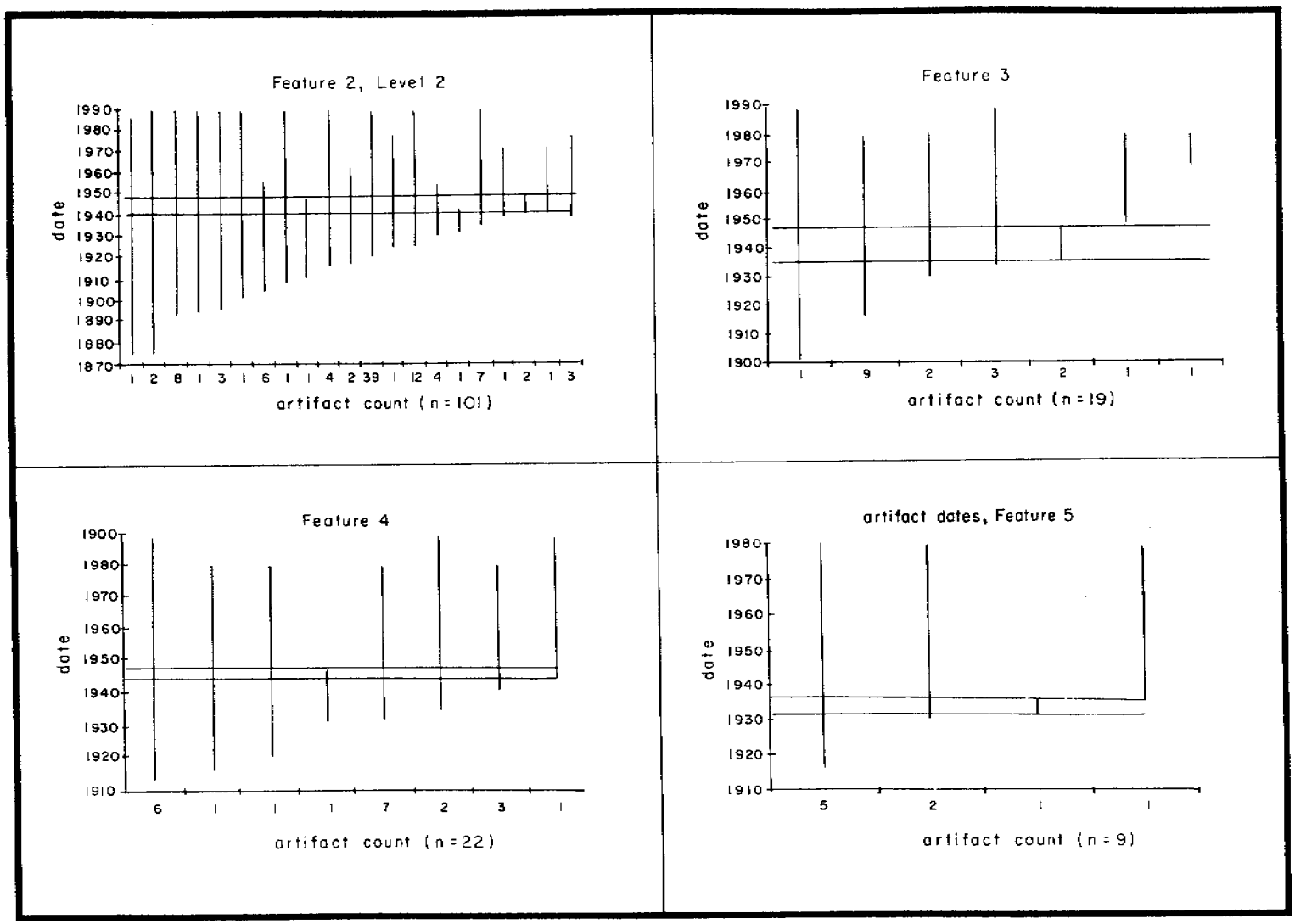


Figure 32. Artifact manufacture date ranges, Features 2, 3, 4, and 5.

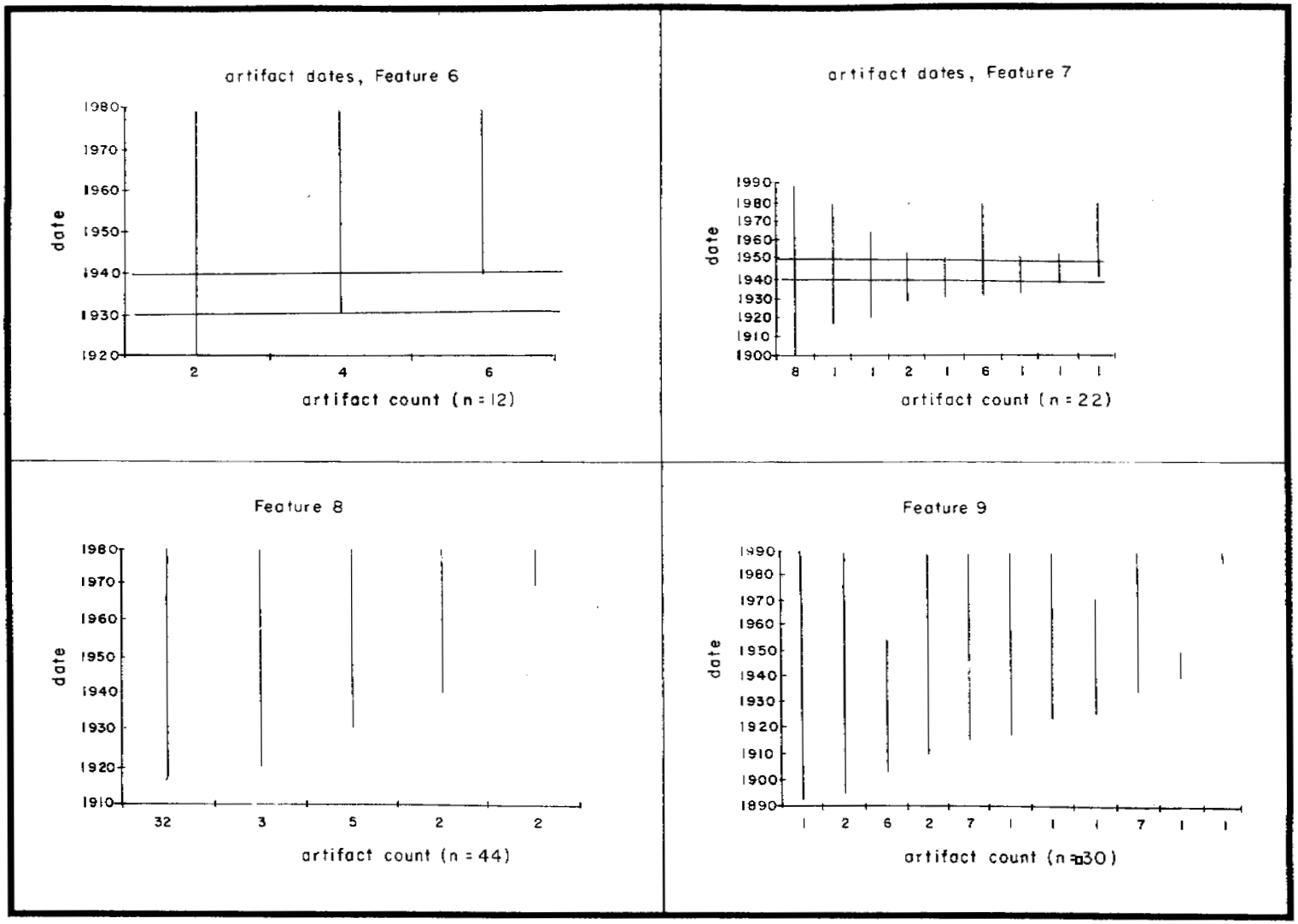


Figure 33. Artifact manufacture date ranges, Features 6-9, LA 59962.

To gain some measure of how surface artifact date distributions may reflect actual occupation episodes, the dates were examined according to the four activity areas shown in Figure 25. Figure 33 shows the artifact dates for the four areas. Area 1 dates range between 1930 and 1940, but the range is based on a single artifact. Area 2 has a minimum date range of 1925 to 1940 and none of the artifact beginning manufacture dates post-date 1940. The Area 2 span includes the date range for Area 1. Area 3 minimum date range is between 1929 and 1953, which is similar to the total surface artifact date ranges. Area 3 also could be divided into two spans, 1929 to 1939 and 1948 to 1953. Area 4 has a date range similar to Areas 1 and 2. The Area 4 date range is from 1930 to 1940 with no beginning manufacture dates after 1940. All four areas have early dates around 1930, but only Area 3 has beginning manufacture dates after 1940. The later dates suggest that the occupation continued into the early 1950s. The later manufacture dates are an indication that Area 3 was abandoned last.

More dates were obtained from the artifacts recorded at and collected from features. The features had varying sample sizes and therefore offered different levels of reliability. Features 2 and 9, which were partly excavated, have the most datable artifacts and they may be the most reliably dated features. The other features have dates derived from surface artifacts. These dates can be used to refine or support the date ranges derived from the general site artifact scatter. The minimum date span for each feature is shown in Figure 35.

Feature 1 was a can-glass dump in the northwest corner of LA 59962, in Area 4. It is 50 m from a hogan ring (Feature 23), and is an isolated can dump. Datable artifacts numbered 34, with a minimum date range of 1940 to 1970. The three cans with post-1970 dates indicate that part of the deposit may post-date the main occupation of the site, representing re-use after the initial abandonment. Some cans may have been contemporary with the main site occupation as indicated by the preponderance of beginning manufacture dates before 1940. The Feature 1 dates are consistent with the surface artifact dates for Area 4.

Feature 2 was a ash-can-glass, 14 m northeast of Feature 19, a masonry hogan foundation. A 1-by-4-m excavation unit was placed across the refuse area. Datable artifacts were retrieved from surface and subsurface contexts. The formation dates for this deposit can be examined as a whole and by the three excavation levels.

There are 193 datable artifacts from all contexts. The manufacture dates range from 1870 to 1980. One artifact has a 1916 to 1919 date range. The minimum date span is 1940 to 1948, with many artifact dates terminating by the early 1950s and no beginning manufacture dates after 1940; 39.6 percent of the artifacts could have been used before the minimum span. Only two of the artifacts were not made after that time span. Fifteen artifacts had date ranges of 20 years of less. Most of the artifacts were bottles and cans with long periods of manufacture. Clearly, this refuse area began to form by 1940 and was no longer in use by the mid-1950s. The latter judgment is based on the absence of artifacts with dates that begin after 1950.

Sixteen datable artifacts came from the surface of Feature 2. One artifact has a 1916 to 1919 date range, and as mentioned before, may have been recycled. The remaining fifteen artifacts have date ranges that are too broad with which to refine the deposit date range.

Seventy-six datable artifacts came from the upper 10 cm. The best minimum occupation span is 10 years from 1940 to 1950. This reflects the feature date.

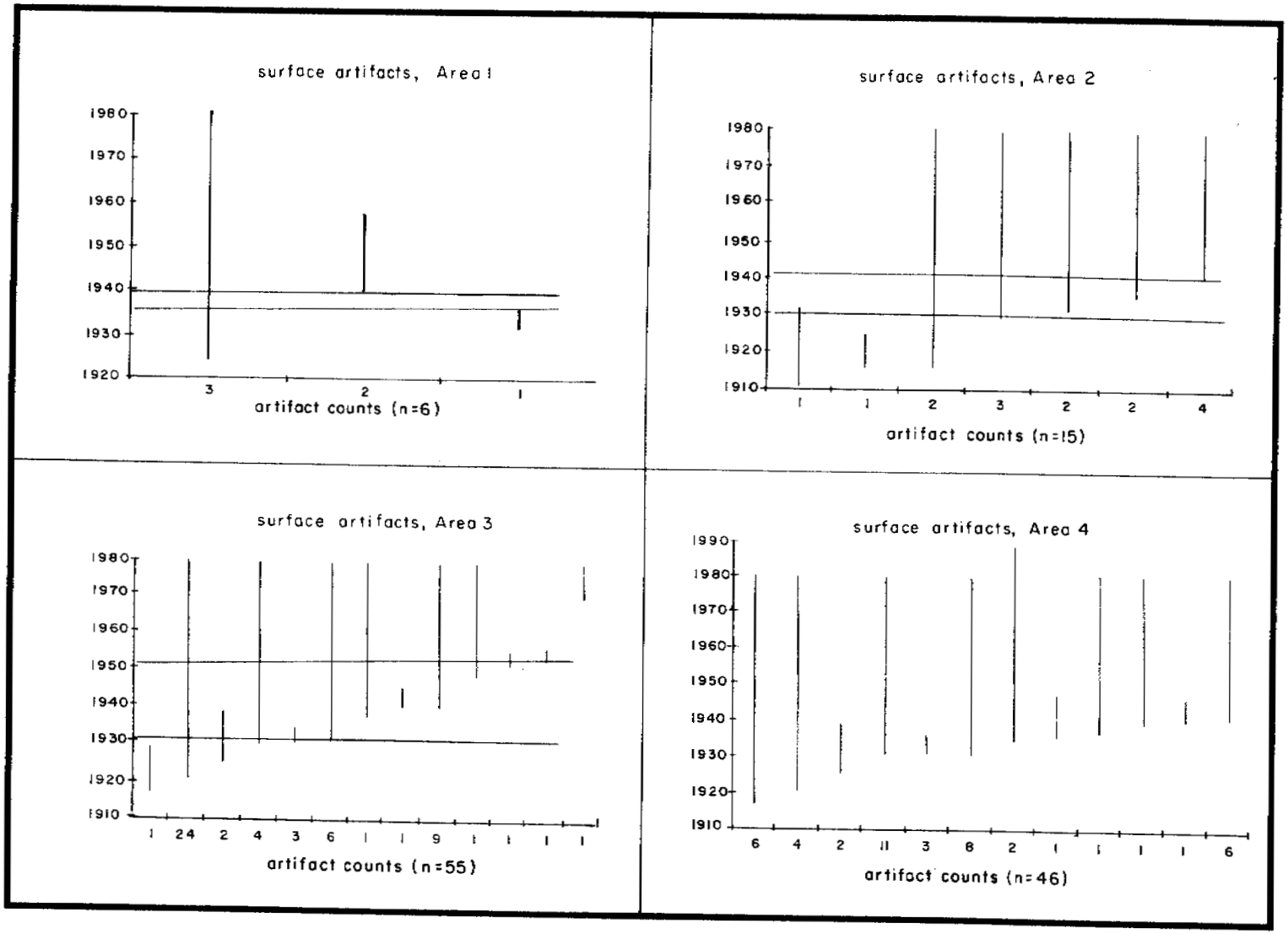


Figure 34. Artifact manufacture date ranges for surface artifacts, Areas 1-4, LA 59962.

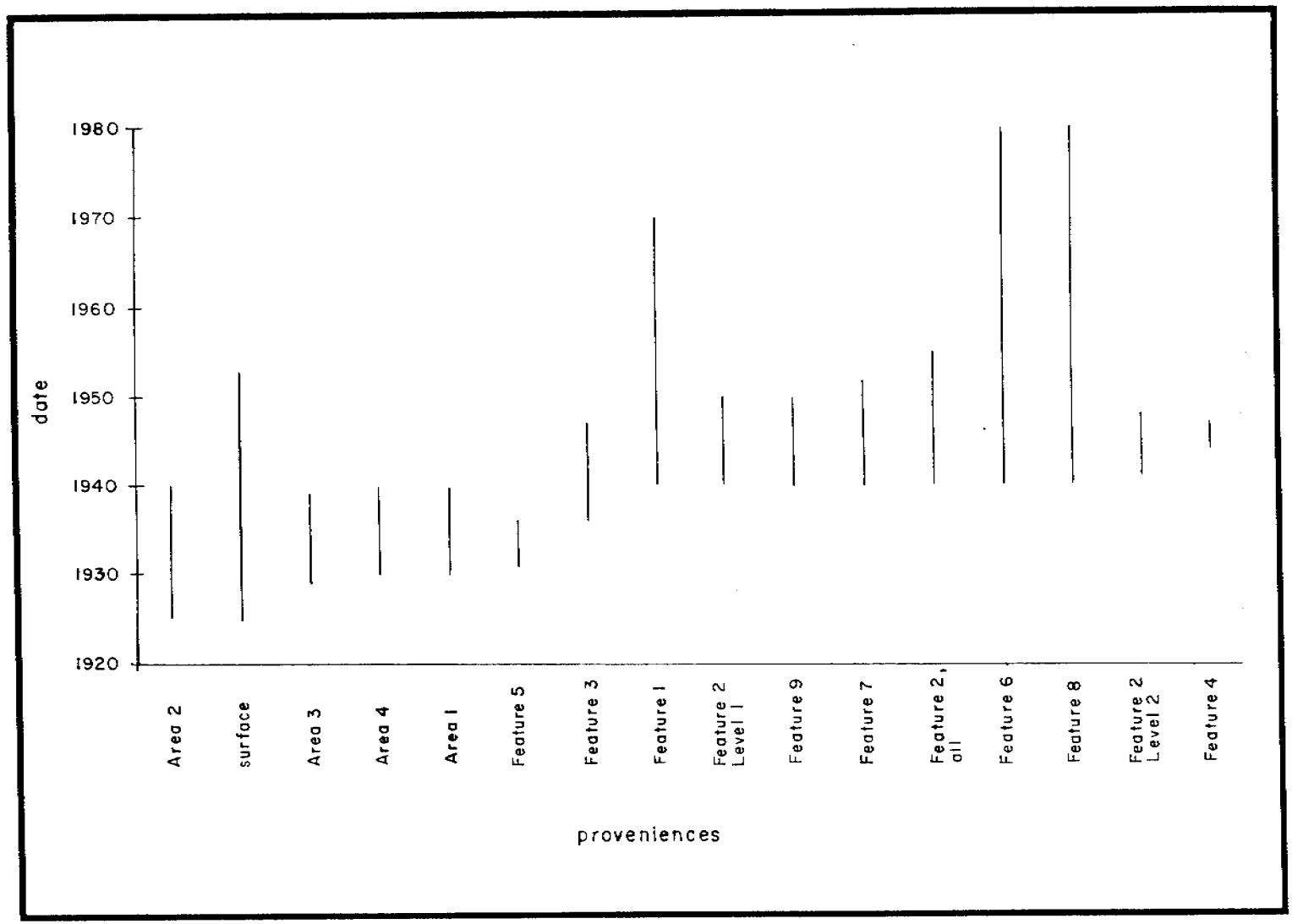


Figure 35. Composite date ranges by feature and area, LA 59962.

There were 101 datable artifacts that came from 11 to 20 cm below the surface. The broadest date range reflects the feature range. The minimum date range is 1941 to 1948. This date range is within the span for Level 1 and shows that the arbitrary levels do not represent discrete and sequential temporal units.

The Feature 2 dates correspond to the Area 3 surface artifact date range, and the surface date range is not refined by the addition of subsurface dates. Curiously, the date range of 1941 to 1948 fills the gap between the two date ranges suggested for Area 3. This suggests that some Area 3 surface refuse may have been deposited before and after Feature 2 was used.

Feature 3 is a small can-glass dump 10 m east of Feature 15, a stone hogan ring in Area 2. Nineteen datable artifacts were recorded. They have a maximum date range of 1900 to 1980 and a minimum date range from 1948 to 1980 based on the latest beginning date and the earliest ending date. Another date range from 1936 to 1947 can be suggested based on manufacture dates for two lard cans. These dates are later than those suggested by the surface artifact dates for Area 2.

Feature 4 was a can-glass dump, 15 m east of Feature 10, a stone hogan ring. Twenty-two datable artifacts were recorded with a maximum date range of 1912 to 1980 and a minimum date range of 1944 to 1947. One artifact had a date range from 1930 to 1945. No beginning manufacture dates post-date 1944. The Feature 4 dates suggest that Area 1 was used slightly later than the 1940 date obtained from the surface artifacts.

Feature 5 was a can-glass dump that was isolated from the masonry hogan foundations within Area 2. Only nine datable artifacts were recorded out of a very small assemblage of surface artifacts. They have a maximum date range of 1915 to 1980 and a minimum date range of 1931 to 1936. The small size of the deposit and the early dates suggest that may have been deposited before the construction of hogans.

Feature 6 was a can-glass dump, 10 m east of Feature 22, a collapsed horno, and 50 m north of Feature 20, a masonry hogan foundation within Area 3. Only 12 datable artifacts were recorded from a small surface artifact assemblage. They have a maximum date range from 1920 to 1980 and a minimum range of 1940 to 1980. These dates do not refine the area date range nor do they inform on the occupation of Feature 20. Like most of the refuse areas, no artifacts were present that have beginning manufacture dates after 1940.

Feature 7 was an ash-can-glass dump, 40 m northeast of Feature 12, a masonry hogan foundation. Twenty datable artifacts were recorded and they have a maximum date range of 1901 to 1980 and a minimum date range of 1940 to 1952. Five artifacts have beginning and ending manufacture dates between 1930 and 1952. There were no artifacts with beginning manufacture dates after 1940. Although this refuse area is far from any residential features, it could have been formed during the occupation of Area 1. Feature 7 post-dates the surface artifact date range of 1935-1940, which is similar to the date range from Feature 4, another feature within Area 1.

Feature 8 was a can-glass dump within Area 2, but it was not located near a residential feature. Forty-four datable artifacts had a maximum date range of 1915 to 1980. Two artifacts motor oil cans date 1970 to 1980. These may have been deposited after the site was abandoned. A residential occupation is indicated by the other cans present. These can types included vegetable-fruit, condensed milk, dried egg, and juice cans. A minimum date range of 1940 to 1960 is obtained when the 1970 to 1980 artifact date range is excluded. No other artifacts had beginning manufacture dates after 1940, suggesting the deposit formed sometime between 1940 and 1960.

Feature 9 was an ash-glass-can dump within Area 3 and 14 m northeast of Feature 20, masonry hogan foundation. A 1-by-2-m unit excavated across the feature provided a sample of the subsurface artifacts. A total of 30 datable artifacts from surface and subsurface contexts was collected and had a maximum date range of 1892 to 1980. The minimum span for the datable artifacts is 1940 to 1950. Datable artifacts from the surface have the same date ranges as the feature. Only seven datable artifacts were recovered from the subsurface. They have a maximum range of 1912 to 1980 and a minimum range of 1934 to 1980. Unlike the excavated deposits from Feature 2 that yielded several datable artifacts, Feature 9 subsurface materials were not very informative. The artifact dates generally are contemporaneous with the Feature 2 artifacts. The low numbers suggest that the deposit was either formed over a shorter period or that it was used by fewer individuals.

Summary

Figure 35 shows the summarized minimum spans for all the dated proveniences. The greatest minimum date span is from 1925 to 1980. This span reflects the reuse of the site for car maintenance and other short-term activities. The best represented date span is from 1925 to 1955, which includes the greatest number of datable artifacts. This span can be divided into two 15-year spans from 1925 to 1940 and 1940 to 1955. The 1925 to 1940 span is derived from the surface artifacts and Feature 5. Feature 3 bridges the two date spans with a range from 1936 to 1947. The 1940 to 1955 span represents the remainder of the features.

The date ranges do not provide fine enough resolution to permit chronological ordering of the hogans. The hypothesis that masonry hogan foundations in Area 1 were the earliest was not confirmed by the date ranges. Date ranges associated with masonry hogan foundations indicate the hogans could have been occupied simultaneously or could represent three continuous occupation episodes with two hogans and the activity areas in use at once.

Site Summary

LA 59962 was an 80,640 sq m artifact scatter with architectural, domestic, and livestock-raising features. More than one-quarter of the site area (24,192 sq m) was within the project corridor. Twenty-seven features were recorded from the total site area, and 4,743 artifacts were collected or recorded from within the project corridor. The 27 features included 7 masonry hogan foundations with associated and isolated hornos, refuse areas, a wood-chopping area, and corrals.

The hogans had been dismantled and the portable construction material salvaged, leaving foundation outlines and scattered rubble. The refuse areas show differential discard practices. One type of discard was refuse areas that contained ash and burned artifact fragments from stove or oven cleaning were located close to the hogan foundations. The other discard pattern was placement of the can-glass dumps at some distance from structures.

Feature arrangements suggest four areas of habitation. Areas 1, 2, and 3 had a full complement of domestic-related features such as hogans, hornos, refuse areas, and a corral. Each area had two hogans with one hogan larger than the other. Areas 1, 2, and 3 may have been used by the same group, representing three continuous occupation episodes with hogans dismantled and rebuilt a short distance away and new extramural activity and discard areas established. Area 4 had isolated features spread over a large area. None of the Area 4 features could be confidently described as contemporaneous. The scattered features in Area 4 suggest that occupation or use was short-term,

perhaps as a sheep camp or a seasonal residence. The absence of an ash area or hearths suggests warm weather use of Area 4. The similar and consistent feature distribution within Areas 1, 2, and 3 suggests that the composition of the family or residential group changed little throughout most of the occupation. Single ash areas and corrals with the hogan pairs indicate that extramural areas may have been shared by the group.

The historic artifact assemblage was large and consisted almost exclusively of manufactured goods, except for animal bone and a few macrobotanical specimens. This suggests that the site residents relied almost completely on the local trading post or off-reservation stores for material goods. Artifacts from the site scatter and unexcavated refuse areas were mostly from the Food and Unassignable categories, with most of the Unassignable category heavily weighted toward bottle and jar fragments. This distribution suggests that bulky and potentially hazardous items were discarded farther from the work areas around the hogan. As the site occupation moved from one loci to another, activity traffic patterns may have changed, resulting in surface artifacts from can and glass dumps becoming scattered across the site.

Features 2 and 9 yielded numerically more artifacts from every category, with the Construction/Maintenance category contributing far more than the surface scatter and other refuse areas. From the excavation of Features 2 and 9 there are more indications that the residents were heavily dependent on manufactured goods for every aspect of their life. There were fragments of flashlights, toys, writing utensils, personal hygiene products, and parts of Euro-American style clothing. Over 100 different kinds of artifacts were collected from Features 2 and 9 reflecting the diversity of manufactured goods that were available to everyone living in the United States.

General inferences about the composition of the residential groups can be made from the artifacts recovered from Features 2 and 9. At least one nuclear family is represented by the presence of children's toys and clothing, and men and women's clothing fragments. Besides clothing, personal care products commonly associated with women are also present. Segregating the artifacts into classes beyond the most basic differences is highly speculative and not likely to be very productive. Kent (1984) shows that sexual division of tasks in Navajo families is not well defined, so that men and women perform similar tasks.

Possible occupation dates range from 1870 to 1980. Most of the artifact manufacture dates cluster around 1925 to 1955, with very few artifacts having beginning manufacture dates after 1950. This suggests that the occupation was winding down by the early 1950s and that most of the artifacts were discarded before 1950. The 1925 to 1955 span is further supported by 29 of 40 artifact date spans of less than 25 years occurring within this period. If a substantial occupation occurred before or after this period more artifacts with manufacture dates in the 1920s, 1950s, and 1960s would be expected.

The 30-year occupation period can be divided into 15-year spans from 1925 to 1940 and 1940 to 1955. The minimum date spans from the surface scatter artifacts cluster within the early range and the artifacts from refuse areas tend to cluster in the later range. This does not provide useful information for discerning when different parts of the site were occupied, since all hogans and associated refuse areas date within the later 15-year range. A 10-year occupation for a feature cluster is suggested by the artifacts from the excavated parts of Features 2 and 9. This evidence lends support to the hypothesis that Areas 1, 2, and 3 represent three separate but continuous occupations.

LA 59963

Site Description

LA 59963 was a circular hogan foundation, an indeterminate rock pile, a series of lambing pens or shelters on the slope below the mesita top, and a circular pile of stone with a large white feather. A series of corral remnants and rock piles were located 100 to 200 m east of the right-of-way. These features probably were associated with the homestead unit but were not recorded. There was no refuse associated with the features. Only the circular rock pile was located within the right-of-way. The remainder of the features was described in Post (1987:39).

The Rock Pile

The circular rock pile was identified during the ethnohistoric study as the place where the resident's children cared for a female dog and her puppies. The rocks were placed to contain the puppies. The other associated artifacts, including a piece of knit sweater and an enamel pan were used to care for the puppies. No further archaeological work beyond the survey recording was conducted at this site. A more detailed description of the site history and use of the overhang is provided in the ethnohistoric study, later in this report.

ECONOMIC AND SOCIAL PATTERNS IN THE WHITEHORSE AND HOSPAH AREA: THE ARCHAEOLOGICAL PERSPECTIVE

This section analyzes the archaeological data from the perspective of the research domains. These domains are the economic and social patterns of site residents as reflected by the material remains. The discussions are divided by site types. LA 59962 is a residential site and the LA 59958 materials reflect residential patterns, although no structural remains were found. LA 59959 and LA 59961 are sweat lodges associated with residential sites. The detail of the analysis and interpretation is dependent on the combined quality and quantity of archaeological data. Therefore, LA 59962 receives the most in-depth treatment because of the quality of the data. The other sites receive treatment commensurate with their information potential.

LA 59962

The data recovery at LA 59962 yielded a substantial body of artifact and feature data. These data will be analyzed and interpreted in terms of economic and social patterns. The economic pattern analysis will examine subsistence and economic status of a Navajo family from 1930 to 1955. The social pattern analysis will examine relationships between site structure and household composition. These studies will use archaeological materials and ethnographic and ethno-archaeological sources.

Economic Patterns

The economic pattern analysis will examine subsistence and economic status of the residents of LA 59962. Subsistence and economic status questions from the research design can be reduced to what did the site residents eat and what was the site residents' economic status? These broad questions contain many assumptions and potential for bias, but they do serve as basic guidelines for the analysis and the examination of more specific questions. Some assumptions and implications of these two questions will be addressed, more specific questions will be asked, then the analysis will be evaluated in light of the questions.

What did the site residents eat? From a cultural reconstructionist perspective, the ideal situation has all food in containers with permanent labels. The food is consumed on-site and the containers are deposited on-site. This "Pompeiian ideal" is unrealistic and the farther back in time from the 1960s that a site was occupied, the more unrealistic it becomes. With regard to twentieth-century Navajo subsistence, there are some basic reasons why this is unrealistic.

One factor conditioning the relationship between consumption and recoverable evidence is that Navajo subsistence before, and probably even after, 1960 was heavily dependent on bulk foods that came in sacks or biodegradable containers. Flora Bailey (1940:273) observed that

> There is little difference to be observed between the food used in the three areas in question. The daily diet of mutton or goat meat, coffee, wheat flour bread, and potatoes, with an occasional addition of canned fresh fruit and vegetables is about the same in all homes. Of course, the financial status of the family at the moment will influence greatly the variety, especially of store foods.

F. Bailey (1940:278) states further that:

> Store foods form an important element in the diet. Flour, sugar, coffee, and potatoes are staples, with canned meat, fruit, and vegetables a luxury. Canned peaches and tomatoes are very popular, as are melons in season, although the latter are sometimes raised by the family and are not primarily store products. Sometimes an acculturated family includes crackerjack and sweets with the ancient corn cake given away at the girls' puberty ceremony.

The bulk items, except coffee, were available in perishable containers or would have no containers at all. Therefore, most of a daily or yearly menu would not leave material remains. This is an ethnographic observation that will be illustrated using the LA 59962 can assemblage.

A second factor that affects analysis of consumption patterns is how a family or supra-household group relied on livestock for food. Mutton and goat were important sources of protein in the Navajo diet. Gilpin (1982:1450-1451) analyzes the effect that herd size could have had on settlement patterns in the late nineteenth or early twentieth century on Gallegos Mesa in northwestern New Mexico. As part of the analysis, Gilpin retrodicts that 15 percent of a sheep herd could be butchered and still retain adequate reproductive capacity. This means that a family could consume 15 animals annually, if the herd size were 100. Gilpin admitted that his study was idealized because subsistence on protein and fat from meat is not possible. For the period after 1930, when wages could contribute to subsistence, sheep may have been kept as a dietary supplement and to produce wool for weaving and sale. Kluckhohn and Leighton (1974:92) suggest that a prosperous Navajo family, dependent on sheep and goats as a food staple, might slaughter one animal a week. To maintain weekly consumption, a Navajo family would have to maintain a minimum herd size of 300, using Gilpin's estimates. At that rate a substantial accumulation of bone would be expected and would indicate a prosperous family. Low sheep or bone counts in a post-1930 archaeological assemblage might indicate the extent to which other food sources were available.

Finally, a third factor is that Navajo families may not have had consumption patterns that were comparable to middle American families. Kluckholn and Leighton (1974:92-93) suggest that consumption for many Navajos followed an erratic pattern ranging from not eating to gorging when food was abundant. The diet content suggest by F. Bailey (1940:273) varied according to financial status. An assemblage that reflected a regular eating pattern would suggest a more acculturated eating habit based on steady income availability.

Undoubtedly there are other conditioners that affect the relationships between cultural preferences and habits, consumption, and the discard that is the archaeological record. Invisible foods, reliance on livestock, and consumption habits seem to be three important conditioners that can be monitored for this analysis.

Subsistence Patterns

What was the subsistence pattern at LA 59962? Subsistence in this discussion focuses on consumption, not food preparation or procurement. These technological aspects of subsistence will be discussed only as they relate to consumption.

Table 16 shows the distribution of foods and containers for the whole site by feature. Bottle, bottle fragments, and unidentified food cans comprise almost 78 percent of the assemblage. Therefore, much of the assemblage can be assigned to subsistence, but cannot be analyzed further in terms of their actual contribution to subsistence. For bottled drinks this is not critical since the

nutritional contribution was probably low. For canned goods, the 213 can fragments do represent a probable loss of nutritional data, but the 437 cans that could be identified by contents still provide a valuable data base.

The distribution of foods and containers provide evidence of subsistence stability across the site and by inference through time. Bottles or bottle fragments were recorded in every feature except Feature 8. Their widespread occurrence shows that bottled drinks were purchased throughout the occupation. The large number of glass fragments in Features 2 and 9 suggests that bottled drinks were common. Cans or can fragments were recorded from all features and from the site scatter. The generic vegetable/fruit can comprised 45 percent of the assemblage. Condensed milk, coffee, meat, and sardine cans made up most of the remaining canned goods. Identifiable foods that were packaged in glass containers were very scarce, and organic remains, besides animal bone, were also very scarce.

A total of 504 animal bones were from sheep, goat or medium-sized mammal, which was probably sheep or goat. Jackrabbit and cottontail, horse, dog, and cow were also recovered in very small numbers. Six sheep/goat individuals were identified in Feature 2, while only one individual was identified in Feature 9. The main protein source was livestock, probably raised by the site residents. Canned meat was consumed occasionally, and the sardines may have been used for food or medicinal purposes.

The variety of can types and sizes suggests that many foods contributed to the daily diet of the site residents. Animal bone and artifact frequencies are lower than would be expected if they had accumulated over a 20- to 25-year occupation. What does the site assemblage represent in terms of dietary contributions? This can be partly examined by looking at the calorie contributions reconstructed from the cans.

The calorie reconstruction based on cans uses standard can volumes, probable contents based on Rathje and McCarthy's Monte Carlo indices for fruit and vegetable occurrences by can size (1978), and the average caloric values for fruits and vegetables. Table 17 shows standard can sizes and most common contents. The main question guiding this analysis is what is the contribution of solid canned foods to the site assemblage? This procedure assumes that all can goods were consumed on site, the majority of discarded cans are represented in the assemblage, the caloric value for foods has remained constant between 1930 and 1970, and averages caloric content estimated for fruits, vegetables, or a combination of fruits and vegetables when they cannot be separated represent actual caloric values.

Using Rathje and McCarthy (1977:282), the average caloric value per ounce of contents was calculated for four standard can sizes: 8.5 oz, 14.5 oz, 20 oz, and 29 oz (Table 18). Vegetables and fruits that were expected to be the most likely to have occurred in site residents' diets were used to calibrate the average caloric value for each can size. For instance, asparagus and green beans were more common in 8.5 oz cans, while pumpkin, spinach, and tomatoes were more common in 8.5 oz cans, while pumpkin, spinach, and tomatoes were more common in 20 oz cans. For can sizes that were not standard in 1970, of which many occurred on LA 59962 between 1930 and 1950, an average fruit/vegetable caloric value was calculated. Fruits were calculated at 26.5 calories per ounce (Kcal/oz), vegetables were calculated at 13.5 Kcal/oz, therefore the fruit/vegetable caloric value that was assigned to nonstandard can sizes was 20 Kcal/oz. Of course, the diet choices of the site residents may have been different from the population represented in Rathje and McCarthy's study. The relative contribution of fruits or vegetables for the site residents or other Navajo sites

Table 16. LA 59962, Food Containers by Feature

Count Row pct Column pct	Surface	1	2	3	4	5	6	7	8	9	Row Total
Bottle	7 23.3 1.2		2 6.7 .2	1 3.3 2.6	1 3.3 .8		3 10.0 13.0	7 13.3 3.5		12 40.0 5.6	30 1.5
Bottle Fragment	288 22.1 51.2	6 .5 12.5	631 48.3 78.6	18 1.4 46.2	72 5.5 57.6	1 .1 10.0	2 .2 8.7	96 7.4 84.2		192 14.7 89.3	1306 65.3
Unidentified can	36 16.9 6.4	3 1.4 6.3	144 67.6 17.9	3 1.4 7.7	10 4.7 8.0	1 .5 10.0		2 .9 1.8	5 2.3 8.3	9 4.2 4.2	213 10.7
Meat can	26 51.0 4.6	6 11.8 12.5	9 17.6 1.1		3 5.9 2.4		4 7.8 17.4	2 3.9 1.8	1 2.0 1.7		51 2.6
Vegetable/plain	3 100.0 .5										3 .2
Fruit/plain	2 100.0 .4										2 .1
Sardine	13 76.5 2.3				1 5.9 .8			2 11.8 1.8	1 5.9 1.7		17 .9
Lard	5 38.5 .9	5 38.5 10.4		2 15.4 5.1	1 7.7 .8						13 .7
Vegetable/fruit/ plain	89 48.1 15.8	20 10.8 41.7	9 4.9 1.1		25 13.5 20.0	3 1.6 30.0	10 5.4 43.5	6 3.2 5.3	23 12.4 38.3		185 9.3
Condensed milk	40 60.6 7.1	3 4.5 6.3		3 4.5 7.7	8 12.1 6.4	2 3.0 20.0	4 6.1 17.4	1 1.5 .9	5 7.6 8.3		66 3.3

Count Row pct Column pct	Surface	1	2	3	4	5	6	7	8	9	Row Total
Coffee/plain	28 70.0 5.0		2 5.0 .2	2 5.0 5.1	2 5.0 1.6					6 15.0 10.0	40 2.0
Juice/plain	5 45.5 .9					3 27.3 30.0			3 27.3 5.0		11 .6
Juice/ribbed	7 53.8 1.2	2 15.4 4.2	2 15.4 .2					1 7.7 .9	1 7.7 1.7		13 .7
Coffee/ribbed	4 50.0 .7	2 25.0 4.2							2 25.0 3.3		8 .4
Fruit/ribbed		1 100.0 2.1									1 .1
Unidentified/ ribbed	1 100.0 .2										1 .1
Vegetable/fruit/ ribbed	5 71.4 .9				2 28.6 1.6						7 .4
Hotdog can	1 10.0 .2			9 90.0 1.6							7 .4
Unidentified bottle			1 100.0 2.6								1 .1
Ketchup bottle				1 100.0 2.6							1 .1
Olive jar	1 100.0 .2										1 .1

Count Row pct Column pct	Surface	1	2	3	4	5	6	7	8	9	Row Total
Unidentified food jar			2 50.0 .2								4 .2
jar cap liner				1 100.0 .1							1 .1
Unidentified glass container									5 100.0 8.3		5 .3
Dried eggs	1 11.1 .2								8 88.9 13.3		9 .5
Column Total	562 28.1	48 2.4	803 40.2	39 2.0	125 6.3	10 .5	23 1.2	114 5.7	60 3.0	215 10.8	1999 100.0

Table 17. Frequency of Can Sizes, Volumes, and Contents

Volume (oz)	Size (diameter by height)	Count	Contents
3	200 x 204	1	Mushrooms
4	202 x 214	1	Baby food
5	211 x 200	14	Chopped olives/pimentos
5.5	208 x 208	1	Meat
6	202 x 308	4	Tomato paste or sauce
9	211 x 400	2	Fruit juice
10.5	211 x 400	41; 1; 8; 8	Vegetables, fruit; Juice; Meat; Dried eggs
12	211 x 414	3	Fruit juice
14.5	300 x 404	17	Vegetables, fruit, meat, or juice
14.5	215 x 315	54	Condensed milk
15	215 x 500	1	Unknown
16	303 x 406	25	Vegetables, fruits, juices, meat, etc.
16	415 x 300	6	Lard
16	502 x 308	12	Coffee
17	308 x 312	1	Vegetables, fruit, meat, etc.
17	306 x 406	1	Vegetables, fruit, meat, etc.
17	308 x 408	1	Condensed milk
19	400 x 304	1	Unknown
20	307 x 409	14	Vegetables, fruit, juices, meat, etc.
24	404 x 306	5	Meat products
26	307 x 604	2	Fruit or tomato juice
29	401 x 411	28	Fruits, some vegetables, juices, etc.
32	502 x 606	7	Coffee
34	404 x 414	3	Fruits, tomato, pumpkin
38	404 x 600	1	Juice(?)
42	314 x 600	1	Juice(?)
46	404 x 700	14	Juice
48	508 x 600	1	Lard
57	500 x 508	2	Fruit, juice, some vegetables
64	408 x 806	1	Unknown
80	608 x 700	1	Coffee
106	603 x 700	11	Vegetables, fruits, juices

Table 18. Vegetable and Fruit Caloric Values by Can Size and Percentage of Occurrence of Food Types by Can Size

Can volume (oz)	Vegetable %	Mean Caloric Value (Kcal)	Fruit %	Mean Caloric Value (Kcal)
8.5	35	113	46	227
14.5	36	191	26	381
20	75	340	25	624
29	37	391	63	769

from the 1930 to 1950 period is not known, so Rathje and McCarthy's data must suffice.

Table 19 shows the total caloric values by provenience and their percentage for one person for one year. Total caloric needs of one person for one year are estimated at between 438,000 and 700,000 calories, based on daily rates of 1,200-1,918 calories. This range probably reflects individual and cross-cultural variation. For this study, the mean of 1,559 calories per day or 569,000 annually was used. Based on the trading post purchases data supplied by Kluckholn and Leighton (1974:79), the average Navajo family in 1940 may have spent 9 percent of their income on canned foods. Therefore, assuming a family of five was an average size (Kelley 1986:115), a family could have consumed canned goods totaling an estimated 256,050 calories in a year or 6,401,2500 calories over a 20-year span. These figures are well above the 65,292 Calories for the total assemblage shown in Table 19. The assemblage total is only 25 percent of a single canned-food caloric year for a family of five. Since approximately one-third of the site area was recorded, an estimated 55,000 calories in unrecorded cans may not be accounted for.

This exercise shows caloric value reconstructions from early- to middle-twentieth-century assemblages may provide information about diet and discard practices. For this assemblage none of the features or the surface assemblage from within the right-of-way exhibits high numbers for caloric value. Based on the site data alone, canned fruit and vegetable contributions may have been very low or many cans were discarded off-site. The 9 percent figure used to estimate Navajo canned food purchases could be closer to 4 or 5 percent, but data to this effect are not available. Availability of fresh fruits and vegetables or a seasonal preference for canned foods might further affect the percentages. Finally, the actual site resident yearly caloric intake may have been less than the 1,559 calories daily average used here.

Based on this study, the contribution of canned goods to site residents' diet was low or an unknown percentage of the cans was discarded off-site. This study suggests that between 1930 and 1955 the residents of LA 59962 relied heavily on bulk foods, the consumption of which is invisible in the archaeological record.

Table 19. Vegetable and Fruit Caloric Contributions by Provenience

Can Volume (oz)	Vegetable Can Count/ Caloric Total	Fruit Can Count/ Caloric Total	Vegetable/Fruit Can Count/Caloric Total	Caloric Total
Surface				
9.0			2/360	360
10.5			18/3780	3780
12.0			2/480	480
14.5	4/764	3/1143		1907
16.0			13/5120	5120
17.0			1/340	340
20.0	2/680	1/624		1304
28.0			3/1680	1680
29.0	2/782	3/2307		3089
34			3/2040	2040
42			1/840	840
82			4/6560	6560
Caloric total for Surface				27,500.00
Feature 1				
14.5	3/382	1/381		763
29.0	5/1955	9/6921		8876
82.0	3		3/4920	4920
Caloric total for Feature 1				14,559.00
Feature 2				
10.5			2/420	420
14.5	1/191	1/381		572
29.0	1		1/769	769
82.0	2		2/3260	3260
Caloric total for Feature 2				5,021.00
Feature 4				
10.5			1/210	210
14.5	2/382	2/762		1144
16.0			4/1280	1280
29.0		1/769		769

Can Volume (oz)	Vegetable Can Count/ Caloric Total	Fruit Can Count/ Caloric Total	Vegetable/Fruit Can Count/Caloric Total	Caloric Total
Caloric total for Feature 4				3,403.00
Feature 5				
20.0			4/1600	1600
Caloric total for Feature 5				1,600.00
Feature 6				
14.5			1/290	290
16.0			2/680	680
24.0			5/2400	2400
29.0		2/1538		1538
Caloric total for Feature 6				4,908.00
Feature 7				
14.5	1/191	1/381		572
20.0			4/1600	1600
Caloric total for Feature 7				2,172.00
Feature 8				
10.5			20/4200	4200
29.0	1/391	2/1538		1929
Caloric total for Feature 8				6,129.00
Caloric total for LA 59962				65,292.00

The faunal data are interesting because only the remains from six butchered sheep/goat carcasses were identified in Feature 2 and one in Feature 9. Kluckholn and Leighton (1974:92) offer that a prosperous family might butcher a sheep or goat once a week and that less prosperous families much less frequently. Gilpin's study (1982:1448-1451) suggests that a butchering rate of 15 percent annually would maintain adequate herd reproductive levels. A family with a herd of 100 animals could butcher up to 15 per year. This figure is closer to the estimates provided by Kelley (1986). Kelley (1986:111) estimated that 4 to 13 animals were slaughtered yearly. Based on 1 to 2 m sq per animal estimate for corral holding capacities, the corrals at LA 59962 could have held 50 to 100 (Feature 24), 22 to 45 (Feature 25), and 30 to 60 (Feature 26) animals. Given the 15 percent rate, LA 59962 residents could have consumed 4 to 15 animals per year and managed to keep a healthy flock.

Six individuals in Feature 2 and one individual from Feature 9 were identified by Mick-O'Hara in the faunal analysis (Appendix 11). About 25 percent of each feature was excavated, so

an estimated 24 individual could have been present in Feature 2 and 4 individuals in Feature 9. If the accumulation at Feature 2 represents the last 10 years of occupation, then remains from 40 to 150 individuals might be expected. This is more than the 24 animals projected for Feature 2. Similar to the can data, actual sheep/goat consumption rates were much lower than projected, or most of the animal bone was deposited outside the ash-can-glass dumps. The faunal assemblage has small numbers of other domesticated and wild species present, but their numbers suggest that nonsheep/goat consumption was an occasional event.

The subsistence pattern suggests that the site residents did rely heavily on bulk foods that came in perishable packages. They consumed livestock at rates much below the prosperous rate suggested by Kluckholn and Leighton (1974:92). Cans were deposited in small quantities at refuse areas within the right-of-way or canned goods were a minor part of the daily diet. The subsistence pattern suggested by the data are very similar to the characterizations provided by F. Bailey (1940) and Kluckholn and Leighton (1974). The canned goods include coffee, baking powder and lard for bread making, bottled soda, canned and bottled condiments, and the consumption of fresh fruit and canned fruit and vegetables.

How this diet changed through time in response to regional and economic stimuli cannot be determined from the assemblage. If can sizes are an indication of available income and a large can of fruit cost more than a small can, then can size should also reflect variability in consumption. The can sizes in Table 19 suggest that there was variability in income and therefore in consumption. For instance, the 29 oz, 57 oz, and 106 oz fruit/vegetable cans, and the 2 lb and one 5 lb coffee cans suggest that there occasionally was money to buy bulk canned goods. Rathje and McCarthy (1978:276) suggest that canned foods do not keep long after being opened and would have been consumed weekly. The large cans in the LA 59962 may have been purchased for special occasions when larger numbers of people would be fed. The small number of dried egg cans were government issue and probably came from food assistance programs. The eight egg cans were concentrated in Feature 8 suggesting that their contribution to the diet was episodic and not a regular occurrence.

Economic Status

Economic status is difficult to address because biases rooted in the Western view of economic success may not reflect the Navajo attitude toward wealth and prosperity. Relative prosperity for a Navajo family in 1940 might seem near the poverty level when compared with a middle income American family. For example, the Navajo per capita income was three to four times lower than in the surrounding states of New Mexico and Arizona (Kluckhohn and Leighton 1974:63). Material wealth or economic condition must therefore be viewed in terms of what was practically attainable by Navajos living on or near the reservation between 1930 and 1950. Economic condition also must be considered in terms of social sanctions that existed against conspicuous displays of wealth or prosperity.

Between 1925 and 1955 on the Navajo Reservation there was a shift from a predominant pastoral economy of trade and barter to subsistence herding combined with wage work and government assistance (Bailey and Bailey 1986). Stock reduction in the early 1930s reduced herd sizes. In 1940, this meant that 2,500 out of 9,500 families owned no livestock, 4,000 families had less than 60 head of livestock, and only 110 families owned more than 500 head of livestock (Kluckholn and Leighton 1974:55). Given Gilpin's estimate that 15 percent of a herd could be

consumed without seriously affecting the breeding stock, over 65 percent of the Navajo families in 1940 lacked subsistence level herds. In effect, stock reduction served to concentrate the wealth represented by livestock into a very few hands.

Without the livestock, 65 percent of the Navajo population was forced to make a living through wage work, or on government assistance, which were never abundant. For instance, public assistance from four programs that aided the disabled, aged, and dependent children amounted to an average grant of $27.60 per case in 1950 for New Mexico (Young 1961:164). After 1950, aid increased with the average grant per case doubling in five years (Young 1961:164). By 1947, 25,000 to 30,000 Navajos were living on the edge of starvation. The primary staples were bread and coffee (Bailey and Bailey 1986:220-221).

An intuitive expectation about economic status is that it would be homeostatic. In other words, as livelihood by livestock production was reduced, there would be an increase in the contribution from wages or federal assistance. Kelley (1986:108) indicates that the actual pattern was counterintuitive and that wage earners were equally distributed among large and small herd owners. This suggested that the large herd owners had a better standard of living and small herd owners or nonherd owners were poorer. The 1947 figure on Navajo poverty suggests that many families had neither livestock or adequate income from wages. Income statistics provided in Bailey and Bailey (1986:219) show that percentages of wage, livestock agriculture, and other income fluctuated. The fluctuations were tied to increased federal employment assistance in the mid-1930s, World War II, and the end of World War II. These statistics suggest that Navajos without subsistence-level herds were most affected by the national economic fluctuations. Kelley suggests that in response to the depression economy, many Navajos in the McKinley Mine area of western New Mexico relied heavily on farming besides livestock (1986:108). Increased reliance on farming probably could be projected into the other periods of poor economic conditions at the beginning of World War II and between 1946 and 1953. Therefore, the economic system of the Navajo was not homeostatic, and several solutions might have been used to avert the poverty conditions that threatened many Navajos between 1930 and 1955.

Clearly, the economic condition of most Navajos between 1930 and 1955 was well below regional and national averages. The historical data suggest economic stratification within the Navajo Reservation. This economic stratification did not have fixed classes but was a continuum along which individuals and families might have experienced a broad range of economic statuses between 1930 and 1955.

At the most desirable end of the continuum would have been the 110 families that owned more than 500 head of livestock as described by Kluckholn and Leighton (1974:55). These families would have consumed sheep at or above the maximum annual rate of 13 suggested by Kelley (1986:111). They presumably would have income available for purchasing food and personal items beyond basic subsistence needs. Their homesites may have included hogans and more European-style cabins and wood-frame homes. Their prosperity would have created an economic halo that would have included a large extended family and friends who would have worked as ranch or farm hands. In the Whitehorse area, there were no large-scale Navajo ranchers mentioned in Kelley's Chaco Ranch study (1982).

The other end of the continuum would be the 25,000 to 30,000 individuals faced with malnutrition. These individuals lived primarily on bread and coffee from income derived from occasional wage work and government assistance. The areal distribution of this poverty-stricken

segment of the Navajo population is not discussed in the literature. It would be interesting to know how many of these people remained landowners or how many were landless, living within or on the fringe of border towns like Gallup and Farmington. These individuals would have no livestock and their diet probably would reflect limited purchases of store bought foods. Subsistence-level farming would have been an option for those with land in arable locations.

In the middle of the economic spectrum would be the families that maintained small animal herds, continued to farm, and/or had steady employment either on the reservation or received money from family members working industrial jobs outside the Southwest. With income beyond subsistence level, they could purchase foods and personal items from the stores in the border towns. Kelley (1986:102) suggests that as wage work was more prevalent, the Navajos became less dependent on the trading posts for goods. Because their livelihood did not depend on herding and the associated trade/barter economy, Navajos could purchase a wider variety of goods from off-reservation stores. The archaeological consequence would be discard patterns exhibiting greater diversity of food containers and personal items.

Based on the artifact assemblage and the hogan construction at LA 59962, the site residents would fit into the middle of the economic continuum. This statement is supported by independent lines of evidence.

First, the three or four separate construction episodes suggest that the land was owned or controlled under a long-term lease by the site residents. If restricted movement within the site area occurred, then the hogans would have been spatially concentrated. Instead, each construction episode was separated by 80 to 100 m. Money and labor were available to the site residents to rebuild their hogans periodically. This would not be expected if money was scarce.

The periodic hogan reconstructions followed a similar form and size for at least three periods, suggesting that there was no significant change in income. As noted before, extra income could have been used to construct European-style wood-frame houses. There is no indication that this occurred during the occupation. However, without superstructural evidence, the quality of the construction within the stone-hogan style cannot be evaluated as a response to fluctuating income.

The three corrals indicate that the site residents kept sheep and/or goats. The 504 animal bones, mostly sheep/goat, recovered from Features 2 and 9, indicate that livestock was an important part of the diet. Kelley (1986:147) suggests that between 1930 and 1950, the corrals in the McKinley Mine area afforded 1 to 2 m sq per animal. When applied to the LA 59962 corrals, this figure indicates that the larger corral, Feature 24, could have held 50 to 100 animals. Feature 26 could have held 30 to 60 animals. The smaller corral, Feature 25, could have held 22 to 45 animals. The upper range of the small corral and the full range for the larger corral would have supplied the site residents with meat at a rate of 4 to 13 animals per year (Kelley 1986:111; Gilpin 1982:1451). These data place the site residents in the middle of the economic status continuum.

The artifact assemblage is diverse and abundant, although the on-site refuse suggests that bulk foods were the dietary mainstay. The can size variability and potential for a variety of contents suggests that site residents income was at times above subsistence level. More expensive large-sized fruit/vegetable cans indicate that surplus money occasionally was available to purchase canned foods in bulk. The different can sizes and probable contents included condiments, canned meats, and perhaps canned breads. Canned breads would not be expected if little or no money were available. Though the canned goods assemblage comprise a small percentage of the probable caloric

requirements of the site residents, it appears they were a regular part of the diet when fresh fruits and vegetables were not available. Diversity in can sizes suggest that off-reservation stores were used to purchase canned goods for at least part of the occupation.

Nonfood artifacts including batteries, writing utensils, watch parts, store-bought toys, such as marbles, and indulgences like chewing tobacco were present. These items would be expected in equal or greater numbers from middle and upper economic level families. The poor families might have some, but not all of these luxury items. The presence of these luxury items in Features 2 and 9 indicate that both households living in Area 3 were in the middle economic range.

With the above patterns in mind, LA 59962 can be compared with two sites (H-27-15 and H-27-116) that appear to be from the middle economic range and one site (H-22-14) that is from the entrepreneur class of Navajo ranchers from the Navajo Indian Irrigation Project (NIIP) in northwest New Mexico. H-22-14 and H-27-116 were permanent sheep camps and H-27-15 was a temporary sheep camp. The artifact data by functional category and material type are presented in Tables 13 and 14.

One problem with comparing artifact assemblages from different projects is comparability of analysis categories. In Table 13, the NIIP data are extrapolated to reflect the categories used in the LA 59962 artifact analysis. H-22-14 was not included in this comparison, but is used in later comparisons. Both H-27-17 and H-27-116 have significantly higher percentages from the Food category than LA 59962. This difference is in part due to the higher percentages in the Unassignable category for LA 59962. This higher Unassignable category may reflect less confidence in functional assignments for the LA 59962 analysis caused by the fragmentary condition of the assemblage. LA 59962 also has a much higher Construction/Maintenance category percentage than H-27-116. The latter pattern is attributed to the large number of nails recovered from the ash dump excavations at Feature 2 and 9. The H-27-226 residents may have relied less on scavenged lumber for heating and cooking. Transportation and Entertainment categories reflect economic status and are more common in the LA 59962 assemblage. Both categories are well represented in the Feature 2 and 9 assemblages and poorly represented in the NIIP assemblages. Differences in the category percentages exist between the three sites, but clearly LA 59962 reflects similar economic status to the NIIP sites. Both NIIP sites were part of a subsistence herding economic base. It is not clear from the archaeological data that LA 59962 site residents were subsistence herders.

Material type comparisons are less ambiguous. Table 14, which includes all three NIIP sites and LA 59962, shows considerable variability. The Navajo entrepreneur site assemblage, H-22-14, is dominated by glass artifacts. The permanent sheep camp, H-27-116, has less glass and an increase in metal artifacts. H-27-15 has equal frequencies of glass and metal. LA 59962, which is an average economic status homesite or residence with some subsistence herding, has more metal, less glass, and significantly greater numbers of rubber and plastic. The percentages of animal bone on LA 59962, H-27-116, and H-22-14 are roughly equivalent, while H-27-15 has at least a 2.5 times higher percentage of bone. This suggests that at the temporary sheep camp subsistence depended more on the herd than the availability of store-bought foods. Fewer material types at H-27-15 also would be expected due to a more restricted range of activities.

The three permanent sites show a high percentage of manufactured goods, but in strikingly different proportions. Some differences could result from the available goods before 1940. H-27-116 and H-22-14 were occupied until 1940, with the bulk of the occupation occurring before 1940

(Vogler et al. 1982:1411-1412). Perhaps the greater number of glass artifacts reflects stocking behavior by the local trading post. Also it is possible that glass containers could have been more common than cans because their contents were preferred by the residents. Part of the predominance of metal artifacts at LA 59962 is due to the nails and fence staples from ash dumps. Nails and staples probably were burned with scavenged lumber for heat and cooking. Still, there are more metal artifacts from the Personal Effects, Transportation, and Household Equipment categories in the LA 59962 assemblage suggesting different purchasing habits. The importance of these different patterns is unclear, but the residents were economically on par with the residents of H-27-116 and H-22-14 based on the numbers and diversity of artifacts recovered from all three sites.

The economic status of the LA 59962 residents based on the continuum of economic status for Navajo families in the 1930s and 1940s and the comparative study of other contemporaneous Navajo sites was middle or average to better than average. The patterns suggest that the purchasing power of LA 59962 residents could have rivaled entrepreneur Navajo ranchers of the 1920s and early 1930s. Although not examined here, the LA 59962 residents' purchasing power may have occasionally rivaled Euro-American ranchers of the NIIP area of northwestern New Mexico.

Social Patterns

Social patterns in this study refer to group composition and size. Initially, changing social patterns in response to changing economic condition were to be addressed, but the temporal resolution is too coarse to address change in 5- to 10-year increments. Change in site structure can be examined through the feature morphology and distribution.

Before the 1940s the typical residence pattern for Navajos was to maintain summer and winter camps in response to pasture needs of the livestock. After 1940, population increase, reduced herd size, and the reduction of traditional use areas forced many Navajo families to reside in permanent year-round residences (Kelley 1986:118). This new residential pattern was reinforced by year-round wage employment. In other words wage earners could not seasonally pick up and leave permanent jobs.

Suggested archaeological consequences of this changing pattern include greater accumulations of refuse and more frequent new house construction because hogans would wear out faster with more use. Because of the artifact accumulation and the evidence for three building episodes in a 20- to 25-year period, LA 59962 is suggested to be a permanent residence.

The composition of the residence group or family unit as hypothesized in the research design should be reflected in the artifact patterns or features. Composition in terms of sex and age would be reflected in the artifacts. This hypothesis was mostly based on assumptions that certain artifacts were more likely to be used by men, women, or children. Division of labor could be reflected in artifact and feature distributions, but Kent (1984) suggested that division of labor by sex was very limited in Navajo families. Kelley (1986:141) asserted that there was division of labor in Navajo families, and that male and female tasks overlapped as needed. Division of labor is not a central issue in this discussion because there are artifacts that are clearly associated with men, women, and children.

The Feature 2 and 9 excavations provided the best information on family composition because of the Function class diversity. Artifacts more commonly associated with men include

tools, such as files and hacksaw blades. Hardware, firearms, watch parts, military buttons, and tobacco could be male artifacts, but they are somewhat ambiguous. Artifacts more commonly associated with women include hair-curlers, "Ponds" face cream, and hairpins. Children's artifacts include marbles, a crackerjack noisemaker, a toy pistol, and a toy airplane. These support the conclusion that a complete family unit was in residence.

The occurrence of toys in Feature 4 and 7 assemblages, besides Features 2 and 9, suggests that children were present throughout much of the occupation. Features 4 and 7 were refuse areas associated with the masonry hogan foundations in Area 1. The Area 2 masonry hogans and associated refuse areas lacked toys or other artifacts that suggested age or sex. This suggests that there may have been some change in the family composition as children grew into adults and perhaps moved away. The 20 to 25 year occupation period would allow for the maturation of a generation of children.

Social patterns may be reflected in changing feature morphology or distribution. For this study, interior dimensions of the seven hogans can be estimated. Kelley (1986:142) showed that dwelling size was significantly larger from 1930-1950 than from 1910-1930. Kelley suggests that the increased dwelling size resulted not from increased wealth, but from families needing more room to accommodate a year-long occupation, more residents, and craftwork. Prior to 1930, these demands were ameliorated by six-month seasonal occupations.

The average dwelling size from 1930 to 1950 in the McKinley Mine area was 24 m sq with a standard deviation of 7.5 m (Kelley 1986:42). The seven hogans at LA 59962 averaged 18.0 m sq with a range from 12.5 to 21.0 m sq. The LA 59962 hogans are generally smaller than those recorded at the McKinley Mine. In terms of changing social patterns, the hogans from Areas 1 and 2 are larger, and probably could house more people. The two hogans in Area 3 are smaller, suggesting that the family size decreased. This would be expected if, as the children grew, they also moved to new locations, thereby decreasing interior space requirements.

There is a consistent pattern of spatial association of a larger and a smaller hogan in Areas 1, 2, and 3. Kelley (1986:132) suggested that families would build two hogans, one for living and the other for work. The living hogan would have had a stove and the work hogan only had a hearth. In addition, the smaller work hogan would be used for food and implement storage. This pattern seems to fit Areas 1 and 2 where there was only one ash area for two hogans. These ash areas are smaller indicating that the hogans were heated with a hearth rather than stoves. The ash areas (Feature 2 and Feature 9) from Area 3 have more ash and are larger, suggesting that both were created from stove dumpings. This suggests that the hogans in Area 3 were occupied full-time and not as living and work hogans.

Estimates of group size based on interior area can be derived from the literature. Cross-culturally there is a tendency toward 6 m sq per person (Brown 1987). Kelley's data from the McKinley Mine had a range of 3.6 to 12.6 m sq per person with an average of 8 m sq per person. For Areas 1 and 2 at LA 59962, the largest hogans would fit three to four people based on a range of 6 to 8 m sq per person. The hogans in Area 3, which are smaller than those in Areas 1 and 2, would fit two to three people. These differences suggest that the occupation of Area 3 occurred after the group size decreased.

Summary

The data recovery efforts at LA 59962 yielded information on the economic and social patterns. The economic patterns were examined in terms of subsistence and economic status. The social patterns informed on group composition and size.

The LA 59962 site residents had a subsistence pattern that exhibited reliance on bulk foods, canned goods, and livestock consumption. While it was difficult to assess the contribution of bulk foods to the diet, the ethnographic data suggested that bulk food contributions were large. This was indirectly confirmed by the canned goods caloric value study, which revealed very low caloric contributions by canned goods. Canned goods were dietary additions and not mainstays. The faunal data suggested that sheep/goat was an important part of the diet, although the bone counts did not reflect projected consumption for a 10-year period. Although the bone counts from refuse areas (Features 2 and 9) were lower than would be expected, the corral dimensions suggest that on-site herd size was sufficient for family-level consumption, while still maintaining adequate breeding stock.

The economic status comparisons with contemporaneous sites from the NIIP project suggest that the site residents were of middle to upper-middle economic status. The diversity of artifacts and material types was comparable to refuse from Navajo ranch entrepreneurs. Since the projected herd sizes for LA 59962 were below entrepreneur herd levels, other sources of income must have been available. Because the material remains are abundant and diverse from Features 2 and 9, wage labor probably provided a source of income. This wage income allowed site residents to live at levels previously reserved for the more affluent livestock entrepreneurs.

Social patterns as reflected by group composition and size were also addressed. Group composition included at least one male and female adult throughout the occupation, and children were evidenced by the presence of toys in Areas 1 and 3. The size of the group was estimated to fluctuate between two and four members throughout the occupation. These numbers suggest that the site residents were a nuclear family.

LA 59958

LA 59958 was classified as a homestead unit during the survey in 1987. Reexamination of the site during the field phase of the data recovery program determined that it lacked architectural features within the right-of-way. Without nearby structures, the possible hornos and refuse areas were isolated on the ridge top. The site artifact scatter and features were mostly from automobile or truck maintenance and livestock raising. These activities occurred between 1965 and the present, with artifact concentrations suggesting episodic artifact deposition during the period between 1965 and 1972.

Dating of the site area within or near the project corridor between 1965 and 1972 allows discussion of the artifact data in terms of general economic and social patterns. The possible hornos may pre-date most of the artifact scatter and refuse areas because they are isolated. Unfortunately, no other features or artifacts can be associated with their use. Therefore, they will not be discussed in this section, but will be related to the information provided by the ethnohistorical study.

Economic Patterns

What was the subsistence pattern for the site residents? There is no structural evidence that the ridge top was occupied as a residence during the 1965 to 1972 period suggested by the artifact scatter and concentrations. During the survey, a trailer was located to the north of the site, but was removed before the field phase of the data recovery program was initiated. A subsistence pattern can be suggested from the artifact data.

The artifacts from the Food category included canned goods such as lard, coffee, vegetable/fruits, meat, and condensed milk, juice, and food supplements such as ketchup and coffee creamer that were packaged in jars and bottles. This configuration is similar to the larger assemblage from LA 59962. Their similarity in content suggests that eating habits had changed very little, with the diet primarily based on bulk foods with canned foods and condiments providing an occasional supplement. The condensed milk cans represent one-half of the Food category recorded within the right-of-way. A concentration of 171 condensed milk cans was recorded in Feature 20, which was outside the right-of-way. This concentration of condensed milk cans to the near exclusion of other food containers suggests the deposit resulted from specialized activities, such as livestock care rather than human consumption. Indirectly, this deposit suggests that for some residents of Hospah, sheep were still an important part of the diet and a source of income.

The Indulgence category is dominated by soda cans. Under the economic conditions of the 1930s to mid-1950s, soda in this proportion would have seemed like a major extravagance. In the context of increased income and possible prosperity associated with the Hospah oilfields, soda might have been a regular part of the diet and not an indulgence or extravagance.

Feature 19, the refuse area located west of the project corridor, had a large amount of tin cans and glass bottles and jars from food consumption. The variety and quantity evident in the refuse area suggest that store-bought foods were a common part of the diet of Hospah residents. Again, regular income from the oilfields, or the uranium mines near Grants, New Mexico, would have allowed store-bought foods to predominate as time and energy was shifted from agricultural and ranching pursuits to regular wage income.

What was the economic status of the site residents? This is difficult to assess from the artifacts recorded within the right-of-way, but is easy to discuss in terms of the refuse in Feature 19. As outlined in the site description, Feature 19 is a refuse area or dump with the full range of consumer goods that were available to Americans in the 1960s and 1970s. There were at least 16 different canned food and drink sizes numbering in the thousands, an early 1960s Ford truck chassis and cab, dinette chair frames, ceramic dishes, enamel pots and pans, refrigerator and gas stove parts, bicycle and tricycle parts, and so forth. The artifact content of the dump reflects the changing pattern in economic status on and near the reservation from agriculture and ranching to wage work. The Hospah oilfields provided periodic long-term temporary employment and this is a good example of the shift to mineral exploration and extraction.

Clearly, the economic pattern in Hospah was one of boom or bust for most people except long-term employees of the oil company. The discarded items in Feature 19 reflect at least a temporary ability to buy into the national economy at a prosperous level.

The Sweat Lodges, LA 59959 and 59961

Two Navajo sweat lodges, LA 59959 and LA 59961, were identified within the project corridor during the survey. The field phase of the data recovery program relocated the sweat lodges. The archaeological study of the sweat lodges focused on recording the material remains. The sweat lodges were not excavated to avoid actions that might be considered disrespectful of Native American religious practices or beliefs. Thus, the archaeological research goals and expectations were of limited scope.

LA 59959

LA 59959 was in essentially the same condition observed during survey when the data recovery program was conducted. LA 59959 had collapsed and stacked architectural elements, a depression, rock discard pile, a hearth, and a light scatter of historic artifacts, some of which were probably used with the sweat lodge. These features, architectural elements, and artifacts were recorded as prescribed by the data recovery plan.

When was the sweat lodge used? To address this question, artifact manufacture dates and the sweat lodge construction materials and methods were monitored. As outlined in the descriptive section of this report the artifacts scattered around and associated with the sweat lodge were from the mid-twentieth century. The datable artifacts from sweat lodge construction and use were wire nails and vegetable fruit cans. They have beginning manufacture dates of 1879 and 1922 and ending manufacture dates that extend into the present. Use dates for the sweat lodge that were determined during the survey could not be refined with artifact manufacture dates recorded during the data recovery program.

The construction details of the sweat lodge were recorded. The structure was made from milled lumber and juniper branches. Nails and wire were used to bind various elements together. A review of Navajo sweat lodge or sweathouse literature provided no correspondence between date of construction and the incorporation of manufactured fasteners and milled lumber (Jett and Spencer 1981:194-197; Bohrer 1964; Brugge 1956; Olson and Wasley 1956). Bohrer's (1964) description of a sweat lodge built about 1962 does not mention the incorporation of manufactured goods. Olson and Wasley (1956) suggested the sweat lodge had undergone the least structural transformation of any Navajo architectural form. Recording of the construction elements of the sweat lodge did not yield a refinement of the survey dates or the artifact manufacture dates.

What was the site structure? This goal was fulfilled by the detailed recording and description of the sweat lodge elements and associated artifacts. This description was provided in the Site Description section of the report, with a map of the sweat lodge and artifact spatial relationships. Site structure will be addressed as part of the comparison between LA 59959 and LA 59961.

LA 59961

LA 59961 was in the same condition observed during the survey in 1987. The remnant of the sweat lodge had upright architectural elements that were deeply buried in the sandy eolian soil, a small

hearth, and a rock discard pile. These features, architectural elements, and artifacts were recorded as prescribed by the data recovery plan.

When was the sweat lodge used? Similar to LA 59959, a goal of the data recovery program was to provide a temporal refinement for the sweat lodge use. This goal was addressed by recording the physical attributes and spatial relationships of construction elements, features, and associated artifacts.

Reexamination of the right-of-way at and around the sweat lodge yielded no artifacts, and therefore no temporal refinement was possible from directly associated artifacts. The survey-defined dates of 1880 to 1920 based on the refuse scattered on top of the adjacent mesa top remained the best date. The paucity of artifacts is a good indicator that the sweat lodge was built before 1950.

The construction elements were juniper branches and they lacked manufactured fasteners or joiners, such as nails or baling wire. The sweat lodge described by Bohrer (1964) that was built in 1962 also did not have manufactured fasteners. Therefore, the absence of fasteners may not be a good temporal indicator. Just as the absence of datable artifacts did not allow further refinement of the use date, neither did the recording of the construction elements.

What was the site structure? This goal was fulfilled by the detailed recording and description of the sweat lodge elements. This description was provided in the Site Description section of the report, with a map of the sweat lodge and associated features. LA 59959 and LA 59961 site structure are compared below.

Comparison of LA 59959 and LA 59961

LA 59959 was probably used during the mid-twentieth century and LA 59961 was used at the turn of the twentieth century. The sweat lodges represent a long-standing Navajo tradition that withstood the rapid onset of acculturation brought on by European settlement of the American West. The sweat lodge served both ritual and social functions, first for men and women, and more recently it became a place of male relaxation and communion. Olson and Wasley (1956:359) suggested that sweat lodge construction and use was an aspect of Navajo culture that has remained unchanged, except the addition of metal fastenings and milled lumber. This observation is reflected in the sweat lodge remnants recorded at LA 59959 and LA 59961.

The forked-stick and tipi-style (Jett and Spencer 1981:195) sweat lodges represent the oldest construction styles. LA 59959 was made in the tipi-style and LA 59961 used the forked-stick style. The latter was the most common style identified in 48 sweat lodges recorded at Chaco Culture National and Historical Park, in northwest New Mexico (Hayes et al. 1981:65). The Chaco sweat lodges commonly had a rock discard pile to the north and a small hearth immediately outside the sweat lodge entrance, which faced to the east.

The east orientation for the doorway is one construction norm for sweat lodges. LA 59958 was completely dismantled, so the orientation of the doorway is not known. However, the location of the hearth to the east of the sweat lodge depression suggests that the doorway faced that direction. LA 59961 still had upright juniper elements. There was a gap in the juniper poles facing to the west suggesting that the entrance faced that direction. The hearth was also located to the

west. The western doorway orientation and hearth location pattern does not fit the expected norm. A possible reason for this digression from the common pattern may be in the sweat lodge location relative to the mesita-top hogan. Typically, sweat lodges were shielded from the wind and secluded from the hogan. The LA 59961 sweat lodge is not out of sight of the hogan, which is to the southeast. Possibly the hogan was built with the door facing away from the hogan to ensure privacy. The need for privacy may have caused a deviation from the traditional rules that governed doorway orientation. The doorway orientation could have been erroneously identified, but the location of the hearth directly west of the doorway minimizes this possibility. The functional necessity of locating the hearth near the doorway seems to operate despite the doorway orientation.

Another spatial aspect of the sweat lodges is the discard of spent rocks to the north or east of the sweat lodge. The large discard pile at LA 59959 is to the northeast of the sweat lodge. At LA 59961, the discard pile is to the northeast of the sweat lodge. The discard pile locations for both sweat lodges conform to the pattern observed in other sweat lodges by Bohrer (1964), Olson and Wasley (1956), and Hayes and others (1981).

From this study, the most interesting question that remains unanswered is when were milled lumber and metal fasteners incorporated into sweat lodge construction. The advent of these modern technological additions could be an important dating tool without associated artifacts or ethnohistorical data. Olson and Wasley (1956:359) recognize this subtle European influence in the traditional sweat lodge construction. More data are needed to address this problem.

AN ETHNOHISTORICAL STUDY OF HOSPAH AND WHITEHORSE, NEW MEXICO

Kathleen M. Stemmler

Introduction

An ethnohistorical survey of the proposed NM 509, New Mexico State Highway and Transportation Department right-of-way, was requested by the Museum of New Mexico, Office of Archaeological Studies, Santa Fe, New Mexico. The ethnohistoric research concerning five sites--LA 59958, LA 59959, LA 59961, LA 59962, and LA 59963--located within NM 509 right-of-way, was divided into four parts: (1) conducting a preliminary investigation of the five sites to be surveyed, (2) preparing questionnaires that would aid in obtaining the necessary data, (3) interviewing selected residents having knowledge about the five sites within the road corridor, and (4) interpreting the collected data.

The preliminary investigation entailed relocating the five sites within the right-of-way that had been recorded earlier by the Museum of New Mexico archaeological survey crew. The interview process required the hiring of a Navajo interpreter who was familiar with the Whitehorse/Hospah area and its residents. Following this, a set of three two page questionnaires referring to the specific sites were compiled after consulting both literary sources and specialists on Navajo culture (Appendix 12).

The questionnaire contained a statement of purpose and direct questions on age, name, and clan affiliations. Most of the questions were designed to determine the dates of occupation and abandonment of the sites, activities performed at the sites, and the group composition. Additional open-ended questions were added to determine the general economic condition of the area. Other questions were designed to determine if occupation, group composition, and subsequent abandonment of the sites were influenced by external political or economic policies that may have affected the Navajo Tribe as a whole either directly or indirectly. Questions were also asked about the wishes of the occupants of the sites with regards to the disposal of the remains left in the proposed right-of-way.

Residents of the Whitehorse area were asked to provide information on the historic sites that are in or near their use areas and those outside these areas. Due to time constraints, interviewing was limited to those residents who were determined by relatives or neighbors to have lived in the area for a long period or those who might have occupied the sites or those who otherwise had knowledge of the occupants of the sites.

A total of 25 interviews was conducted with one individual being interviewed twice for two separate sites. The interviews and preliminary investigations took place within a ten-day period between October 21 and 31, 1988. All but eight interviews were conducted in Navajo and translated by the interpreter as the interview proceeded. Questions were asked almost exactly as written with modifications being made according to the individual's knowledge of the site and history of the area. Most of the interviews took place in the respondents' homes, usually with at least one other person present besides the interviewer, interpreter, and respondent. Three interviews were conducted at the Hospah oilfields, while one interview took place with the Whitehorse Chapter manager, Nelson Sandoval. Interviews were also conducted in Crownpoint with the chapter president, Leonard Tsosie, and with Emery Chee of the Bureau of Indian Affairs, Land Operations department. One other interview took place at a Crownpoint Senior Citizens' Center.

Actual time spent interviewing the respondents varied from 15 minutes to three hours with the average interview lasting about an hour. All interviewees were cooperative and sometimes volunteered or were asked to visit the site with the researcher and interpreter, thus prolonging the interviewing process.

Interpretation of collected data included a literary search of materials associated with Navajo history and culture with specific emphasis on archaeological and ethnohistorical research conducted in the Checkerboard area. Newspaper articles were not consulted. Follow-up interviews were conducted with additional individuals being contacted, while other individuals were recontacted to expand or clarify previously collected data. The information presented below is a result of these processes.

Historical Background

The 1900s

The Whitehorse-Hospah community is in the central Checkerboard area of northwestern New Mexico. The history of this area and the Navajo Reservation in general were largely shaped by federal government policies that were intended to provide a secure land base for thousands of Navajos returning from Fort Sumner.

Population statistics vary with regards to the exact number of Navajos living off-reservation on public domain land both seasonally and permanently after 1868, but estimates range between 8,000 and 20,000 (Bailey and Bailey 1982:182). This created a major problem for the federal government who had placed themselves as trustees for the Navajos.

Many Navajos who settled off-reservation during this time were destined to compete against non-Navajo stockmen who began to enter northwestern New Mexico searching for grazing land and water. Under an early homestead act passed by Congress in 1862, both Navajos and non-Navajos were entitled to make a claim on public domain lands. Many obstacles prevented most Navajos from filing under this act. These obstacles were lack of knowledge of the act and how to file, and an inability to find the survey stakes needed to file a claim (Bailey and Bailey 1982:183).

The General Allotment Act of 1887 gave Native Americans the legal right to claim an allotment of land both on reservations and public domain land. The remaining parcels not claimed were then to be placed back into the public domain holdings. The purpose of the act was to break up the Indian Reservations into private holdings thus forcing Native Americans to follow Anglo forms of land tenure. The allotment system did not threaten the Navajo Reservation, but it did affect those Navajos living off-reservation on the public domain. The first allotments issued to Navajos living on this category of land were made between the years 1906 and 1911, although Indian Service officials were slow in registering claims for the Navajo (Brugge 1980:204). The withdrawal of public domain in northwestern New Mexico by Executive Order in 1907 aided Navajos in receiving allotments. A later Executive Order reinstating a large area of this land in the following year was a set back in procuring land for off-reservation Navajos.

Land granted to the Atlantic and Pacific Railroad in 1866 also hampered off-reservation Navajos from obtaining sufficient grazing land. To entice the railroad company to build a transcontinental railway, Congress granted all odd-numbered sections of land, 40 miles on either side

of the right-of-way, to Atlantic and Pacific. The Atlantic and Pacific went bankrupt in 1900. The Atchison, Topeka, and Santa Fe Railway took over and began leasing land to non-Navajos, and eventually Navajos, due to a strong urging on their behalf from BIA agent, Samuel Stacher (Kelley 1982:54).

With passage by Congress of the Stock Raising Homestead Act of 1916, settlers from New Mexico and Texas took advantage of large tracts of uncultivatable land released by the federal government in the public domain. This act also allowed Navajos who had allotments on railroad land to seek a secure title to them (Kelley 1982:351).

Between 1907 and 1934, the railroad made some exchanges with the federal government. It then turned around and sold some its larger tracts to private ranchers. In the 1950s, the Navajo Tribe bought several private ranches in the Checkerboard area and now holds them in fee-simple; meaning that the Tribe now pays the taxes on them.

New Mexico State Land is another category of land that was also leased to non-Navajo stockmen and a few Navajo. In 1912, the federal government granted New Mexico rights to Sections 2 and 32 of each township from which the state could extract revenue. These sections were to aid in financing public education. Sections 16 and 36 of each township were leased to the state by the federal government as of 1898 (Kelley 1982:25).

All the above categories of land existed in the Checkerboard area including the Whitehorse-Hospah area in the late nineteenth to early twentieth centuries. Both the Whitehorse store and Hospah oilfields once sat on what used to be railroad land (M.G., pers. comm. [an employee of the New Mexico State Land Office]).

Today in this area, a mixture of private holdings, state land, allotments, tribal fee, and tribal trust land are present. According to Tribal and BIA officials, the consolidation of lands for off-reservation Navajos continues (L.T. [Navajo Nation] and E.C. [BIA], pers. comm.).

The 1920s

Before their internment at Fort Sumner, the Navajo subsistence pattern included farming and livestock raising for purposes of family consumption. After their release from the fort, the Navajos were given sheep, seeds, and the promise of government rations on which they were to survive until their herds and fields could sustain them. During the first decade of the twentieth century, Navajo livestock increased rapidly. By World War I the Navajos had gradually been lured via trading posts and the rise in wool and sheep prices into producing for the national market (Bailey and Bailey 1982:572). This gradual transformation from a self-sufficient economy to a market-oriented economy caused a number of changes for Navajo families.

One effect of this transformation was the reduction of farming activities as families pooled together their resources to focus on livestock raising and weaving. As Navajo families sold their herds, they were forced to depend on credit issued by the trading posts to purchase food and other items (Bailey and Bailey 1982:572-573; Kelley 1986:31). It is during this period that some Navajos began to seek wage work, predominantly with the railroad, or in the developing oilfields. Another result of the change to a market-oriented economy (Kelley 1986) was the uneven distribution of livestock that occurred both on and off the reservation. While many Navajos had 100 or less sheep, goats, horses, and cattle (Kelley 1986:33), others had large herds and tended to swallow up some of these smaller livestock owners.

According to Kelly (1986:32), the social organization began to change as families settled in one area for a longer period. They built larger houses accompanied by other structures such as ramadas, corrals, and storage facilities. Consequently, they began to discard more varied items on the sites that they inhabited.

In the Whitehorse-Hospah area, four of the area residents interviewed stated that the major economic activities in the area between 1900 and 1920 included dry farming of corn and squash and herding of sheep, goats, horses, and cattle. According to one resident of the area, a few families (exact number unknown), owned up to 1,000 head of livestock during this period. Another area resident mentioned that several men from Whitehorse began working for the railroad (exact number unknown).

It was also during this period that the first non-Navajo rancher entered the Whitehorse-Hospah area and began grazing livestock. Jean Carrica, a Basque sheepherder, is reported by Kelley to have settled in the area around the year of 1921 (Kelley 1982:60). The Whitehorse store owner remembered Mr. Carrica and stated that he was a very large man in stature, firm in disposition, yet pleasant. He also stated that Mr. Carrica eventually moved to Montana. Kelley states that Carrica's ranch was bought by Phillips Petroleum in 1958 and traded to the Navajo Tribe in 1977 for land west of Whitehorse (Kelley 1982:79).

Federal policy has also had a great deal to do with influencing changes in the Navajo subsistence pattern. Early mineral acts passed by Congress such as the General Mining Law of 1872 and the Mineral Leasing Act of 1920, opened up both public and reservation lands for mineral exploration and development without the permission of the surface owners (Kelley 1982:282). U.S. involvement in World War I combined with the availability and subsequent demand for automobiles from the 1920s on increased the demand for oil. This increased demand aided in convincing Congress that the oil companies needed tax breaks to expand exploration and drilling.

The Hospah oilfields were first mapped in 1924 by Morgan and Henderson. Later in the same year, Hurst, Welch, and Ufer began drilling the first well. Apparently the operation ran into some difficulties and drilling was suspended. In 1927, Midwest Refining Company took over the lease and the first well was completed in the same year with an initial pump of eight barrels per day. Two additional wells were also completed that year (Fassett 1978:345).

During this time, one resident stated that ten employees, one of them a local Navajo, were hired to work at Hospah. The chance for work in the oilfield was short-lived as the field subsequently lay idle until 1938 when it was purchased by Petroleum Products Corporation (Fassett 1978:345).

The 1920s saw only the beginning of the oil companies' and other fuel-oriented corporations' interest in Navajo land holdings, both on and off the reservation. The federal government, in reaction to the oil companies' request to drill on federally trusted lands, was directed by statute, to see that a tribal council was formed for the purposes of signing oil leases (Kelley 1986:9). Therefore the first Navajo Tribal Council was activated in 1922, with Chee Dodge as the chairman.

The discovery of oil, gas, coal, and uranium on Navajo lands has been a major point of contention among tribal officials and between tribal officials and the general Navajo population. Up to this date, mineral development has been the foundation of Navajo funds, which have provided several benefits. Benefits include employment, industry, road improvements, health benefits, and welfare assistance for the Navajo population. Despite the benefits mineral exploration and development on Navajo lands has created problems. These problems include decreased grazing land, destruction of the contour of the land, several health problems found among the people living near

these sites and the cause of Navajo relocation to other areas.

As has been previously mentioned, the Navajos residing in the Checkerboard area faced many problems in finding enough productive grazing land for their livestock. Anglo ranchers, oil companies and the railroad all had a piece of the land in northwestern New Mexico. With the completion of the railroad in New Mexico in 1881, cattle ranchers herded their stock to the newly formed towns of Grants, Thoreau, and Gallup (Kelley 1982:41).

Meanwhile, a number of opportunistic individuals began to establish trading posts both on and off the reservation to take advantage of rising sheep and wool prices. Traders encouraged Navajos to produce for the market and aided in the eventual transformation of the Navajo economy from self-sufficient to market-oriented (Kelley 1986:8). This was achieved by extending credit to Navajos in exchange for goods and services that were conveniently offered through the trading posts. Shopping at the trading post saved Navajos from traveling long distances on sometimes treacherous roads.

The goods and services such as wagons, tools, kerosene lamps, and Pendleton blankets, carried by the trading posts, provided the Navajo with a new range of items to purchase with credit. The trading post interaction gave the Navajos a view of Anglo material culture and economic philosophy. The Navajos learned about the concepts of competition, profit, loss, and surplus. These ideas contrasted with Navajo economic philosophy of barter and sharing among kin groups.

One early trading post in the central Checkerboard area was started by Richard Wetherill who was hired by the Hyde Exploring Expedition to supervise and collect artifacts from the local ruins. The store, built around the year 1898, was in one of the largest ruins in Chaco Canyon, Pueblo Bonito. According to Kelley, the purpose of the Pueblo Bonito Trading Post was to sell goods to the Navajos who worked excavating the ruins (Kelley 1986:48).

The first store in the Whitehorse area was built in 1921 and run by Dan Rangel. The local residents referred to him as "Mexican Dan." The store was then bought by Muriel E. Buck between the years 1929-1930. Rangel then moved approximately 10 miles east of the store and opened another store called the Prairie Dog Trading Post. This store, according to one Whitehorse resident, was only opened a short time when Mr. Rangel decided to return to his hometown of Thoreau.

Before purchasing the store in Whitehorse, Mrs. Buck had worked for Ed Sargent and Bob Smith at the Star Lake Trading Post. Both Sargent and Smith were also owners of several other trading posts including the one at Pueblo Alto, northeast of Whitehorse (Barde 1976:256).

When Mrs. Buck took ownership of the store, she set about enlarging it and eventually a stone hogan was built near the store for guests traveling by foot or wagon. The store eventually became known by local residents as Buck's Store. A map of New Mexico published in 1950 showed Whitehorse as Buck, New Mexico. The local Navajos refer to Whitehorse as "The Place Where Someone Drown" (R.C. [local resident], pers. comm.).

To get supplies for the store, Mrs. Buck's grandson, Robert Cupp, stated that she would go by wagon around Mt. Taylor and into Bernalillo, which at this time was larger than Albuquerque.

The store carried wagons, tools (such as shovels and hammers), cloth, Pendleton blankets, and food stuffs (such as coffee, sugar, bacon, crackers, and occasionally bananas, which were considered a delicacy by the local residents). The store had a well and was the major supplier of water to the residents of Whitehorse and Hospah and the BIA school.

Running accounts were kept on the residents of the community. In the spring the traders were paid back with lambs and in the fall with wool. The wool was then taken to Albuquerque and the lambs were taken to Thoreau. Once a year, usually in August, the traders in the surrounding areas gathered in Thoreau to ship the lambs by rail. This was considered both a social and economic occasion for the traders (R.C., pers. comm.).

To keep track of credit and debits, trade tokens or *secos* were issued by the store instead of cash. *Secos* or *beeso bisga* in Navajo (Bailey and Bailey 1982:670), were commonly used by trading posts in the late nineteenth to early twentieth century. They often had the name of the trading posts imprinted on the token as did the ones issued by Buck's store. Use of tokens in the Whitehorse area continued through the 1950s.

The importance of the trading posts as a multipurpose institution can hardly be overlooked. Trading posts served as post offices, banks that made loans as credit and pawn, employment offices, and as a news source for the community. Traders also performed undertaker duties on occasion (Bailey and Bailey 1986:268-272).

The Whitehorse store functioned in these capacities. As a former owner commented, the trader would often function as medical consultant when someone was ill or as a shuttle service on the occasion that residents needed a ride to Farmington or Gallup to work for the railroad.

During the 1930s while Mrs. Buck still owned the store, a tradition was begun during December to celebrate Christmas. A large pot of mutton stew was prepared with fry bread and the entire community was invited to partake. Children received both fruit and nuts as gifts. This tradition continued through the 1950s.

Mrs. Buck sold the store in 1948 to P. Nelson and subsequently passed way in 1950. Since then, several individuals have had ownership of the store, including George Huntsmen and his father-in-law Maurice Tanner, Bob Smith and Mrs. Buck's grandson Robert and his wife, Rita Cupp. In 1987, Thriftway store chain bought the store. Gradually it has become a specialized, self-service, convenience store that sells gas, soda pop, canned goods and ranch supplies. One can still phone the store and leave a message for a local resident, pick up mail, or hear the latest gossip.

The importance of the trading posts as an institution began to decline in the 1950s. As Navajos shifted to wage work and were eventually able to purchase automobiles, they could go to urban areas to shop for bargains. It was also during this period that both the state and the Navajo Tribal government were able to extend their services to include employment offices and welfare assistance. Banks began to compete for the accounts of the Navajos as well, thus striking another blow to one of the many functions that the trading post once filled (Bailey and Bailey 1986:268-272).

The 1930s

The 1930s brought continued change for the Navajo people beginning with the appointment of John Collier as Commissioner of Indian Affairs in 1933. Collier determined that Navajo economy was weak due to land erosion caused by the overgrazing of livestock and the overcrowding due to population growth among the Navajo people. Collier introduced a number of legislative acts that he felt would alleviate some economic problems faced by the Navajos (Parman 1976).

Collier initiated several actions: (1) the reduction of the livestock population both on and off the reservation; (2) the division of Navajo lands into grazing districts administered by BIA personnel;

(3) the extension of the Navajo Reservation boundaries; (4) the establishment of work programs that were designed to substitute for the loss of livestock; and (5) the introduction and passage of the Indian Reorganization Act. The latter eliminated the issuance of new allotments and gave the Navajo Tribe more freedom in decision-making and funds to aid the general Navajo population. It also readied the area for industrial growth (Bailey and Bailey 1982:575; Kelley 1986:151).

Residents of the Checkerboard area did not fall under the livestock reduction program designed for reservation Navajos. Instead, they were placed under the Taylor Grazing Act in 1937. Under this controversial act, grazing districts were established. The grazing districts were first administered by the Grazing Service, a part of the Department of the Interior.

The issuance of livestock permits eventually proceeded along with the formation of land boards in each district, whose membership was made up of local stockmen from the area. In 1946, the Grazing Service merged with the Bureau of Land Management and the BLM in turn took over the administration of the off-reservation lands (Adams 1970:311).

In 1937 Collier convinced several Congressmen to introduce bills that would extend the boundaries in both the states of New Mexico and Arizona. The Arizona boundary bill passed easily while the New Mexico bill met with controversy. It was opposed almost immediately by both ranchers and a coalition of Navajos headed by Jacob C. Morgan, a highly influential man and tribal delegate. As a result, the bill died in committee and the Navajo Tribe has since then been involved in regaining land for off-reservation Navajos caused by the defeat of this bill (Kelley 1986:100).

During this period, both voluntary and forced reduction of livestock took place both on and off the reservation. To replace the loss of income that was incurred by the Navajo people, federally funded work projects were developed and implemented. These included the Civilian Conservation Corps (CCC) and the Soil Conservation Service (SCS). These programs employed a large number of Navajos who worked building roads, dams, wells, schools, and irrigation ditches (Bailey and Bailey 1982:576). When the United States entered World War II, the projects that were begun in the mid-1930s lost impetus; the CCC was eliminated, while the SCS was cut by two-thirds (Kelley 1986:102).

The effect of the Collier era was felt profoundly by the Whitehorse area residents. All residents interviewed who remembered this period stated that their lifestyle changed after the enforcement of the Taylor Grazing Act. Two interviewees mentioned that several residents would meet at the Chapterhouse or someone's hogan to discuss the problems they were having with the reduction policy enacted by the federal government.

The Whitehorse Chapterhouse was built in 1929, according to one resident. It was often used to discuss such issues as education for the children of the chapter and possibilities of work for the older members of the area. Collier pulled the funding from the chapterhouses during the thirties because he viewed them as a gathering place where opposition to his policies was vocalized. This could be why some meetings opposing livestock reduction were held in the hogans in Whitehorse during this time. One resident stated that because of livestock reduction, even the owners of over 1,000 animals were forced to sell at least half their stock. Other herds were reduced by 100 or fewer animals (Kelley 1986:33). The same resident went on to say that the major effect of livestock reduction was that area residents were forced to choose alternate forms of subsistence. The lifestyle of herding was no longer available and could no longer support them.

As with Navajos on the reservation, residents of the Whitehorse area began to seek wage

work. Both the CCC and the SCS were active in the Whitehorse area. Theron Cupp, the son of Mrs. Buck, went to work as a surveyor for the road improvement programs; other residents worked constructing dams and digging wells. There were several CCC camps located throughout the Checkerboard area; according to one interviewee, a large camp was located in Cuba.

During this period, the Whitehorse Community Boarding School was built for the children living in the Whitehorse area. Enrollment was authorized at 60 children but during the years between its construction and into the 1950s, enrollment ranged between 31 and 43 children (Young 1955:106, 1957:307, 1961:24).

During the 1930s, competition for grazing land continued between Navajos and non-Navajos. Both the railroad and the oil companies continued to acquire large tracts of land. In 1931, the railroad began land exchanges with the Indian Service in the Checkerboard area. Both parties intended to consolidate their holdings in the area. Once the railroad had procured a number of large tracts of land, it leased them to ranchers such as Harold Prewitt and Ed Sargent, who then fenced the leases. Kelley has documented an event from 1935 in the Whitehorse area when Harold Prewitt hired both local Navajos and non-Navajos to fence the area around Whitehorse Lake and to expel the Navajos living within the fenced area (Kelley 1982:67).

Whitehorse Lake apparently went through periods of both wet and dry. Brugge reports the lake as dry in 1898 (Brugge 1980:258). One area resident reports several times before the 1950s when sheep dippings took place at the lake.

Other non-Navajo ranchers also began moving toward the Whitehorse area and as a result displaced smaller stock owners. Ranchers listed by Kelley in McKinley County between the years 1934 and 1936 include Emory Burnham, Jean Carrica, J. B. Farris, Harold Prewitt, and Ed Sargent (Kelley 1982:70-71). Another rancher by the name of Floyd Lee was mentioned by two of the interviewees and was said to have settled in the Whitehorse area.

According to a 1936 survey, Navajo livestock had declined from 100,000 head to 37,000 head in 20 years (Kelley 1982:68). The decline was attributed to the encroachment of non-Navajo ranchers, livestock reduction, and two very severe winters in 1925 and 1932 (Young 1961:165).

Meanwhile in the Hospah area, Petroleum Products Corporation had purchased the oil fields from Midwest Refining in 1938. Three more wells were drilled with a field potential of 850 barrels of oil per day. Upon demonstration of this ability, a refinery at Prewitt was constructed in 1940 with a four-inch pipe connecting Hospah to Prewitt (Fassett 1978:345).

With land acquisition by a number of special interest groups, including the railroad, oil companies, and non-Navajo ranchers, residents of the Whitehorse area began to feel constricted. As one resident put it, ". . . it was becoming congested."

The decrease in livestock increased pressure on families to produce more with less available to them. The Great Depression during the 1930s brought with it a major decline in both wool and lamb prices to an all time low. Families found themselves having to depend more on credit received from the trading posts. In the Whitehorse area handicraft production went up and wage work was increasingly sought after. One interviewee stated that many residents during this period had to depend on the women to weave rugs for an income. Jobs available in Whitehorse during this period were limited to a few positions at the community school (at least two), possibly one position at Hospah, and two known positions at the store.

It is probable as Kelley has demonstrated, that with this increased pressure on families to produce more, added space in the hogan was needed for indoor storage and work space. More outdoor space also was needed for such activities as cooking, wood cutting and for the livestock corrals and pens (Kelley 1986:12).

At the same time, families were beginning to stay longer in their seasonal areas, for reasons previously mentioned. One Whitehorse resident commented that for his family, the Whitehorse area was used as a summer grazing area until members of his family began filing for allotments early on, and later, other members moved into the area to be close to the school where they were working.

The 1940s

With the ushering in of the 1940s came the issuance of stock permits and the continued forced sales of livestock, in particular, horses (Kelley 1986:101; R.C., pers. comm.). While the United States entered into World War II, "range riders" (or as the Whitehorse residents used to refer to them "The Men Who Lead the Horses Around") joined the war effort and were no longer available to enforce stock reduction. Thus World War II brought on the end of stock reduction.

The war demanded all the work force it could muster. Approximately 3,400 Navajos joined the armed forces. Other Navajos left the reservation to take advantage of job opportunities at war plants and oilfields, with the railroad, and in ranching and farming all over the United States. According to estimates given, over 15,000 Navajos found work in the war industry alone (Bailey and Bailey 1986:576).

Whitehorse community residents contributed to the war effort. One interviewee joined the armed services. Others worked for the Santa Fe Railroad, in the Hospah oilfields, and as migrant farmworkers. Farmworkers were shipped by rail to pick vegetables in Idaho, Washington, and Colorado. Other residents went to work in the nearby towns of Grants, Milan, and Bluewater where they picked carrots. One resident described the fields as containing hundreds of individuals who lived in camps in the fields. The fieldworkers picked the crops during the day and in the evening, lights flooded the fields so that harvesting could continue around-the-clock.

In the Hospah oilfields, it was reported by a supervisor that there were close to 70 employees; 40 to 50 digging ditches and 20 involved in drilling and pumping activities. As has previously been mentioned, a pipeline was constructed from Hospah to Prewitt during the early 1940s. Don Smouse, the trader running the Borrego Pass Trading Post at this time, remembers transporting pipe up to Hospah before the War as he was one of the few people in the area that had a pick-up.

Once the ditches had been dug, the employees were laid off. This left a steady crew of 20 men that remained; 8 local Navajos and 12 Anglos in Hospah.

While one or two of the Navajos lived on the site during the week, most walked to Hospah daily. At least one employee walked from as far away as the Whitehorse store.

During the war era, Hospah had an airfield, a post office, school, a `chow hall,' and a cook. Several small wooden houses were also constructed for Anglo workers. Forty wells were drilled at this time, but because of the lack of electricity, only 15 wells could operate at once. During this time the fields were pumping close to 1,000 barrels a day according to the supervisor in charge during this period.

The only vehicles that were available at Hospah during the war years were a pick-up, a tanker, and a winch truck. Gas was imported to Hospah, and along with oil and tires, was traded for water at the Whitehorse store. The Hospah water apparently had oil in it and was therefore unsafe to drink.

Generators were used for power and kerosene lamps were used for light. Supplies for the oilfields were brought from both Gallup and Prewitt.

The school at Hospah was a one-room schoolhouse that employed one teacher and went up to the eighth grade. There were approximately 10-12 children enrolled in the school during the 1940s until it closed in 1957 (Kelley 1982:291). Anna Fondaw, a missionary from Star Lake, has documented her journey to Hospah in 1947. She and her husband Claude were asked by the teacher to teach both a Bible and music class during the school year (Fondaw 1976:231).

Although many Navajos both on and off the reservation had worked for the railroad during the late nineteenth century, it was not until 1942 that the railroad began actively to recruit Navajos as employees. In 1946, it was estimated that nearly 5,000 Navajos were being employed annually by the railroad. By the late 1940s, a well-organized recruitment system had been established between the railroads and the trading posts and by 1949, close to 7,000 Navajos were seasonally employed (Bailey and Bailey 1982:434-435).

In the Whitehorse area, according to two interviewees, a few Navajos (exact number unknown) worked for the railroad in both Denver and Phoenix before the war. It was not until the late 1940s, when the recruitment system was enacted, that the trading post began taking truckloads (20-30 male residents) to meet the trains in Gallup and Farmington.

By the end of the war, the soldiers returned home with the war plant workers. The returning veterans and factory workers were often rehired at their old job, and as a result many Navajo workers lost their jobs. Wool and lamb prices plunged with the number of livestock (livestock reduction had finally taken effect). An owner of the Whitehorse store commented that during the post-war years, a lot of credit was issued "... as there was very little cash." A few families in the area (exact number unknown) continued to work as farm laborers while others continued working for the railroad and at the Hospah oilfields.

The end of the 1940s saw many Navajos beginning to realize that they could no longer subsist or rely on livestock to survive, nor could they survive on seasonal wage labor (Kelley 1986:151). Permanent wage work, welfare assistance, or both were needed for a family to survive.

The family was continuing to change as well. More of its members would accept work away from the homestead, leaving other family members to care for livestock.

Finally, another effect of the war was that thousands of Navajos had been directly exposed to not only the Anglo culture but to other cultures around the world. This expanded world view resulted in changes in lifestyle and cultural values.

The 1950s

From the 1950s on, a number of transformations continued to take place among all aspects of Navajo culture. The beginning of the 1950s saw the passage of the Navajo-Hopi Long Range Rehabilitation

Act by Congress. This act authorized millions of dollars to fund a variety of programs in road construction, health and employment services, education, welfare, and industrial development both on and off the reservation (Bailey and Bailey 1982:578). Opportunities for wage labor increased, and work shifted from seasonal to year-round.

Simultaneously, welfare began to develop as an entirely new source of income (Bailey and Bailey 1978: 579). Both sources of income gradually replaced livestock herding as the major contributing incomes to Navajo families. Homestead farming became less important as more time was spent earning wages away from the home. These changes in the economy resulted in a decline in the importance of the trading posts. As more Navajos began to replace credit with cash, and wagons with automobiles, shopping patterns turned away from the trading posts and toward the larger cities (Young 1961:251).

The emphasis on education was heightened as more schools were constructed. As herding became less important and families opted to sell their livestock due to labor shortages, more children began to attend the schools. Table 20 shows this steady increase in school enrollments. As a result, the children were exposed to the Anglo culture and language at an early age.

Railroad work continued to be an important source of income for many Navajos throughout the 1950s but started to decline toward the end of the decade when mechanization took away many jobs. Officials of the railroad began to cut unemployment compensation as well and insisted that Navajos leave their families for long periods of time to work year-round (Bailey and Bailey 1982:435; Young:1961:225).

Navajos continued to work off the reservation as migrant farmworkers. In New Mexico, the State Employment Service established offices in Shiprock, Huerfano, Farmington, and Gallup to recruit Navajos interested in farmwork. This was arranged through the trading posts with transportation to the fields (Bailey and Bailey 1982:436)

Both oil and gas exploration and drilling decreased in the early 1950s, but gradually began to climb in the Checkerboard area during the middle of the decade. El Paso Natural Gas began construction and operation of several compressor plants near Thoreau and Gallup. Oil strikes in the San Juan Basin also led EPNG to close its refinery at Prewitt and build a larger one at Ciniza, east of Gallup. They also added another pipeline from Thoreau to Ciniza to Prewitt (Kelley 1982:286). Close to 40 residents of Whitehorse were reported to have worked on these pipelines during this time. Natural gas production continued to grow through the 1960s while oil production declined after 1957 and did not peak again until the 1960s (Kelley 1982:290).

According to Kelley, Hospah had 44 wells as late as 1956 (1982:285). The supervisor during this time stated that there were eight steady employees during the early 1950s. When production dropped to 425 barrels per day in 1955, the company cut back to five employees; three Anglos and two Navajo pumpers.

Some 20 to 30 residents continued to work for the railroad while others continued as farm laborers (exact number unknown). Employment at the school and store continued. Theron Cupp was said to have hired two sisters to tie fishing flys for him. A few Navajos were also busy constructing the new chapterhouse.

Farming declined in this area dramatically during the 1950s. The reason given for the decline by two of the residents was that the climate had become a lot drier. According to one interviewee, until the 1950s, it had rained every two or three days in the summer. The grass was tall and there was

Table 20. Whitehorse Day School Enrollments from 1949 to 1961

Date	Enrollment	Date	Enrollment
1949-50	39		
1951-52	43	1956-57	31
1952-53	38	1957-58	31
1953-54	41	1959-60	52
1954-55	40	1960-61	62

(Young 1955:88, 1957:307, 1961:60)

plenty of wood. This gradually changed and the residents began to experience overgrazed ranges, lack of water, and wood. These problems continue to exist today in the Whitehorse-Hospah area.

During the 1950s, the area residents enjoyed the benefits of the Navajo-Hopi Long Range Rehabilitation Act. Roads were improved and a windmill was constructed near the store so that the community could haul water.

Although the Whitehorse population had experienced the effects of livestock reduction during the 1930s and 1940s, a few families rebuilt their herds. Still, the herds remained below levels of the 1920s and early 1930s. Two residents stated that during the 1950s, there were a lot of sheep, goats, and cattle in the area. At least two families had 500 or more animals.

Three residents and Danny Charley, a liaison for the Bureau of Land Management, Farmington office, stated that by the 1950s the Whitehorse residents were restricted in their movement of herds from one area to another. In comparison, Theron Cupp was quoted by his son as saying that during the 1930s one could travel all the way to Albuquerque because there were no fences. During the 1940s, the residents could move around somewhat, but by the 1950s, seasonal movement was at a minimum.

The use of credit by local Whitehorse residents continued into the early 1950s until approximately 1955, when some residents purchased automobiles and chose to shop in Gallup, Farmington, and Grants. The issuing of credit began to decline, and trade tokens were no longer issued after 1955. Rug weaving continued in the area, but to what extent is not known.

The 1950 census figures supplied by the BIA-Crownpoint Office gives the population figure of 237 for the Whitehorse Chapter. The census official did not know whether this figure was for the total population or for men and women only. According to the principal of the Whitehorse School during this time, there were approximately 400 residents in Whitehorse area in the 1950s.

1960 to Present

Where the 1940s saw the beginning of fencing by Anglo ranchers and the issuance of grazing permits in the off-reservation areas, the 1950s saw the beginning of the fencing of grazing areas by Navajos (Bailey and Bailey 1982:510-511). The 1960s began an era, according to three area residents, of the fencing of land adjacent to individual allotments by the Bureau of Land Management.

Livestock production declined in the 1960s. Three residents stated that the children were attending school and leaving the area to find work. The children showed little interest in caring for the family livestock. There may be other reasons for this decline in livestock raising as well. A severe drought that began in the early 1950s continued into the early 1960s and accelerated declining water supplies (Young 1961:165). Declining wool and livestock prices were major contributors to a decreased interest in commercial livestock raising.

In the same year, the BLM turned over the responsibilities of overseeing most of its grazing leases in the eastern agency to the tribe. A number of tracts of public domain and other lands were purchased for Navajo use, but were overseen by the BLM (Kelley 1982:353).

Welfare assistance both on and off the reservation continued to grow. Food stamps appeared in the Whitehorse area in the early 1960s, according to a previous store owner. Public assistance expenditures for the Navajos residing in New Mexico in 1951 were reported to be $296,638.50 and by 1960 had risen to $1,204,000 (Young 1957:347).

The Hospah oilfield employment rose from five Navajo employees to a total of 15 (Navajos and Anglos combined) when Tenneco took over ownership of the fields and began drilling in 1965 (Fassett 1978:341; Kelley 1982:291). The number of employees appears to have remained steady through August 1, 1989, when almost half were permanently laid off after the purchase of the fields by American Exploration.

The Whitehorse Community Boarding School was declared both overcrowded and unsafe by 1960 (Young 1961:24). This is not surprising given the Whitehorse Chapter census figures, which rose from 237 in 1950, to 654 in 1960, and 968 in 1970. Still, the boarding school continued to operate until 1966 when it was permanently closed. After the Whitehorse school closed, the children were bussed to the Pueblo Pintado school.

With the disappearance of credit issued by the store, the decline in stock raising, combined with the layoffs at Hospah and the closure of the school, residents of the Whitehorse area have had to rely on welfare assistance and wage work to subsist. The younger generation is continuing to leave the Whitehorse area in search of work and is leaving behind the older generations to care for the homesteads. Some of the residences appear to have been enlarged as there are still younger children to care for. High school graduates who are unable to find work remain at home longer. Older unemployed members of the family who have been either retired or have been unsuccessful in the job market also stay at home.

Structures have begun to change as well. Since the 1960s, more trailers and wooden houses have appeared in the area next to the traditional hogan. Electricity has also become available. Hauling water is still necessary and usually means a early morning trip to the windmill located near the store or a trip to Crownpoint. Wood for building and heating is nonexistent in the area. This is a real problem, forcing residents to rely on expensive electric heaters.

Automobiles and pick-up trucks have replaced wagons and are also expensive to run and maintain. Roads remain unimproved in the immediate area and are occasionally impassable during the wet months of the year. The construction of NM 509 will improve employment opportunities for some area residents while greatly improving access to urban centers to the south.

Conclusion

Federal policies combined with national market trends and national historic events have had a major impact on Whitehorse area residents. From the time of their release from Fort Sumner, Navajos in the off-reservation area have been affected by congressional acts and laws that have limited their ability to successfully expand their pastoral economy. Anglo ranchers and corporate entities, such as the Atlantic and Pacific Railroad have competed for resources critical to maintaining larger than subsistence-level herds. As a result of competition, many Navajos have been restricted to owning overgrazed and unwatered tracts of land. Fencing and low prices for livestock products have transformed the Navajo economy to the point where pastoralism is no longer a viable alternative. The Navajo family economy has become dependent on wage work and assistance programs. The Whitehorse area is a regional example of this gradual cultural change of the past 140 years among the Navajo.

ETHNOHISTORIC SUMMARY OF THE SITES

Residential Sites

Both LA 55958 and LA 59962 have been classified as residential sites partially located within the project corridor. The following discussions integrate site and local history, economy, and social organization. This results in some redundancy, but is necessary to place the information in the appropriate context.

Occupational History

LA 59958, once railroad land, is now private property on which an abandoned Navajo homestead with corrals and a cornfield are located. It is a residential site associated with the Hospah oilfields. Navajo oilfield employees used both this site and LA 59959 as temporary residences during their employment.

The hogan foundation that is on this site was reported by four employees at Hospah as belonging to Jones Largo, a Medicine Man and temporary employee at Hospah. One employee remembers Mr. Largo living in the hogan at least as early as the 1940s and possibly before then. It is possible that Mr. Largo was working at Hospah as early as 1927, when the first well was drilled. Mr. Largo, according to both his nephew and his son-in-law, worked at Hospah off and on for nearly fifty years, and as a steady employee for two to three years in the mid 1960s before retiring in 1967.

The hogan does not appear to have been occupied steadily by Mr. Largo. A former supervisor at Hospah during the mid 1940s to early 1950s stated that Woody Albert and his wife lived in the hogan for a time. Woody has since passed away and his wife lives across the road from the oilfields. Several attempts were made to contact her regarding this site, but these attempts were unsuccessful.

According to two family members and two employees who knew Mr. Largo, Mr. Largo apparently returned to work in the oilfields on many occasions and lived in several different types of shelter including tents, during his employment at Hospah. He eventually moved in with his nephew who was living northeast of LA 59958 in the late 1960s before retiring and moving with his wife, Mary, to Littlewater, where he passed away several years later (exact year unknown).

The sheep pen, horse corral, and cornfield, which are still in use at the site, were built by R. Y., a supervisor at Hospah. The sheep pen was built 15 years ago, while the horse corral was built 5 years ago. R. Y. stated that he lacked legal right to the land or its structures as it was private property.

Economy

Exploration and development of the Hospah oilfields, as has been mentioned previously, began in 1924, although actual output did not commence until 1927. In this early period of Hospah history, it was reported by one area resident that nine Anglos and one Navajo were first hired for drilling and maintenance of the field. How long they were employed is not known.

The Hospah community experienced growth in the 1940s because of increased drilling in the area. Both Anglos and Navajos worked constructing the pipeline to Prewitt and worked in the oilfields. Once the pipeline was completed, and the initial setting up and drilling of wells had ended, 8 local Navajos and 12 Anglos remained employed. The Anglo employees at Hospah were skilled laborers, such as electricians and welders, while the local Navajos were employed as maintenance crew members. According to a former supervisor, additional local residents were periodically required for maintenance projects.

Between 1949 and the mid 1960s, according to a former supervisor at Hospah, only six steady employees were needed to work in the oilfields: three Anglos and three Navajos. When Tenneco took over the fields in the mid 1960s and began exploration and drilling activities, the employment figures increased to a total of 15 Anglos and Navajos combined. This figure appears to have remained steady until August of 1989 when American Exploration bought the fields and let six of the employees go. Today at Hospah, there are eight Navajos and one Anglo employed in the fields.

Social Organization

The traditional Navajo settlement pattern associated with livestock raising was not feasible for employees and their families living near the oilfields. Many dwellings were temporary residences for both the Anglos and the Navajos. They were 'shacks' for the Anglos and tents and open camps for the Navajos during the peak period of oil production in the early to mid 1940s. While Anglo employees lived at Hospah and were supplied with bed and board, most Navajos working there walked to work daily, some from as far away as the Whitehorse store. Others camped in the area during the week and returned to their more permanent homesites on the weekend. Whether meals were included for local Navajos working in the oilfields is not known.

There does not appear to be any set pattern of living arrangements at LA 59958. It seems that distance from one's more permanent homesite, length of employment, and availability of other members of the family to take care of the homestead all played a role in determining settlement patterns at Hospah.

It is during the early to mid 1940s that a school, post office, and airstrip were constructed. Both Anglo and Navajo children, 10-12 in all, attended the school. Between the years 1949 and 1955 when employment declined at Hospah, T. M., the Hospah oilfield supervisor at the time, stated that when a position became available at Hospah, he often would try to hire an individual who had school-age children for the sole purpose of keeping the school open another year.

Supplies were usually brought in from Gallup and Prewitt. Water was hauled in from the Whitehorse store, Crownpoint, and Sand Springs. Food was often purchased from the Whitehorse store.

During the 1960s, when a surge in hiring occurred due to the drilling of new wells, three more permanent dwellings were constructed in the area. A wooden frame house was built just north of LA 59958 by Jones Largo's son-in-law. The son-in-law and his wife and six children occupied the house until 1987. In 1987, the son-in-law retired from work and returned with his family to their more permanent homestead located a few miles east of the Whitehorse store.

Today employees working in the oilfields drive to work and return home the same evening. Only one of the Navajo employees, R. Y., a supervisor at Hospah, and his family live on the site. He also grows corn and tends horses on LA 59958.

LA 59962, Occupational History

Four individuals provided information for this site: M. T., a former resident of the site; his mother, E. T., former resident of the site; E. T.'s brother-in-law; and R. C., grandson of Mrs. Muriel Buck, and owner of the Whitehorse store for a number of years.

LA 59962 is an historic homestead located on Navajo Tribal Trust land. There are seven masonry hogan foundations, with hornos, trash dumps, wood-chopping areas, and a 1930s automobile associated with the site.

According to two of the former residents of the site, Features 15, 18, 19, 20, and 23, as shown on the site map, were occupied between the years 1939 and 1955 by M. C. and E. T., clan sisters (they had the same father, but different mothers), T. T., their husband, and E. T. and T. T.'s three children. Feature 10 was occupied during the 1940s (exact years unknown) by E. T.'s sister, E. Y., her husband, and their four children. Feature 12 was apparently used for storage.

Feature 23 was the first structure occupied by the T family. Before this time, M. C. lived in a hogan just east of the site for approximately six months before T. T. and his family joined M. C. and decided to move to LA 59962. A ramada was initially constructed at this site, followed by Hogan 5.

Between the late 1940s and the early 1950s, the family moved a little further southwest and built and occupied Features 19 and 20. Feature 19 was occupied by M. C., while Feature 20 was occupied by E. T. and her three sons. M. C. also had a son, but little is known of him except that he disappeared.

Features 15 and 18 were eventually built and occupied in the early to mid 1950s and abandoned in 1955 when E. T. retired from working at the boarding school. She and her family then moved to T. T. and E. T.'s allotted land approximately 1 mile east of the Whitehorse store. Feature 18 was occupied by M. C. while E. T. and her children occupied Feature 15.

Features 10 and 12 were occupied during the 1940s by the Y family, C. Y., his wife, E.Y., and their children. The Ys moved north of the chapterhouse sometime after the T family moved (exact year unknown).

Economy

During the period of occupancy of LA 59962, several wage-earning activities were engaged in by the residents of the site. E. T., born in 1902 and a high school graduate of Crownpoint, worked in Crownpoint, Pueblo Pintado, and at Buck's store along with her sister, V. C., before moving to LA 59962. Just before her move to the site, E. T. was working as a cook at the Whitehorse Community boarding school. During the summers of 1940 and early 1950s, the entire T family would often move to Bluewater and pick lettuce and carrots. There was also a short period when the family apparently

moved to Hospah and T. T. worked in the oilfields. T. T. was eventually blinded (exact circumstances unknown), but it is said that he could get around the Whitehorse area. He functioned so well that those who did not know him could not tell that he was blind.

Most likely T. T. received some form of assistance, because of his blindness, through the federal government, the state, or the tribe. The Navajo-Hopi Long Range Rehabilitation Act provided federal subsidies to the state of New Mexico to be used as payments for the blind, aged, and disabled in the 1950s.

M. C., E. T.'s clan sister, wove rugs during their time spent at LA 59962 and worked as a janitor at the school for a short time.

According to M. T., a former site resident, the T family had between 35 and 40 sheep, a wagon, and a few horses. The Y family also had livestock but exact numbers are not known. C. Y., one of the residents of Feature 10, was reported by T. M., supervisor of the Hospah oilfields during this time, as among the eight steady employees during the 1940s. He was also reported by one of the store owners later in the 1950s to have worked at the Whitehorse store. It is also possible that the Y family moved to their land north of the chapterhouse and store during C. Y.'s employment at the store. The 1930s automobile belonged to a member of the Y family; whether it was C. Y.'s or one of his sons is not known.

Apparently during both families' stay at LA 59962, wage work began to replace livestock herding as the major source of income. The T family herd was small and therefore wage work combined with rug weaving were probably the main contributors to the family income. The Y family had at least one known individual working full-time at Hospah during this period as well.

Social Organization

The reasons for movement by the T and Y families to LA 59962 were most likely socioeconomic. When T. T., who was already married to E. T., took on responsibility for M. C., the families joined households at LA 59962. E. T. stated that her primary reason for moving to the site was so that she could be closer to the school where she was working.

The reasons for the Y family moving to the same site also may have been socioeconomic. Both E. T. and E. Y. were sisters and C. Y., E.Y.'s husband, was employed at the Hospah oilfields. Moving to LA 59962 may have provided both homestead groups with an opportunity to cooperate socially and economically.

Movement from one hogan to another by the T family was most likely determined by several factors that included the need for more indoor and outdoor space, requirements demanded by livestock, and the birth of another child in 1942. These factors may have contributed to the decision to construct additional hogans in the next two areas of the site.

Seasonal movement did occur among members of the T family, not because the livestock required it, but because the need for wage labor determined movement. During the school year, the T family lived at LA 59962, but during the summer months some of them would move to Bluewater, leaving a few individuals behind to care for the homestead.

The year 1955 was a turning point for the residents of the site, as members of the T family returned to their allotment while members of the Y family began making plans to move to land north of the chapterhouse and store. It was also in the mid-1950s that the issuance of trade tokens and the extending of credit by the Whitehorse store declined. During the same period, welfare assistance became more widely available and individuals could return to their original homesteads with the hopes of filing for assistance. Automobiles were also more common during this period and one could now live a greater distance from work and drive or catch a ride to the job site.

It appears that the two families banded together for awhile at LA 59962 not only because of matrilineal relationships, but also as an economic support group. Structures were built and as a result much debris was discarded as the site became a more permanent settlement during this period of active wage earning.

When the economic reasons for cooperation dissolved, due to retirement and the lack of work at Hospah, the families moved to other more permanent residences within the Whitehorse area and pursued other economic activities.

T. T. died in 1957, and M. C. died of tuberculosis the following year. E. T. is now residing in a senior citizen's center in Crownpoint, while M. T. and his family still occupy the family allotment.

Sweat Lodge Sites

Both LA 59959 and LA 59961 are sweat lodge sites in the right-of-way. The sweat lodges were associated with homesteads outside the project corridor.

LA 59959

Occupational history. LA 59959 is "Section 36" land, owned by the State of New Mexico. The revenue from Section 36 land is used to support education programs. Information about this site was provided by two residents and employees at the Hospah oilfields. The sweat lodge and associated extramural features are located within the proposed right-of-way. Occupational history parallels that of LA 59958 as both sites were residences for Navajo employees working at the Hospah oilfields.

A stone hogan located northeast of LA 59959 was constructed in the early 1960s, (1961 or 1962), by two former employees of the oilfields. One of these employees was the nephew of Jones Largo. Together these individuals built the hogan and a small wooden house near it. These structures temporarily housed family members and other employees of Hospah (exact number unknown) between the early 1960s until 1985, when the last occupant moved to his permanent home and now commutes to Hospah.

According to an interviewee that recently moved from this area, the sweat lodge was built in 1949 by Casus Mescal (exact spelling unknown), a local Navajo who worked at the oilfields. Several male individuals were reported to have used the sweat lodge at the site, including one interviewee who described the sweat lodge as approximately 2 ft deep and able to fit six people at a time. The structure was abandoned in the 1960s after Casus Mescal passed away. A new sweat lodge was built as a replacement just east of this site near the masonry hogan.

The practice of abandoning an area or structure after the death of a person was common practice among the Navajo. The purpose was to avoid both the dead and the things connected with the dead. Many Navajo feel that those who come in contact with the dead or his or her belongings will become ill and possibly die. The fear of ghosts rather than the fear of the dead is paramount in this situation. Sweat lodges were often abandoned after the death of their owner (Kluckhohn and Leighton 1974:320).

A new sweat lodge replaced the one at LA 59959 and was built near the masonry hogan in 1968 or 1969. It was removed by the owner in the late 1970s when he retired from the oilfields.

In trying to determine the wishes of the users of the sweat lodge with regards to the disposal of the structure, we were simply told by the interviewees that the owner of the sweat lodge had passed away. One individual said that it was not for him to say as he was not the owner. The other interviewee stated that it was on state land and therefore the state should determine what should be done with the remains. When a medicine man in the area was consulted on the religious value of the site, the medicine man stated that there was no sacred value attached to the sweat lodge. A check of the literary sources on the sweat lodge and its uses indicated that it was used for a number of purposes, including ritualistic purposes of purification and the curing of illnesses and as a meeting place or men's club (Kluckhohn et al. 1971:317; Reichard 1974:49).

It is probable that the most common uses for the sweat lodge at this site were to relieve fatigue after time spent in the oilfields and as a meeting place for the men. Most likely work and family were two of the main topics of discussion. It could have also been used for curing. Mr. Largo was a medicine man, and, if available, may have been called upon to aid a person who was ill.

Although the sweat lodge was probably used for a variety of reasons by the men living at the site, none of the interviewees that used the structure, or knew about it, mentioned it as sacred or were worried about it being removed by the construction of the road. Neither did they mention that it had any historic value, as at least one of these individuals has a sweat lodge.

LA 59961

Occupational history. Information gathered for LA 59961 came from four family members associated with the site; two of them lived on the ridge just east of the site at one time. Exact dates of use and abandonment are lacking. The younger interviewees for the site were not alive during the occupation of the site. The older interviewees have long since forgotten many events that took place at the site.

The sweat lodge, now a part of Navajo Tribal Fee Title land, is associated with remnants of dwellings on top of the ridge located just east of the site. This site and the land surrounding it were part of the 'customary use area' of Whan Abeita's family. Many family members belonged to the Hashtl'ishnii Clan. According to the oldest living resident of the site, M. W., her family 'moved around' in this area before Fort Sumner. It is possible, as two other residents of the area have suggested, that the Whitehorse area may have been used as a summer grazing area. If this were the case, then the dwellings on top of the ridge east of LA 59961 could have been at least in part a summer base camp.

A younger member of the family stated that her family used to move all over the Whitehorse area, Littlewater, Crownpoint and Rincon Marquis. Eventually they settled across the road from LA

59961 around the year 1949.

The sweat lodge is said by family members to have belonged to Whan Abeita who apparently died so long ago that no one member of his family remembers exactly when. Both birth and death records were checked at the BIA office at Crownpoint and there was no information on Whan Abeita. As one of his daughters was born in 1906, it may be assumed that he was alive during this period.

The residential site on top of the ridge to the east was abandoned when M. W.'s grandmother's sister passed away. She died in the masonry hogan that is on the southwest facing bench below the ridge top. A number of family members are buried in this area, including one of M. W.'s great aunts, her grandparents, and a brother-in-law, Roy Jones, who died in 1949 and is buried south of the site just outside the right-of-way. None of the burials are in the right-of-way according to M. W.

The Abeitas herded livestock including sheep, cattle, goats, and horses during the early years before livestock reduction. M. W. stated that their livestock had been drastically reduced during the 1930s. A former owner of the Whitehorse store reported that M. W.'s family still had a great deal of livestock in comparison to other residents in the Whitehorse area during the 1950s. Today only two of the original occupants of the site are alive and they own a handful of animals.

There was a controversy with regards to the future status of the sweat lodge at LA 59961. The problem exists between two relatives of Whan Abeita, his daughter, M. W., and his grandson, J. B. According to M. W., the sweat lodge can be moved out of the right-of-way so that the road can be built. "There's nothing to it," M. W. stated. Yet J. B., who resides just north of the site, wants the sweat lodge preserved in memory of his grandfather. J. B. also stated that the structure was ". . . very sacred because people sing and pray and use a medicine man in them." J. B. went on to say that ceremonies were performed in the sweat lodge for his grandfather when he was ill. He continued by saying that the area in which LA 59961 is located is referred to as the Long House Area. The mesas to the east of the site are called Bear Springs Mesa and Eagle Mesa. According to J. B., these mesas are considered sacred. These mesas are outside the project corridor.

Sweat Lodges in a Cultural Context

According to Navajo mythology, the first sweat lodge was built by First Man at the Place of the Emergence (Reichard 1974:48). Johonaa'ii, the Sun, used the sweat lodge as a test for the Twins to determine whether or not they were his real sons (Zolbrod 1984:209). A further search of the literature revealed that there are three main purposes for the sweat lodge according to the Navajo: for purification, good health, and as a social gathering place (Reichard 1974:49). M. W. stated that the purpose of the sweat lodge was for cleansing. She also stated that there were several sweat lodges throughout this area, but that the people that used them have passed away. J. B. stated that he still has a sweat lodge that he uses.

According to the medicine man that we interviewed, sweat lodges were used frequently by the older people for both cleansing and for the curing of illnesses. He went on to say that special songs and prayers were sung in association with the sweat lodge. Also a special drink was often prepared for use in the structure. Both Kluckhohn and others (1971) and Reichard (1950) have also mentioned such a drink. Reichard refers to an emetic that was sometimes used in the sweat lodge for purification purposes (Kluckhohn et al. 1971:322; Reichard 1950:727).

A number of Navajo curing ceremonies incorporate the use of the sweat lodge as an important element in the curing process. Ceremonies such as Mountaintop Way, Nightway, Big God Way, and Shooting Holy Way, to name but a few, utilize the sweat lodge for purification and curing (Kluckohn et al. 1971:318; Reichard 1950:727). Sweat lodges were also used by hunters and warriors for ceremonial purposes (Kluckhohn et al. 1971:326).

Before entering a sweat lodge, a person was expected to invoke the Holy People to join him or her in the praying and singing of the ancient prayers (Reichard 1974:49; Kluckhohn and Leighton 1974:144). Beyond this invocation, there were different rituals depending on one's reason for using the sweat lodge. Kluckhohn refers to the use of the sweat lodge as a 'lay rite'; the major purpose was for personal hygiene (Kluckhohn and Leighton 1974:44). Reichard refers to the use of the sweat lodge as a 'rite of purification' (Reichard 1950:727). The best summary appears to come from Fishler's Navajo interviewees who stated that there were both religious and therapeutic reasons for using the structure (Kluckhohn et al. 1971:324).

The sweat lodge at LA 59959, according to interviewees familiar with the site, was used primarily as a place to cleanse and gather socially. The sweat lodge at LA 59961 may have been used both as a social gathering place and as a part of a curing ceremony performed for J. B.'s grandfather, Whan Abeita.

From this information it appears that the sweat lodge is a multipurpose structure that may be used for at least three purposes. In the Whitehorse-Hospah area, the use of the sweat lodge has decreased considerably over the years. When asked how often the people would use the sweat lodge, the medicine man replied that they were used whenever a person was feeling dirty or ill. Father Berard Haile reported that the sweat lodges were used as frequently as two to three times a week (Franciscan Fathers 1919:34). The medicine man also stated, as did J. B., that once there were separate sweat lodges for men and women. When asked why there was such a separation, he stated that illness could occur if the sexes were mixed. Kluckhohn mentions that in the Smith Lake-Pinedale area, separate sweat lodges for men and women were also common (Kluckhohn et al. 1971:326). Reports on the use of the sweat lodges by both men and women in other areas of the reservation suggest that the most common scenario would be groups of men and women using the same sweat lodge but at different times. Men were reported as frequenting them more often than women, and for different purposes (Kluckhohn et al. 1971:319; Reichard 1974:48).

The medicine man was asked why sweat lodges were no longer used as frequently as they once were? He replied that the major reason was that people had taken the wood from the sweat lodges for use as fuel because there was a lack of wood in the area. The other reason for their disuse was that there is much work involved in building a sweat lodge; the cutting of wood, certain songs that must be sung, and they must be built within a one day period (Kluckhohn et al. 1971:319). We also asked our consultant if there was anything today that has replaced the use of the sweat lodge. He replied that there was nothing that has replaced it and went on to say that he wished he had one.

Kelley found in her study of land-use patterns in the checkerboard area that there were two major reasons for the disuse of the sweat lodge: (1) many adults were able to shower on the job or pay for public showers in Gallup; (2) little time existed for men to gather together socially as they once did in the sweat lodge, as leisure time is now at a minimum (Kelley 1986:193). Kelley goes on to say that the use of the sweat lodge today is usually associated with religious ceremonies such as those performed by the Native American Church.

In summary, there are both secular and sacred values placed on the sweat lodge. The majority of the residents of the Whitehorse-Hospah area that were interviewed may rightfully argue that it is not the sweat lodge itself that is considered sacred, but the prayers and activities performed within the sweat lodge that may be considered as such. According to them, the removal of the sweat lodge will not harm the ritual activities that are performed within the structure, it will only harm the structure, which in their eyes is of little value when compared to the benefits that the road will bring to them.

LA 59963: Shrine or Puppy Pen?

LA 59963 was on Individual Allotment Land. The land was occupied by members of the Tsi'naajani Clan. According to an interviewee, the site was inhabited between the years 1940 and 1957. It was abandoned when a decision was made by the occupants to move to the top of the ridge located northeast of this site. The purpose of the move as stated by the informant was ". . . for a better view."

The archaeological survey reported a cairn existing in the proposed right-of-way. The interviewee, a relative of the occupants of the site, stated that the structure in question was the site where his childrens' dog gave birth to her puppies. The identified pile of sandstone was placed under the overhang to constrain the puppies. The modern doubleknit clothing was used as a ground cover for the animals. The enamel pan associated with the sandstone pile was used to feed the puppies. The informant knew nothing of the feather that was identified at this site. The feather was not at the site when the ethnohistorian visited the area. When asked if the he had any wishes as to the disposal of the items at the site or the site itself, the interviewee stated that he did not mind if the road passed through this area.

The conclusion was that the locus under the sandstone overhang was a children's area used to care for pets. It had no religious importance.

CONCLUSIONS: THE ARCHAEOLOGICAL AND ETHNOHISTORICAL STUDIES IN RETROSPECT

Stephen S. Post

The goals of this data recovery effort were to employ two data recovery methods that relied on different data sources to address similar questions about changing Navajo economic and social patterns during the twentieth century in the Whitehorse and Hospah region. This approach was different from the more common method of using the ethnohistorical data to locate the archaeological features and to provide a context for analysis and interpretation. In other words, the ethnohistorian would supply the site history and information about the economic and social patterns, and then the archaeological record could be analyzed and interpreted from the ethnohistorical perspective. Instead, we preferred to conduct both studies independently, generate separate analyses and interpretations, then compare notes at the end. However, the studies did not operate in complete isolation. The archaeological study relied on available archaeological and ethnoarchaeological data for comparative analysis and interpretation. The ethnohistorical study used the site descriptions to focus the interviews and to collect information that could be compared with the archaeological study. Both studies were organized within the historical context of changing events that might have affected the economic and social patterns. The intent of this section is to reevaluate the site histories, economic patterns, and social patterns in terms of the two approaches, and present synthesized conclusions. This section will be divided into the residential and sweat lodge sites, with the different results compared by site history, economic, and social patterns.

LA 59958

LA 59958 was originally identified as a residential site during the survey. The data recovery program found no architectural remains within the project corridor. The lack of structures with which to associate artifacts reduced the ability of the archaeological study to address the site history and economic and social patterns in great detail. The ethnohistorical study was much more successful in addressing these issues because it was not limited to the material remains. Many individuals who had lived in Hospah for the last 40 or 50 years were available as were different document sources.

Site History

The archaeological study, which relied on artifact manufacture dates to suggest when the site was occupied, yielded a temporal range between 1965 and 1972. This was based on the artifact scatter within the right-of-way and the refuse areas outside the right-of-way. Based on the survey evidence of a structure within the right-of-way, a 1930 to 1960s occupation was expected, but never encountered. Excavation did not confirm the survey identification. When the area including the possible hogan foundation was excavated, no other evidence of occupation was found. The two possible hornos, Features 16 and 17, near the south end of the site, were collapsed and partly buried. Their condition suggested an age greater than 20 years, but a more precise estimate could not be obtained. Thus, the archaeological study focused on the later 1965 to 1972 period.

The ethnohistorical study, through interviews with oilfield workers and former site residents, determined that a hogan had been occupied during the 1940s and 1950s. The actual span was not

remembered by the people interviewed. The sheep pen and corral were built between 1972 and 1982. The interviews did not positively identify the period between 1965 and 1972 as a time when anyone was living at the site.

Whether the possible hogan foundation identified during the survey, but not confirmed during the data recovery, was an actual hogan remnant remains problematic. It is possible that the Hospah residents that referred to Jones Largo's hogan could have been referring to a different location or the ephemeral outline identified during the survey was a masonry hogan remnant, that lacked structural components that could be verified during data recovery. The two possible *hornos*, Features 16 and 17 at the south end of the site, may be indirect evidence that there was a hogan nearby, although isolated ovens or hearths have been reported in the literature (Hayes et al. 1981; Reher 1977).

The ethnohistorical study identified a 1940s to 1950s occupation that was not evident from the features or artifacts. The ethnohistorical study also suggested that habitation might have occurred in temporary structures that left no visible remains. For LA 59958, the ethnohistorical study provides more complete information about site history.

Economic Patterns

The archaeological and ethnohistorical studies complemented one another in revealing economic patterns for the period after 1960. The archaeological study provided little economic data from the 1940 to 1950 period.

The 1940s were a period of prosperity for Hospah as the United States used all available resources for the war effort. Oil was an important wartime resource. At one time, as many as 70 people were employed. There was an airfield, a post office, a school, and a 'chow hall.' LA 59958, on the edge of town, was occupied periodically by Mr. Jones Largo and others as the oil companies needed workers for various projects. This would have been a time of relative prosperity, even with only periodic wage work available.

The ethnohistorical data indicate that there should have been more refuse from the 1940s and 1950s on the site. By the 1940s, wage income allowed Navajos to buy more manufactured goods and processed foods, which would have resulted in a greater quantity of durable containers. Refuse areas or ash areas with a substantial quantity or concentration of durable goods were not found within the right-of-way nor were they apparent in the two refuse concentrations recorded outside the project corridor. The reasons behind this absence of 1940s to 1950s refuse were not determined by the archaeological or ethnohistorical studies.

Between the 1960s and 1980s, economic prosperity in Hospah continued to rise and fall with the oilfield. The ethnohistorical and archaeological data show that in the 1960s, most Hospah residents were tied to the commercial economy of the reservation border towns and probably the more distant metropolitan areas like Albuquerque. This increased use of the regional markets, combined with rising income when it was available, allowed Hospah residents to purchase more goods and a wider variety of goods. This is reflected in the refuse scatter within the right-of-way and in the refuse areas outside the project corridor.

Social Patterns

The archaeological study did not address social patterns because the associations between artifacts

and architectural features were too vague or were absent. The ethnohistorical study suggests that the site pattern reflected the Hospah pattern of social composition. Oilfield workers with permanent jobs settled in and around Hospah. They could afford to build houses or rent company lodgings. Most of the permanent employees were of European descent. The Navajo employees would move to Hospah if a job was long term or they would commute to Hospah from their traditional lands around Hospah and Whitehorse.

Jones Largo's employment record was a good example of the Navajo pattern because he moved in and out of Hospah in response to work availability. Depending on his family needs, he lived in a hogan, a tent, or with relatives. With the emphasis on increased wage labor in the 1940s and 1950s, many Navajos developed a new mobility pattern in contrast to the seasonal summer-winter pastoral pattern. Work was available with the railroads, mines, industrial factories, etc. All or parts of families would move to the work location. When the jobs ended, such as after World War II, many Navajos returned to traditional lands or new lands on the reservation. This pattern persisted between the 1960s and 1980s.

The ethnohistorical study did not yield great detail on changing social patterns. It did confirm that the Hospah area social patterns changed with the emphasis on wage work, a pattern that occurred throughout the reservation. Mobility, rather than being seasonal, was in response to job availability. Family or group size changed as relatives moved from household to household.

LA 59962

The results of the archaeological and ethnohistorical studies of LA 59962 can be more readily compared than for LA 59958. The issues of site history and economic and social patterns were addressed using both methods. The studies yielded some interesting differences and reevaluations of conclusions.

Site History

The archaeological study recovered 493 datable artifacts. From the artifacts an occupation range between 1925 and 1955 was suggested. This range was divided into two 15-year periods of 1925 to 1940 for the surface scatter artifacts and 1940 to 1955 for the artifacts from refuse areas. An order of occupation within the site could not be determined from the artifact manufacture dates or from evidence for construction material reuse. The hogans appeared to be occupied by the same family in successive order, but the order could not be determined.

The ethnohistoric study provided definite information about the occupation sequence. Feature 23 was the first hogan occupied by the clan sisters, M. C. and E. T., and their husband. Initially, they had only one hogan. From the late 1940s to the early 1950s, Features 19 and 20 were occupied by the two sisters and their husband, a period of 4 or 5 years. Surprisingly, the occupation of Feature 23 generated very little refuse considering that it was used from 1939 to 1947. From 1950 to the time of abandonment in 1955, the sisters and their husband lived in Features 1 and 2, another 5-year stretch. Feature 18 in Area 1 was occupied by E. T.'s sister and her family from the mid 1940s to 1956 or 1957, a 12-year period. Feature 21 in Area 1 was used for storage and never occupied.

The exact occupation dates for specific features are not provided by the ethnohistoric study. Clearly Areas 2, 3, and 4, were used by the same family from 1939 to 1955 with changes in residence

made every 4 to 6 years. Feature 23, the very reduced hogan foundation in Area 4 was the earliest structure on the site. Although the residents did not say so, the construction materials probably were used in subsequent hogan construction. The ethnohistorical study and the archaeological studies coincided since the features dated by the archaeological study were 1940 to 1955 and the ethnohistorical dates were 1939 to 1955. The early dates derived from the surface artifacts may have come from seasonal use of the site for grazing, before the more permanent occupation from 1939 to 1955.

Economic Patterns

The archaeological study suggested that the presence of store-bought canned foods and the diversity in can sizes was an indication that wage income was an important part of the site residents' subsistence. The diverse can sizes suggested that the residents had access to off-reservation stores and/or differential access to goods. This was especially indicated by the large can sizes that were recorded. The ethnohistorical study confirmed the emphasis on wage income. The sisters and husband worked many jobs, including at the trading post and the day school in Whitehorse for the women and the oilfields of Hospah for the husband. The wage income may not have been high, but it was steady. Differential access to goods was made possible by the day school cooking job. It is likely that the large cans came from the school kitchen. These cans may have been empty and used as containers or the contents may have not been completely consumed and were brought home rather than discarded. Therefore, the residents may not have had more income to buy large sized cans as suggested in the archaeological study, but had access to them through the school.

The length of occupation at the hogan pair within Area 3 is important because it refines the sheep/goat consumption reconstruction. The archaeological study suggested that the low level of four animals per year were consumed based on projected numbers of sheep/goat carcasses in Feature 2. The 5-year occupation determined ethnohistorically would easily accommodate the estimate of four to five animals per year. Given that most of the residents' food was purchased and not raised, the low end figure is certainly credible.

During the interviews, the former residents said they had 35 to 40 sheep. The archaeological estimates derived from the corral dimensions suggested that 50 to 100 could have been kept. At a 15 percent consumption threshold for maintaining a good breeding population, 35 to 40 sheep would have meant that 5 to 6 per year could have been consumed. This is very close to the estimate derived from the faunal analysis of Feature 2. The faunal reconstruction resulted in an excellent fit between the archaeological and the ethnohistorical data.

The archaeological data on the economic status of the site residents were equivalent to the entrepreneurial Navajo ranchers of the NIIP area. Artifact diversity and quantity suggested that steady income was available and the residents' purchasing power was equal to or better than the average Navajo living on or near the reservation from 1940 to 1955. The ethnohistorical information indicated that the site residents had special status. E. T. was born in 1900 and was a high school graduate from Crownpoint. A Navajo with a high school education was rare before World War II. Because of her education, E. T. had better employment potential. E. T. worked at the trading post and at the day school; these were undoubtedly coveted and scarce on-reservation jobs. These jobs and the oilfield job held by E. Y.'s husband supplied income that allowed the families to live at a better than average economic level.

Again, the archaeological and ethnohistorical data result in similar conclusions about economic status, but through different information sources. The ethnohistorical information suggests

that wage income was important, as did the diversity of the material goods. For the 1930 to 1960 period, refuse content is a good indicator of economic status.

Social Patterns

The ethnohistorical information provided an uncomplicated account of the occupation history and family composition. Areas 2 and 3 were inhabited by the two sisters, E. T. and M. T., M. T.'s husband T. T., and their three children. Apparently, the group size and composition changed little from 1945 or 1946 to 1955. This is reflected in the archaeological data as site structure. The feature composition of Areas 2 and 3 were very similar with the two hogans and associated activity areas. The hogan sizes increased through time, which reflects the need for more space as E. T. and M. T.'s three children grew. The exterior activity space did not change except that there was a woodchopping area in Area 3 indicating that wood stoves were available for heating between 1946 and 1951.

The archaeological interpretation was based on similar feature distribution, size, and the historical suggestion that a second hogan was often used for work or storage space. This interpretation suggested that the same family group used the site for the whole occupation. The similarities in Areas 1, 2, and 3 indicated similar group size and needs throughout the occupation. Area 4 was suggested to be a specialized area, since the hogan was small and dismantled. There were no other features associated and no ash accumulation nearby. The ethnohistorical study determined that Area 4 was the first to be occupied. The absence of features could be explained by recycling of building material. The low numbers of discarded artifacts cannot be explained.

The ethnohistorical study showed that the archaeological interpretation was somewhat skewed and lacking in detail. Areas 2 and 3 were occupied by the same family. Area 1 was occupied contemporaneously with Area 2 by members of E. T.'s extended family. Toys were found in Area 1 suggesting that there were children and the ethnohistorical study confirmed this. The pattern of one hogan for residence and one for storage did apply to Area 1, but the arrangement and size of the features between all areas was so similar that different uses of the two hogans could not be determined by the archaeological study.

Family size estimates derived from archaeological and ethnographic data were consistently too low. The archaeological estimates showed that the hogans should not house more than two to four people at a time. There were five individuals in E. T.'s family and at least four members in the Y family. This underestimate suggests that the interior space requirements for some Navajos are very low by cross-cultural standards. The ethnohistorical data yielded more accurate group size estimates. The archaeological data suggest that archaeologically derived estimates for Navajo household size would be low if only ethnographic and cross-cultural data were used.

Clearly, and not unexpectedly, the ethnohistorical study yielded more accurate information about the group size and composition and whether it changed through time. Former residents were asked who lived at the site and when. The archaeological study relied on inferences based on ethnographic and ethnoarchaeological studies. The differences between the ethnohistorical and archaeological research indicate that the former can provide very good detail, while the latter can only yield estimates.

LA 59959 and LA 59961

The archaeological and ethnohistorical study of the sweat lodges at LA 59959 and LA 59961 had different goals and therefore yielded different information. The archaeological study focused on recording the structural and material remains of the sweat lodges without excavation. This information was used to date the sites and address changing attitudes in the construction of sweat lodges. The ethnohistorical study focused on questions of site history, the changing ceremonial importance of sweat lodges, and the wishes for the disposition of the sweat lodge elements.

The archaeological recording of LA 59959 and LA 59962 did not provide temporal refinement beyond that determined by the survey. The artifacts associated with the sweat lodge at LA 59959 were mixed with domestic refuse or they had manufacture dates that spanned more than 50 years. The survey recording placed the sweat lodge use after 1930. There were no temporally diagnostic artifacts associated with the sweat lodge at LA 59961. This absence of artifacts suggested that the sweat lodge pre-dated the occurrence of trading posts and the common use of manufactured goods by Navajos. The survey recording placed the site between 1880 and 1920.

The style of construction for both sweat lodges was similar to forms discussed in the literature (Jett and Spencer 1981; Bohrer 1964; Brugge 1956; Hayes et al. 1981). LA 59961 was made in the forked-stick style that reflects an early forked-stick construction of hogans and sweat lodges. There were no manufactured goods, such as nails or wire used in its construction. The orientation of the door and exterior hearth to the west did to conform to the common eastern orientation described in the literature. This departure from the common lay-out of sweat lodges suggests that the lay-out was not constrained by simple directional rules. The later sweat lodge at LA 59959 was of the tipi-style of construction. This form apparently evolved out of the forked-stick style, but at an unknown time, so its occurrence is not temporally diagnostic. It was made from milled pine and rough-cut juniper with nails and wire used to join the upright poles. The doorway orientation was not determined, but the location of the hearth 5 m to the east suggested that the entrance faced east. The use of manufactured goods in the construction of the sweat lodge indicated that it was made in the 1940s or later. By this time manufactured goods were available to and commonly used by Navajos. These two sweat lodges are not a large sample, but together they illustrate the small changes that have occurred in sweat lodge construction since the end of the nineteenth century.

The ethnohistorical study indicated that through time the use of the sweat lodge changed little. There was no information gathered that would suggest that it stopped being a place for healing, rejuvenation, and fraternization. These sweat lodges were apparently used by men and post-dated the time when they were used by women as well as men. The ethnohistorical study suggested that sweat lodge use was on the decline because of the lack of firewood and the amount of work that went into building a sweat lodge. This decline in sweat lodge use is not being replaced by a similar practice. Instead, new or existing western religious practices are being adopted.

The disposition of the sweat lodges was different in each case. At LA 59959, the owner had died, there were no close relatives with an interest in the sweat lodge remnants, and the land was owned by the State of New Mexico. For these reasons there was no additional treatment of the remnants, such as moving them to a location outside the right-of-way.

At LA 59961, there were different wishes from two descendants of the former owner. The granddaughter of the owner said that the remains could be removed from the right-of-way, although she did not specify to where or how. The great-nephew of the owner wanted the remains preserved

in place or to be paid for their removal. He considered the remains to be sacred, while the granddaughter and a local medicine man did not. In consultation with the Navajo Nation Historic Preservation Division, the juniper poles were removed from the ground and stacked against a sandstone outcrop 65 m east of the original location. This was done in response to the granddaughter's wishes.

LA 59963

Only a portion of LA 59963 was in the right-of-way. The feature was originally recorded as a rock pile with a pan, part of a knit sweater, and a white feather. The function or importance to local residents of this feature was not known. The ethnohistorical interview determined that the feature was used to care for a mother dog and her puppies. The feature and its associated artifacts did not have any significance beyond this fact for the site residents. No further work was conducted at the site.

REFERENCES CITED

Adams, Eleanor B.
1970 Cattlemen, Conservationists, and the Taylor Grazing Act. *New Mexico Historical Review* 45:311-329.

Bailey, Flora L.
1940 Navaho Foods and Cooking Methods. *American Anthropologist* 42(2):270-291.

Bailey, Garrick A.,and Roberta Glenn Bailey
1980 Ethnohistory. In *Prehistory and History of the Ojo Amarillo: Archaeological Investigations of Block II, Navajo Indian Irrigation Project, San Juan County, New Mexico,* vol. 4, edited by David T. Kirkpatrick, pp. 1389-1524. Cultural Resources Management Division, Department of Sociology and Anthropology, New Mexico State University, Report 276.

1982 *Historic Navajo Occupation of the Chaco Plateau.* University of Tulsa, Oklahoma.

1986 *A History of the Navajos: The Reservation Years.* School of American Research Press. Santa Fe, New Mexico.

Barde, David
1976 A Brief Report of Trading Posts in the Star Lake Area: A Research Proposal For Development Anthropology. In *An Archaeological Survey of Star Lake: A Report on the Prehistoric, Historic, and Current Cultural Resources of the Star Lake Area, McKinley County, Northwestern New Mexico,* edited by Walter K. Wait. Southern Illinois University, Carbondale.

Beal, John
1984 *The Lee Ranch Mine Project: Dimensions of Occupational Persistence.* School American Research Contract Archaeology Program Report No. 086. Santa Fe.

Berge, Dale
1968 The Gila Bend Stage Station. *The Kiva* 33:169-243.

Binford, Lewis R.
1980 Willow Smoke and Dog's Tails: Hunter-Gatherer Settlement Systems and Archaeological Site Formation. *American Antiquity* 45:44-20.

1983a Organization and Formation Processes: Looking at Curated Technologies. In *Working at Archaeology,* edited by L. R. Binford, pp. 269-286. Studies in Archaeology, Academic Press.

1983b The Archaeology of Place. In *Working at Archaeology,* edited by L. R. Binford, pp. 357-378. Studies in Archaeology, Academic Press.

1983c Forty-seven Trips: A Case Study in the Character of Archaeological Formation Processes. In *Working at Archaeology,* edited by L. R. Binford, pp. 243-268. Studies in Archaeology,

Academic Press.

Bohrer, Vorsila L.
1964 A Navajo Seathouse. *Plateau* 36(3):95-99.

Brown, Barton M.
1987 Population Estimation from Floor Area: A Restudy of "Naroll's Constant." *Behavior Science Research* 21:1-41.

Brugge, David M.
1980 *A History of the Chaco Navajos.* Reports of the Chaco Center 4. National Park Service, Chaco Center, Albuquerque.

Camilli, Eileen
1989 The Occupational History of Sites and the Interpretation of Prehistoric Technological Systems: An Example from Cedar Mesa, Utah. In *Time, Energy, and Stone Tools,* edited by Robin Torrance, pp. 17-26. Cambridge University Press.

Chapman, Richard C.
1977 Analysis of Lithic Assemblages. In *Settlement and Subsistence along the Lower Chaco River: The CGP Survey,* edited by C. A. Reher, pp. 371-456. University of New Mexico Press.

1979 The Archaic Occupation of White Rock Canyon. In *Archeological Investigations in Cochiti Reservoir, New Mexico,* vol. 4, *Adaptive Change in the Northern Rio Grande Valley,* edited by Jan V. Biella and Richard C. Chapman. Office of Contract Archeology, University of New Mexico, Albuquerque.

Douglas, R. W., and Susan Frank
1972 *A History of Glassmaking.* G. T. Foulis and Co. Ltd., Oxfordshire.

Duran, Meliha S., and C. Timothy McKeown
1980 Historic Artifacts. In *Prehistory and History of the Ojo Amarillo: Archaeological Investigations of Block II, Navajo Indian Irrigation Project, San Juan County, New Mexico,* vol. 3, edited by David A. Kirkpatrick, pp. 1023-1208. The Cultural Resources Management Division Report No. 276. New Mexico State University, Las Cruces.

Elyea, Janet M., and Patrick Hogan
1983 Regional Interaction: The Archaic Adaptation. In *Economy and Interaction along the Lower Chaco River,* edited by P. Hogan and J. C. Winter, pp. 393-402. Office of Contract Archeology and Maxwell Museum of Anthropology, University of New Mexico, Albuquerque.

Elyea, Janet M., and Peter N. Eschman
1983 Archaic Site Descriptions. In *Economy and Interaction along the Lower Chaco River,* edited by P. Hogan and J. C. Winter, pp. 63-104. Office of Contract Archeology and Maxwell Museum of Anthropology, University of New Mexico, Albuquerque.

Eschman, Peter N.
1983 Archaic Site Typology and Chronology. In *Economy and Interaction along the Lower Chaco River,* edited by P. Hogan and J. C. Winter, pp. 375-384. Office of Contract Archeology and Maxwell Museum of Anthropology, University of New Mexico, Albuquerque.

Fassett, James E.
1978 *Oil and Gas Fields in the Four Corners Area: Farmington, New Mexico.* Four Corners Geological Society.

Ferrill, Joel T.
1978 Climate. In *Western Area Survey.* Public Service Company of New Mexico, Albuquerque.

Fondaw, Anna Pauline
1976 An Historical Account of Missions at Star Lake, New Mexico. In *An Archaeological Survey of Star Lake: A Report on the Prehistoric, Historic, and Current Cultural Resources of the Star Lake Area, McKinley County, Northwestern New Mexico,* edited by Walter K. Wait. Southern Illinois University, Carbondale.

Fontana, Bernard L., J. Cameron Greenleaf, Charles W. Ferguson, Robert A. Wright, and Doris Frederick
1962 Johnny Ward's Ranch: A Study In Historic Archaeology. *The Kiva* 28(1-2).

Franciscan Fathers
1919 *An Ethnologic Dictionary of the Navajo Language,* vol.1, *English-Navajo.* The Franciscan Fathers, St. Michael's, Arizona.

Fuller, Steven L.
1989 *Research Design and Data Recovery Plan for the Animas-La Plata Project.* Four Corners Archaeological Report Number 15. Complete Archaeological Service Associates, Cortez, Colorado.

Gilpin, Dennis
1982 Historic Sites Data: Summary and Analysis. In *Gallegos Mesa Settlement and Subsistence: A Set of Explanatory Models for Cultural Resources on Blocks VIII, IX, X, and XI, Navajo Indian Irrigation Project,* edited by Lawrence E. Vogler, Dennis Gilpin, and Joseph K. Anderson. Navajo Nation Papaers in Anthropology No. 12. Navajo Nation Cultural Resources Management Program, Window Rock.

Gilpin, Dennis
1983 Historic Artifacts. In *Cultural Resource Investigations on Gallegos Mesa; Excavations in Blocks VIII, IX, and Testing Operations in Blocks X, and XI, Navajo Indian Irrigation Project,* vol. 3, edited by Lawrence E. Vogler, Dennis Gilpin, and Joseph K. Anderson, pp. 1381-1463. Navajo Nation Papers in Anthropology No. 24. Navajo Nation Cultural Resources Management Program, Window Rock.

Hayes, Alden C., David M. Brugge , and W. James Judge
1981 *Archeological Surveys of Chaco Canyon, New Mexico.* Publications in Archeology 18A, Chaco Canyon Studies, National Park Service, U. S. Department of the Interior,

Washington, D. C.

Hogan, Patrick
1986 *Overview, Research Design, and Data Recovery Program for Cultural Resources within the Bolack Exchange Lands.* Office of Contract Archeology, University of New Mexico, Albuquerque.

Hogan, Patrick, and Joseph C. Winter
1983 *Economy and Interaction along the Lower Chaco River,* edited by P. Hogan and J. C. Winter, pp. 3275-286. Office of Contract Archeology and Maxwell Museum of Anthropology, University of New Mexico, Albuquerque.

Huse, Hannah, Bradley A. Noisat, and Judith A. Halasi
1978 *The Bisti-Star Lake Project: A Sample Survey of Cultural Resources in Northwestern New Mexico.* Bureau of Land Management, Albuquerque District.

Irwin-Williams, Cynthia
1973 *The Oshara Tradition: Origins of Anasazi Culture.* Eastern New Mexico University Contributions in Anthropology 5(1). Portales.

Jett, Stephen C., and Virginia E. Spencer
1981 *Navajo Architecture: Forms, History, Distributions.* University of Arizona Press, Tucson.

Jochim, Michael A.
1976 *Hunter-Gatherer Subsistence and Settlement: A Predictive Model.* Academic Press, New York.

Kearns, Timothy M.
1988 Basketmaker II Synthesis. In *Excavation in the Middle La Plata Valley for the San Juan Coal Company,* vol. 3. Division of Conservation Archeology, No. 6. Farmington, New Mexico.

Kelley, Klara B.
1982 *The Chaco Canyon Ranch: Ethnohistory and Ethnoarchaeology.* Navajo Nation Papers in Anthropology 8. Navajo Nation Cultural Resource Management Program, Window Rock.

1986 *Navajo Land Use: An Ethnoarchaeological Study.* Academic Press.

Kelly, Robert L.
1988 The Three Sides of a Biface. *American Antiquity* 53(4):717-734.

Kent, Susan
1984 *Analyzing Activity Areas: An Ethnoarchaeological Study of the Use of Space.* University of New Mexico Press, Albuquerque.

Kirkpatrick, David T. (editor)
1980 *Prehistory and History of the Ojo Amarillo: Archaeological Investigations of Block II, Navajo Indian Irrigation Project, San Juan County, New Mexico.* The Cultural Resources Management Division Report No. 276. New Mexico State University, Las Cruces.

Kluckhohn, Clyde, W. W. Hill, and Lucy W. Kluckhohn
1971 *Navajo Material Culture.* Belknap Press of Harvard University Press, Cambridge.

Kluckhohn, Clyde, and Dorothea C. Leighton
1974 *The Navaho.* Revised edition. Harvard University Press, Cambridge.

Kovel, Ralph, and Terry Kovel
1986 *Kovel's New Dictionary of Marks: Pottery and Porcelain, 1850 to the Present.* Crown Publishers, Inc., New York.

Lancaster, James W.
1983 *An Analysis of Manos and Metates from the Mimbres Valley, New Mexico.* M.A. thesis, Department of Anthropology, University of New Mexico, Albuquerque.

Lent, Stephen, C.
1991 *The Excavation of a Late Archaic Pit Structure near Otowi, San Ildefonso Pueblo, New Mexico.* Archaeology Notes no. 52, Museum of New Mexico, Office of Archaeological Studies, Santa Fe.

Loose, Richard W.
1978a Physiography/Geology. In *Western Area Survey.* Public Service Company of New Mexico, Albuquerque.

1978b Cultural Resources. In *Western Area Survey.* Public Service Company of New Mexico, Albuquerque.

Love, David
1982 Petrographic Description and Sources of Chipped Stone Artifacts in Chaco Canyon. In *Chipped Stone of Chaco Canyon, New Mexico,* by Catherine M. Cameron. National Park Service, Division of Cultural Research, Albuquerque.

Maker, H. J.., J. J. Folks, J. U. Anderson, and W. B. Gallman
1971 *Soil Associations and Land Classification for Irrigation, Sandoval and Los Alamos Counties.* New Mexico State University Agricultural Experiment Station Research Report 188. New Mexico State University, Las Cruces.

Maker H. J., H. E. Dregne, V. G. Link, and J. U. Anderson
1974 *Soils of New Mexico.* New Mexico State University Agricultural Experiment Station Research Report 285. New Mexico State University, Las Cruces.

Moore, James L.
1980 Archaic Settlement and Subsistence. In *Human Adaptations in a Marginal Environment: The UII Mitigation Project,* edited by J. L. Moore and J. C. Winter, pp. 358-368. Office of Contract Archeology, University of New Mexico.

Moore, James L., and Joseph C. Winter (editors)
1980 *Human Adaptations in a Marginal Environment: The UII Mitigation Project,* edited by J. L. Moore and J. C. Winter. Office of Contract Archeology, University of New Mexico.

Olson, Alan P., and William W. Wasley
1956 An Archaeological Traverse Survey in West-Central New Mexico. In *Pipeline Archaeology,* edited by Fred Wendorf, Nancy Fox, and Orian L. Lewis, pp. 256-391. The Laboratory of Anthropology and the Museum of Northern Arizona, Sant Fe and Flagstaff.

Parman, Donald
1976 *The Navajos and the New Deal.* Yale University Press, New Haven.

Post, Stephen S.
1987 *An Archaeological Survey Report and Research Design for Eight Sites Located Along Proposed State Road 509, near Whitehorse, McKinley County, New Mexico.* Laboratory of Anthropology Note No. 400. Museum of New Mexico, Santa Fe.

1992 *Excavation of a Lithic Artifact Scatter (LA 66471) and an Archaic Period Structure (LA 66472) along State Road 44, near Cuba, Sandoval County, New Mexico.* Office of Archaeological Studies, Archaeology Note no. 26. Museum of New Mexico, Santa Fe, New Mexico.

Rathje, William L., and Michael McCarthy
1977 Regularity and Variability in Contemporary Garbage. In *Research Strategies in Historical Archeology,* edited by Stanley South, pp. 273-286. Academic Press, New York.

Reher, Charles A. (editor)
1977 *Settlement and Subsistence along the Lower Chaco River: The CGP Survey.* University of New Mexico Press, Albuquerque.

Reichard, Gladys A.
1950 *Navajo Religion: A Study of Symbolism.* 2 vols. Pantheon Books, New York.

1974 *The Sweathouse . . .Tsa'aszi(1). Spring 1947-50.* Ramah New Mexico School Board, Inc. Bollingen Series 18. Pantheon Books, New York.

Riley, John L.
1958 *A History of the American Soft Drink Industry, 1807-1957.* American Bottlers of Carbonated Beverages, Washington.

Rock, James T.
1980 Glass Bottles: Basic Identification. Ms. on file, Klamath National Forest, Region 5, United States Forest Service.

1984 Cans in the Countryside. *Historical Archaeology* 18(2):97-111.

Rudecoff, Christine, A.
1988 *Archaic Occupations on the Southeastern Chaco Slope: Archaeological Survey and Test Excavations at LA 49171, LA 57173, and LA 57174, McKinley County, New Mexico.* Laboratory of Anthropology Notes No. 460. Santa Fe.

Scheick, Cherie
1981 *Investigations into Land Patterning in the South Hospah Mine Area, New Mexico.* School

of American Research Contract Archaeology Report No. 028. Prepared for Chaco Energy of Albuquerque by the School of American Research Contract Archaeology Program, Santa Fe.

Schiffer, Michael B.
1987 *Formation Processes of the Archaeological Record.* University of New Mexico Press, Albuquerque.

Simmons, Alan H.
1982 *Prehistoric Adaptive Strategies in the Chaco Canyon Region, Northwestern New Mexico,* vol. 3, *Interpretation and Integration.* Navajo Nation Papers in Anthropology Number 9. Navajo Nation Cultural Resource Management Program, Window Rock, Arizona.

Smiley, Francis E.
1985 *The Chronometrics of Elderly Agricultural Sites in Northeastern Arizona: Approaches to the Interpretation of Radiocarbon Dates.* Ph.D. dissertation, University of Michigan, Ann Arbor.

Thomas, David H.
1978 Arrow Heads and Atlatl Darts: How the Stones Got the Shaft. *American Antiquity* 43(3): 461-472.

Toulouse, J. H.
1971 *Bottle Makers and Their Marks.* Thomas Nelson, Inc., New York.

Vierra, Bradley, J.
1980 A Preliminary Ethnographic Model of Southwestern Archaic Settlement System. In *Human Adaptations in a Marginal Environment: The UII Mitigation Project,* edited by J. L. Moore and J. C. Winter, pp. 351-357. Office of Contract Archeology, University of New Mexico.

1985 *Hunter-Gatherer Settlement Systems: To Reoccupy or not to Reoccupy, That Is the Question?* M.A. thesis, Department of Anthropology, University of New Mexico, Albuquerque.

1987 Regional Archaic Mobility Patterns. Paper presented in the symposium on "The Archaic of the Northern Rio Grande" at the 60th Annual Meeting of the Pecos Conference, Pecos Pueblo, New Mexico.

1988 Archaic Hunter-Gatherer Archaeology in Northwestern New Mexico. Paper presented at the 1st Southwest Symposium, Tempe.

Vogler, Lawrence E., Dennis Gilpin, and Joseph K. Anderson
1982 *Gallegos Mesa Settlement and Subsistence: A Set of Explanatory Models of Cultural Resources on Blocks VIII, IX, X, and XI, Navajo Indian Irrigation Project.* 3 vols. Navajo Nation Papers in Anthropology No. 12. Navajo Nation Cultural Resources Management Program, Window Rock.

Vogler, Lawrence E., Dennis Gilpin, and Joseph K. Anderson
1983 *Cultural Resource Investigations on Gallegos Mesa; Excavations in Blocks VIII, IX, and Testing Operations in Blocks X, and XI, Navajo Indian Irrigation Project. 3 vols.* Navajo Nation Papers in Anthropology No. 24. Navajo Nation Cultural Resources Management Program, Window Rock.

Wait, Walter K.
1983 The Nonceramic Component. In *The Star Lake Archaeological Project: Anthropology of a Headwaters Area of Chaco Wash, New Mexico,* edited by Walter K. Wait and Ben A. Nelson. pp. 51-178. Southern Illinois University, Carbondale.

Ward, Albert E., Emily K. Abbink, and John R. Stein
1977 Ethnohistorical and Chronolgoical Basis of the Navajo Material Culture. In *Settlement and Subsistence along the Lower Chaco River: The CGP Survey,* edited by Charles Reher, pp. 191-216. University of New Mexico Press, Albuquerque.

Whitford, Walter, G.
1978 Habitat Types. In *Western Area Survey.* Public Service Company of New Mexico, Albuquerque.

York, Frederick
1983 Socio-economic Change at Star Lake: A Research Proposal for Development Anthropology. In *The Star Lake Archaeological Project: Anthropology of a Headwaters Area of Chaco Wash, New Mexico,* edited by Walter K. Wait and Ben A. Nelson. Southern Illinois University, Carbondale.

Young, Robert W.
1955 *The Navajo Yearbook of Planning in Action.* Navajo Agency, Window Rock, Arizona.

1957 *The Navajo Yearbook.* Navajo Agency, Window Rock, Arizona.

1961 *The Navajo Yearbook.* Navajo Agency, Window Rock, Arizona.

Zolbrod, Paul W.
1984 *Dinebahane': The Navajo Creation Story.* University of New Mexico Press, Albuquerque.

APPENDIX 1. PREHISTORIC FEATURE DESCRIPTIONS FROM LA 59958

Feature 1

Feature type: Probable simple hearth.

Grid location: 146-147N/78-79E.

Level: Feature evident on surface.

Dimensions: 87 cm north-south by 60 cm east-west (east-west is projected).

Samples collected: Pollen and flotation.

Feature Description: Feature 1 was an amorphous, oblong pit, slightly burned, lined by one upright oxidized sandstone slab and ringed by numerous horizontal sandstone slabs. The pit was dug out of native brown sand. The fill was light gray, mottled with small charcoal flecks. Mottling, caused by shifting sands and spreading of the feature, made the edges hard to define. The hearth was sectioned to define, and the remainder was excavated and sampled. It was used once. No datable material or artifacts were associated.

The flotation sample yielded no burned taxa and only a small number of *Chenopodium* seeds. The pollen sample yielded no economic pollen and in general reflected the modern sample collected from the site surface away from the features. No function could be inferred from these data. The lack of good pollen was mainly due to poor preservation.

Feature 2

Feature type: Amorphous burn.

Grid location: 55-56N/74E.

Level: Feature evident on stripped surface.

Dimensions: 1.24 m east-west by 1.4 m north-south

Samples collected: Pollen, flotation, and C-14.

Feature Description: Feature 2 appeared as an amorphous stain on the stripped surface that was investigated by digging a 20 cm wide, 30 cm deep trench to examine the profile. The profile revealed a semi-basin-shaped pit. The remainder of the pit was excavated, revealing the sandstone slabs. A burned piece of wood and some charcoal was uncovered on the SE edge of the pit. The wood appeared to be a branch or root, recently burned. A C-14 sample was taken in this area. The nine burned sandstone slabs ranged in size from 8 cm by 11 cm to 2 cm by 3 cm. There are no artifacts associated with the feature.

The flotation sample yielded no burned or economic taxa. Chenopodium and Euphorbia seeds were found in small numbers. They are locally available today and may represent a post-occupation intrusion. The pollen sample had more variability than other samples. Pollen grains from eight different plant species were identified. They were not economic species used by Archaic and early Basketmaker groups.

The carbon-14 sample yielded an A.D. 233 to 466 one-sigma date range. This is within the date range traditionally assigned to late Archaic or Basketmaker II (En Medio phase).

Feature 3

Feature type: Hearth.

Grid location: 150N/82E.

Level: Evident on surface.

Dimensions: 50 cm north-south by 47 cm east-west by 20 cm deep.

Samples collected: flotation, pollen, and C-14

Feature Description: Feature 3 was a semicircular hearth with straight sides and a curved bottom, dug out of native soil. The fill was loose to medium compacted sand, ranging in color from brown to dark gray-brown sand and mottled with small oxidized sandstone slabs. The edges of the pit were lightly burned, but not oxidized. A single flake was recovered from the bottom of the hearth.

The flotation sample had burned twigs of *Juniperus* and a small number of cheno-ams. Cheno-ams are considered economic species but they are also common in the modern environment in areas that have been disturbed. The pollen sample had no economic species and very low counts of other pollen.

The carbon-14 sample yielded a one-sigma date range of 375 B.C. to A.D. 100. This date range suggests an occupation during the late Archaic period (En Medio phase).

Feature 4

Feature type: Hearth.

Grid location: 149N/82E.

Level: Evident on the surface.

Dimensions: 55 cm north-south by 54 cm east-west by 20 cm deep.

Samples collected: Flotation, pollen, and C-14.

Feature Description: Feature 4 was a circular, deep, basin-shaped hearth filled with dense

compacted black soil and abundant charcoal. The edges of the pit were hardened from burning. No artifacts were associated with the feature. Judging from the intensity of the burn and the size of the wood, it was used to generate heat.

The flotation sample yielded burned *Juniperus* twigs and *Chenopodium*. The burned *Chenopodium* may be economic, although it could also be incidental. The numbers are low and no other species is present in high numbers from which to suggest economic use. The pollen sample had very low numbers of pollen grains and no interpretations could be made.

The carbon-14 sample yielded a one-sigma date range of 96 B.C. to A.D. 77. This is one of the smallest date ranges for the carbon-14 samples. The date range falls well within the late Archaic period (En Medio phase).

Feature 5

Feature type: Probable simple hearth.

Grid location: 41-42N/84E.

Level: Evident on the stripped surface.

Dimensions: 55 cm in diameter by 15 cm deep.

Samples collected: Flotation, pollen, and C-14.

Feature Description: Feature 5 was a roughly circular, basin- shaped pit containing dark stained brownish gray sand and charcoal. The feature was cross-sectioned, and samples were taken from the remainder of the fill. A small sandstone slab and a piece of angular debris were found in the pit. Features 6, 7, 14, and 15 are near to Feature 5 and could be associated.

The flotation sample yielded burned *Chenopodium* seeds and *Juniperus* twigs. Because the *Chenopodium* seeds they were probably not from economic use. The pollen sample yielded Cactaceae, which could be economic, but they are also present in the modern sample. Cactaceae is also a constituent of Feature 8 only.

The carbon-14 sample yielded a one-sigma date range of 375 B.C. to A.D. 109. This is one of the broadest date ranges. It could be a result of small sample size and the use of old wood. This date range spans a good part of the late Archaic period (En Medio phase).

Feature 6

Feature type: Probable simple hearth.

Grid location: 41-42N/83-84E.

Level: Evident on the stripped surface.

Dimensions: 54 cm east-west by 64 cm north-south by 12 cm deep.

Samples collected: Flotation, pollen, and C-14.

Feature Description: Feature 6 was a well defined, oval, basin-shaped pit containing dark stained brownish gray soil and flecks of charcoal. No artifacts were associated with it. The feature was nearby to similar Features 5, 7, 14, and 15.

The flotation sample yielded burned *Chenopodium* seeds and *Juniperus* twigs. As in Features 4 and 5 the *Chenopodium* seeds are present in small numbers and may be incidental. No other economic species was identified. The pollen sample only yielded *Pinus* and no other species.

The carbon-14 sample yielded a one-sigma date range of 396 to 186 B.C. This falls within the late Archaic period (En Medio phase). On a general scale Features 3, 5, and 6 have very similar date ranges.

Feature 7

Feature type: Probable simple hearth.

Grid location: 41-42N/83-84E.

Level: Evident on the surface.

Dimensions: 33 cm north-south by 40 cm east-west by 22 cm deep.

Samples collected: Flotation, pollen, and C-14.

Feature Description: Feature 7 was a shallow, basin-shaped pit containing gray stained sand and small flecks of charcoal. No artifacts were associated with it. Nearby Features 14 and 15 were similar in shape, size, and fill content.

The flotation sample yielded charcoal and burned *Chenopodium* seeds. The seeds are present in small numbers and may be incidental, rather than economic.

The carbon-14 sample yielded a one-sigma date range of 97 B.C. to A.D. 51. This date range fits well with the ranges for Features 4 and 8. It is in the latter part of the late Archaic period (En Medio phase).

Feature 8

Feature type: Probable simple hearth.

Grid location: 128N/100E.

Level: Evident on stripped surface.

Dimensions: 63 cm east-west by 54 cm north-south by 15 cm deep.

Samples collected: Flotation, pollen, and C-14.

Feature Description: On the stripped surface, Feature 8 appeared as an oval-shaped, dark stained area containing charcoal flecks and burned slabs of sandstone. The sandstone ranged in size from 3-10 cm. Feature matrix consists of dark brownish gray mottled sand and charcoal. Possible bone fragments were observed, but were not of a sufficient size for recovery. No other artifacts are associated.

The flotation sample yielded burned Juniperus twigs and unburned seeds of *Amaranthus* and *Portulaca*. This sample is different from the majority because it lacks *Chenopodium*. The seeds are probably not from economic use because they are unburned. The pollen sample is similar to Feature 5 because it has Cactaceae. Cactaceae is also present in the modern sample. No species were clearly used during the prehistoric occupation.

The carbon-14 sample yielded a one-sigma date range of A.D. 14 to 119. This date range is similar to Features 4 and 7. Features 4 and 7 are close to each other, and Feature 8 is more isolated. A late Archaic period (En Medio phase) occupation is indicated by the date range.

Feature 9

Feature type: Probable simple hearth.

Grid location: 125N/99-100E.

Level: Evident on the stripped surface.

Dimensions: 75 cm east-west by 58 cm north-south by 14 cm deep.

Samples collected: Flotation and C-14.

Feature Description: Feature 9 appeared 3-4 cm below surface and was characterized by a circular, dark stain containing burned slabs of sandstone ranging in size from 6 to 14 cm. Feature matrix consisted of dark brown and gray mottled sand and charcoal. Two burned sandstone slabs were found on top of the matrix and may have been lining for the pit. The slabs measured 14 by 24 cm and 10 by 10 cm. No artifacts are associated with this feature.

The flotation sample yielded unburned *Juniperus* twigs and cheno-am seeds. The cheno-ams are good evidence of economic use because they are unburned. The pollen sample yielded no evidence of economic use of plant species.

Feature 10

Feature type: Probable simple hearth.

Grid location: 140N/83E.

Level: Evident on stripped surface.

Dimensions: 55 cm north-south by 52 cm east-west by 20 cm deep.

Samples collected: Flotation and pollen.

Feature Description: Feature 10 was a circular, basin-shaped pit containing compacted, mottled gray-brown sand and flecks of charcoal. The pit was dug out of hard compacted tan-brown to brown clay sand. This varied from the native soil that lined other pits in the area, but was similar to Stratum 2. This pit was only lightly burned and may have been used once or twice.

The flotation and pollen had low potential to yield economic data, so they were not processed.

Feature 12

Feature type: Probable simple hearth.

Grid location: 142N/107-108E.

Level: Evident after removal of a pile of sandstone slabs.

Dimensions: 76 cm north-south by 55 cm east-west by 13 cm deep.

Samples collected: flotation and C-14.

Feature Description: Feature 12 was a shallow, pear-shaped pit with dark stained soil and small flecks of charcoal. One lithic artifact and two burned sandstone slabs were found in the pit. This feature was under a pile of sandstone slabs originally thought to be the collapsed remains of an *horno*.

Only the flotation sample was processed. It only yielded charcoal and no other plant species. The C-14 sample was too small for processing.

Feature 13

Feature type: Pit.

Grid location: 156N/76E.

Level: Evident on the stripped surface.

Dimensions: 2.15 m north-south by 2.25 m east-west by 15 cm deep.

Samples collected: Flotation and pollen.

Feature Description: Feature 13 appeared on the surface as an amorphous, mottled, dark grayish

brown stain. Appearing in association with the stain were a large sandstone slab and sandstone rubble. These were outside and immediately adjacent to the stained area. A 20-cm-wide trench was cut through the feature to determine depth. The profile of the feature showed a shallow basin-shaped configuration with no stratigraphy within the matrix. After excavating the remainder of the feature, it was oval in shape and contained a large sandstone slab at the bottom of the stained area along with a few smaller pieces of sandstone. None of the sandstone at this level exhibited much evidence of burning nor does the matrix of the feature exhibit much charcoal or charcoal staining. Four flakes were collected from the fill.

The flotation and pollen samples yielded no evidence of economic use of plant species. They were typical of the low yield samples from this project.

Feature 14

Feature type: Probable simple hearth.

Grid location: 41-41N/83-84E.

Level: Evident on stripped surface.

Dimensions: 50 cm north-south by 32 cm east-west by 18 cm deep.

Samples collected: Flotation and C-14.

Feature Description: Feature 14 appeared first as mottled sand and gray stained sand. Excavation revealed a small basin-shaped pit containing mottled sand, gray stained sand, and charcoal. There are no artifacts associated with this feature. It was near Features 5, 6, 7, and 15 (all within a 2-m-sq area), and could be associated.

The flotation and C-14 samples were considered to have low data potential after lab processing, so they were not included in the analytical samples.

Feature 15

Feature type: Probable simple hearth or associated pit.

Grid location: 41-42N/83-84E.

Level: Evident on stripped surface.

Dimensions: 20 cm in diameter by 12 cm deep.

Samples collected: Flotation and C-14.

Feature Description: Feature 15 was a small basin-shaped pit containing lightly stained sand and small flecks of charcoal. It was on the southeast edge of Feature 5 and in proximity to Features 6, 7, and 14. These may all be associated. There are no artifacts associated with Feature 5.

The flotation sample yielded a small number of burned *Chenopodium* seeds and charcoal. The burned seeds cannot be definitely attributed to prehistoric processing or consumption.

The C-14 sample was too small for processing and was not included in the analytical sample.

Feature 18

Feature type: Probable deflated simple hearth.

Grid location: 142N/105E.

Level: Evident on the stripped surface.

Dimensions: 68 cm north-south by 50 cm east-west by 12 cm deep.

Samples collected: none.

Feature Description: Feature 18 was a shallow, irregular-shaped pit containing dark, mottled, fine-grained sand and one small blackened sandstone slab. The deflated state of this feature left little to sample. No artifacts were associated with this feature.

Feature 21

Feature type: Diffuse edged pit.

Grid location: 146N/114E.

Level: Evident on stripped surface.

Dimensions: 2 m north-south by 1.5 m east-west.

Samples collected: Flotation.

Feature Description: This feature was discovered by surface stripping and first appeared as a circular stain with mottling radiating out from it. The pit turned out to be shallow and basin-shaped but did not have distinct edges. Mottling of sand and stained sand continued in an amorphous fashion, and was slightly deeper in places. Two small tabular pieces of sandstone were found in the fill. The feature was the deflated remains of a pit. There were no associated artifacts.

The flotation sample yielded two burned taxa, *Chenopodium* and *Portulaca*. These seeds may suggest economic use of these plants, rather than incidental occurrence.

Feature 22

Feature type: Mottled stain.

Grid location: 148N/116E.

Level: Evident on stripped surface.

Dimensions: 1.93 m north-south by 1.5 m east-west by 10 cm deep.

Samples collected: Flotation.

Feature Description: Feature 22 was a shallow, amorphous, mottled area containing sand, dark stained sand, and a few small blacked sandstone slabs. No definite shape was defined during excavation. This feature was the deflated remains of a pit and may be associated with nearby Feature 21. One small piece of obsidian was collected.

The flotation sample yielded small numbers of unburned *Chenopodium* and Compositae. No economic use of plant species or feature function can be inferred from these remains.

Feature 23

Feature type: Slab-lined hearth.

Grid location: 141N/108E.

Level: Exposed during blading of the site.

Dimensions: 50 cm north-south by 48 m east-west.

Samples collected: Flotation and pollen.

Feature Description: Feature 23 was a circular, slab-lined hearth exposed during the blading. It was exposed at between 5 and 10 cm below ground surface. Hearth matrix was a dark stained sandy soil underlain by four sandstone slabs laid flat in a rough basin-shaped configuration. No charcoal was noted. Flotation and pollen samples were obtained from beneath the slabs at which point the dark soil continued 2-4 cm. From the exposed surface, the feature appeared 5 cm deep. No artifacts are associated.

The flotation sample yielded no economic or unburned plant remains. The pollen sample contained one of two occurrences of *Salix* and the only occurrence of *Artemisia*. This sample is different from the other sample in that the species may not be available in the immediate area. No interpretation is offered by Holloway (this report) as to the significance of their occurrence.

Feature 24

Feature type: Charcoal-stained area.

Grid location: 172N/90N.

Level: Exposed during blading of the site.

Dimensions: 3 m north-south by 2 m east-west (projected) by 20 cm deep.

Samples collected: none.

Feature Description: Feature 24 was a dark charcoal-stained area containing sandstone slabs. The feature was exposed more than a meter below the surface during blading of the dune area to the north of the major portion of the site. It measured approximately 2.5 m southeast-northwest as observed along the edge of the grader cut. The unexposed portion of the feature was under a tree and was not accessible by the grader. A large sandstone slab metate was collected from among the sandstone slabs at the bottom of the feature.

Feature Descriptions from LA 59962
Hogan Foundations

Feature 10

Feature type: Hogan

Location: on the eastern edge of the right-of-way at 514N/124E.

Dimensions: The exterior dimension was 7 m in diameter. The interior dimension, based on the few probable foundation stones, was between 4.5 and 5 m in diameter.

Construction: A circular concentration of small- to medium-sized tabular sandstone slabs and blocks. Four sandstone blocks, probable foundation stones, have an average size of 30 by 35 by 6 cm. Upper wall stones range in size 14 by 10 by 3 cm to 20 by 19 by 12 cm. The remaining mound of rocks is 5-10 cm high, and encircles a shallow interior depression. The doorway is oriented to the east at 90 degrees.

Comments: The absence of larger stones indicates that they may have been salvaged and reused for the construction of Feature 12, a hogan located to the north of Feature 10. No other materials are associated with this feature to suggest its age or other details of its construction. It has been trampled by livestock, contributing to the distribution of the wall slabs.

Feature 12

Feature type: Hogan

Dimensions: Exterior dimensions are 6.25 m east-west by 7 m north-south. The interior of the hogan, as indicated by the large tabular foundation stones, is 5.3 m east-west by 5 m north-south.

Construction: A ring of large tabular sandstone blocks and slabs, double wide, and one to two courses high. The sandstone blocks and slabs range in size from 14 by 15 by 5 cm to 16 by 24 by 5 cm. The interior depression is 10-20 cm deep. Two hand-cut juniper boughs remain, suggesting that it may have had a cribbed log roof.

Comments: The walls have collapsed both inward and outward. It is possible that the rubble is six to eight courses, making this one of the better preserved hogan rings. It does appear that the upper portions have been salvaged and removed, including most of the roof. The door opening is situated southeast at 120 degrees. No artifacts are present around the hogan. Feature 7, an ash and can dump, and Feature 13, a collapsed *horno*, may be associated with the Feature 12 occupation.

Feature 15

Feature type: Hogan.

Location: West of the right-of-way towards the southern end of the site.

Dimensions: 6 m north-south by 8 m east-west.

Construction: Several large sandstone slabs and boulders are embedded in the ground forming a ring foundation for the hogan. These large stones, which comprise 25 percent of the total, are both brown and light yellow-brown and range in size from 25 by 30 cm to 35 by 50 cm. Numerous mid-size rocks (45 percent) lay scattered about in a haphazard manner, and range in size from 10 by 20 to 15 by 25 cm. The remaining 30 percent are smaller stones, from 5 by 5 cm to 5 by 10 cm, and may have been used for chinking. A break in the alignment of foundation stones is probably the east-facing doorway.

Comments: The hogan appears to be associated with Feature 16, a possible horno, and an abandoned 1940s vehicle parked nearby.

Feature 18

Feature type: Hogan.

Dimensions: The outside diameter is 5.1 m, the inside diameter is 4.5 m.

Construction: Foundation stones and a second course of rocks remain intact on the southeast side of the structure. A few large stones are present on the outside of the structure and many small slabs are scattered around the perimeter. The largest foundation stone is 29 by 63 cm, the largest coursed stone is 29 by 84 cm. The hogan sits on slightly raised ground and has an interior depression filled with dirt and weeds. The entrance faces directly to the east.

Comments: Two metal strips and a crushed enamelware bowl are associated with the hogan. The following artifacts were on the perimeter of the hogan: one salve/balm can (6 cm in diameter), one unidentified metal cap (7 cm diameter), a rubber strip (from an innertube), and a metal strip (stapled into a circle with one curled edge).

Feature 19

Feature type: Hogan.

Dimensions: 7 m north-south by 8 m east-west

Construction: Consists of a ring of tabular brown sandstone ranging in size from 3 by 5 cm to 40 by 50 cm, the majority (90 percent) averaging 15 by 20 cm. The ring of rocks rise above ground level 15-20 cm with the depression in the center being equal to the outside ground surface. Two large boulders, one on top of the other, appear to be what is left of the east- facing doorway. Three juniper boughs are scattered among the rocks.

Comments: One piece of sheet metal lies nearby. No other cultural material remains. It appears that the bulk of the rocks were removed and recycled, leaving only the smallest and largest rocks behind. The scattered hogan ring measures 7.2 m east-west by 8.5 m north-south. The ring itself is 2 m wide all around. The interior of the ring measures 3 m east-west by 4 m north-south. This feature is located centrally on the site near the excavated trash dumps.

Feature 20

Feature type: Hogan.

Dimensions: Exterior measures 6.3 m north-south by 6 m east-west, interior measures 2 m north-south by 2.3 m east-west.

Construction: Consists of a circular ring of brown sandstone slabs and juniper boughs. Within the ring of rubble are four large sandstone boulders. The largest measures 35 by 50 cm. The ring is moderately defined, most of the rocks having been removed from the east portion of the ring. The rubble is categorized as follows: 75 percent average 10-15 cm, 20 percent measure less than 10 cm, and 5 percent measure greater than 15 cm.

Comments: The depression in the center of the ring is very slight, suggesting an older structure. The remains of an *horno* (Feature 21) are present 4 m to the north of the hogan.

Feature 23

Feature type: Hogan.

Dimensions: The outer diameter measures 6.3 m north-south by 7 m east-west; the inner diameter measures 2.6 m north-south by 3.1 east-west.

Construction: Consists of a ring-shaped scatter of brown sandstone slab rubble. A portion of the southeast exterior wall remains, consisting of a series of stacked sandstone slabs aligned southwest-northeast. This wall portion measures 1.5 m long, .35 m wide, and .25 m high. More sand is built up behind the interior wall, making the inside wall measure .14 m. Slabs measuring more than 30 cm were plotted on the sketch map. Fifty percent of the slabs are roughly 20 cm, 35 percent are between 10-20 cm, and fifteen percent are less than 10 cm. Aside from the intact wall segment, a few large slabs and two small juniper boughs, no structural elements of the hogan remain.

Comments: The feature is located in an area relatively devoid of vegetation, on a slight northeast-southwest trending slope, and as a result has experienced some sheet erosion. There is no obvious

depression in the hogan center, however some mounding has occurred in association with the intact segment of the wall.

Possible *Hornos*

Feature 11

Feature type: Probable *horno*.

Location: Southwest of Feature 10.

Dimensions: 1.5 m east-west by 1.6 m north-south, 15-18 cm high.

Construction: A circular, mounded, light yellow-brown and brown sandstone block and slab rock pile. The stones range in size from 11 by 15 by 5 cm to 32 by 40 by 5 cm.

Comments: No foundation stones are apparent. The oven door is no longer discernible. Much of the original stone used for the *horno* has apparently been removed.

Feature 13

Feature type: Collapsed *horno*.

Dimensions: The exterior dimensions are 2 m east-west by 2.1 north-south.

Construction: Consists of one to three courses of tabular sandstone piled on top of each other. The slabs are both brown and light brown, and range in size from 13 by 16 by 5 cm to 28 by 35 to 8 cm. Four upright slabs, two to a side, appear to be the remnants of the oven door. The opening is oriented southeast at 105 degrees.

Comments: A lard bucket located near the opening could be associated with baking activities. This feature appears to be contemporaneous with Feature 12.

Feature 14

Feature type: Possible *horno*.

Location: 6 m southeast of a hogan (Feature 15) and 4 m away from an abandoned 1940s vehicle.

Dimensions: 2 m east-west and 1.5 m north-south.

Construction: A roughly circular arrangement of a few sandstone slabs.

Comments: The *horno* may have been dismantled and some of the stones recycled. There is broken glass, an evaporated milk can, and other assorted cans nearby.

Feature 16

Feature type: Possible *horno*.

Location: 2 m northeast of Feature 15, a hogan.

Dimensions: 2 m east-west by 2 m north-south.

Construction: A semicircular alignment of sandstone slabs ranging in size from 5 by 5 cm to 25 by 30 cm.

Feature 17

Feature type: Collapsed *horno*.

Location: Between and to the east of two hogans, Features 15 and 18.

Dimensions: 1.7 m north-south by 2.1 m east-west by .3 m high.

Construction: The rocks, although collapsed, remain intact as a mound.

Comments: Two pieces of bailing wire, a tin can, and a coffee can lid are present nearby. The *horno* is between and to the east of two hogans, Feature 15 and 18.

Feature 21

Feature type: Collapsed *horno*.

Dimensions: .9 m north-south by 1.5 m east-west.

Construction: Consists of an oval mound of scattered sandstone. A few large sandstones occur just outside the mound area, their sizes ranging from 50-60 cm in length and 20-30 cm in width. Sixty percent of the sandstone in the mound is greater than 20 cm in size. Forty percent are less than 20 cm in size.

Comments: The *horno* is probably associated with Feature 20, a hogan.

Feature 22

Feature type: Possible *horno*.

Dimensions: The extent of the scatter is 2.8 m north-south by 2 m east-west; the mounded area measures 0.6 m north-south by 1.5 m east-west.

Construction: Consists of an amorphous to oval scatter of sandstone slabs and blocks. A slight mound containing larger sandstone pieces occurs in the south portion of the feature. Forty percent

of the sandstone slabs are greater than 20 cm; sixty percent are less than 20 cm.

Comments: The feature is located on a north-trending slope.

Ash, Can, and Glass Dumps

Feature 1

Feature type: Glass and can dump.

Dimensions: 5.4 m in diameter.

Surface artifacts: Recorded in the field.

Feature 2

Feature type: Ash and artifact dump.

Dimensions: 5 m in diameter.

Surface artifacts: Cans, broken glass, metal, rubber, and other miscellaneous historic artifacts were recorded in the field.

Comments: A 1-by-1-m test unit was placed in an east-west orientation across the central portion of the dump and was excavated to 28 cm below surface where sterile soil was encountered. Numerous subsurface artifacts were collected, including glass, metal, bone, coal, ceramics, rubber, fabric, marbles, jacks, belt buckles, a zipper pull, steel wool, aluminum foil, and shoe soles. The trash had been burned and was mixed with burned wood and ash. The dump is near Feature 19, a hogan, and may be associated.

Feature 3

Feature type: Glass and can dump.

Measurements: 5.4 m in diameter.

Surface artifacts: Recorded in the field.

Comments: The dump is near to Feature 15, a hogan, and may be associated.

Feature 4

Feature type: Glass and can dump possibly associated with Feature 10, a hogan.

Dimensions: 2.5 m in diameter.

Surface artifacts: Recorded in the field.

Feature 5

Feature type: Can dump.

Dimensions: 1.4 m in diameter.

Surface artifacts: Recorded in the field.

Feature 6

Feature type: Ash, glass, and can dump.

Dimensions: 2.8 m in diameter.

Surface artifacts: Recorded in the field.

Feature 7

Feature type: Ash, glass, and can dump

Dimensions: 5.4 m in diameter.

Surface artifacts: Recorded in the field.

Comments: The dump is near Feature 10, a hogan, and may be associated.

Feature 8

Feature type: Glass and can dump.

Dimensions: 3.1 m in diameter.

Surface artifacts: Recorded in the field.

Comments: The dump is near Feature 20, a hogan, and may be associated.

Feature 9

Feature type: trash dump.

Dimensions: 4 m in diameter.

Surface artifacts: Recorded in the field.

Comments: Appeared on the surface as a burned area with large quantities of charcoal, bone, and piñon shells. A 1-by-3-m trench was dug through the burned area in 10-cm levels. Historic artifacts were collected from the surface strip and from Level 1. Level 2 was sterile. It may be associated with Feature 20, a hogan.

Possible Corral Outlines

Feature 24

Feature type: Probable animal pen or corral.

Dimensions: 11.5 in diameter

Construction: Consists of a circular area that lacks vegetation and is more compacted than the area around it. What is probably a pole fragment is located on the eastern edge of the feature.

Comments: The feature is located in a swale north of a gentle rise. There is no cultural material within the circle, however, there are can and bottle fragments around the perimeter. Two hogans, Features 15 and 19, are nearby, but it is unclear whether or not they are associated with the corral.

Feature 25

Feature type: Probable animal pen or corral.

Dimensions: 7.6 m in diameter.

Construction: Consists of a circular area where the soil is compact and devoid of vegetation.

Comments: It is located in a swale north of a gentle rise. The feature appears to be in association with Features 3, 14, 15, and 16. A fencing spool is present on the surface of the circle perimeter.

Feature 26

Feature type: Probable animal pen or corral.

Dimensions: 11.6 m by 8.5 m.

Construction: It consists of an oblong area containing little or no vegetation and soil more compacted than the surrounding area.

Comments: A few glass bottle fragments are present in the southern portion of the feature. Metal

pieces, tin cans, and enamelware fragments are found on the perimeter. The pen appears to be associated with Features 4, 10, 12, and 13.

Miscellaneous Rock Pile

Feature type: Oval-shaped sandstone rock scatter.

Dimensions: 3.4 m north-south by 2.2 m east-west. A slight mound occurs in the area containing the densest concentration of sandstone measuring 1.65 m north-south by 1.4 m east-west.

Construction: No structural components are apparent. A few of the rocks are up to 40 cm in length, however, most of the rocks range in length from 10-20 cm.

Comments: Four of the rocks exhibit some fire-staining, as they appear a yellowish pink in color. Artifacts appearing in association with the feature include a "D" size battery core, metal screw-top jar lid, a fruit or vegetable sanitary can lid, and a source shaped aluminum piece. The function of this feature is unknown.

Wood-Chopping Area

Feature 29

Feature type: A woodpile/chopping area.

Dimensions: 10 m in diameter.

Comments: The area is cleared of vegetation and the ground is covered with wood chips. The major type of wood is juniper, noticeable because of the gnarled grain. The feature may be associated with Feature 19, a hogan, to the south, and Feature 2, a dense ash dump, to the east, which are less than 20 m from Feature 29. Tin can and glass fragments are in and around the feature.

APPENDIX 2. FLOTATION FROM LATE ARCHAIC/BASKETMAKER II HEARTHS AND ROASTING PITS AT WHITEHORSE (LA 59958), SOUTHEAST OF CHACO CANYON, NEW MEXICO

Mollie S. Toll[1]

Introduction and Methods

The 16 flotation samples discussed here originate from features dating primarily to the period 400 B.C. to A.D. 100, with some dating to as late as A.D. 400. LA 59958 is located on a low sandstone ridge overlooking Sandoval Arroyo, at the west edge of Hospah, New Mexico (20-25 miles southeast of Chaco Canyon). Sampled features include hearths, roasting pits, and unburned pits.

The 16 soil samples collected during excavation were processed at the Office of Archaeological Studies by the simplified "bucket" version of flotation (see Bohrer and Adams 1977). Each sample was first measured as to volume (ranging from 1.0 to 2.7 liters), then 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 a fine screen (about 0.35 mm mesh) lined with a square of "chiffon" fabric, catching organic materials floating or in suspension. The fabric was lifted out and laid flat on a coarse mesh screen tray until the recovered material had dried. 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.

A two-stage analysis of the flotation samples allowed a review of the nature of botanical remains in all 16 samples by scanning, then an in-depth inspection (or full sort) of the 7 samples that were known to contain charred (probably cultural) plant parts. In scanning, all materials caught in the larger screens (4.0 and 2.0 mm mesh) were sorted completely, and samples of materials from the 1.0 and 0.5 mm screens were examined. Material passing through all screens (usually containing very few fragmentary remains of seed taxa occurring in the larger screens) was not examined at all. Examples of each taxon encountered were collected, but no effort was made to retain every seed present, and seeds were not counted. Scanning provides a reliable record of presence and absence of seed taxa in flotation samples. Where cultural plant materials are present in low frequency (as is often the case with Archaic or Basketmaker deposits relatively close to the modern ground surface), scanning is a cost-efficient method of providing an overview of botanical contents without spending a great deal of laboratory time counting and labeling modern, intrusive seeds (see Table 1).

As the full-sort samples tended to be large, it was necessary to subsample some screen sizes in each sample (usually the smallest one- or two-particle size categories). The actual number of seeds recovered is reported in Table 2, along with an estimated number of seeds per liter, which takes into account both subsampling and original sample volume.

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[1] Castetter Laboratory for Ethnobotanical Studies, Technical Series 288.

From each full-sort flotation sample with sufficient charcoal, a sample of 20 pieces of charcoal was identified (10 from the 4 mm screen, and 10 from the 2 mm screen). Each piece was snapped to expose a fresh transverse section, and identified at 45x. Low-power, incident light identification of wood specimens does not often allow species- or even genus-level precision, but this analysis can provide reliable information useful in distinguishing broad patterns of utilization of a major resource class.

Results

Of the 16 samples reviewed, three (FS 181, 199, 225) had no botanical remains at all, and six (FS 179, 180, 182, 183, 189, 198) had only unburned, probably intrusive plant parts (Table 1). Carbonized materials, which can reasonably be assigned to prehistoric cultural activity, included a single fragment of a charred juniper seed in FS 187, and charred goosefoot seeds in the remaining six samples. Whitehorse cultural floral debris was very limited taxonomically, consisting of little else than goosefoot seeds; these were numerous only in Features 4, 7, 15, and 21 (all stains or unburned pits). The complete absence of remains of agricultural plants is reasonable evidence that site occupants were not farmers; tiny *Zea* cob fragments tend to be common even in poorly preserved deposits of agricultural period sites.

Further examination of seven features (Table 2) reveals more details of the prominence of goosefoot in cultural plant remains at this site. Goosefoot seeds numbered 1,266.4 seeds-per-liter, or 99.7 percent of the estimated potential economic seed taxa. Six of seven features contained carbonized goosefoot, with two showing particularly high concentrations. Feature 4, with a carbon-14 date placing use in the Late Archaic-early Basketmaker period, was a roughly circular, well-burned hearth, about 25 cm deep. The charcoal was predominantly juniper (Table 3). Feature 21 was an amorphous mottled area, measuring about 1.5-by-2 m and lacking sufficient charcoal for either a carbon-14 date or an evaluation of fuel associated with the feature. Other carbonized plant remains that could reasonably be associated with the Late Archaic/Basketmaker occupation of the site include a charred fragmentary juniper seed in Feature 8, a pit with lightly stained soil and no evidence of burning, and a charred dropseed grass seed in Feature 21.

The charcoal assemblage reflects the local availability of piñon and juniper, within the Alkali Sacaton-Saltbush series (Donart et al. 1978), widespread in the Chaco area. All Whitehorse wood was coniferous. Piñon predominated in five features, but juniper was the principal wood in Feature 4.

Summary

At Whitehorse, Chenopodium (goosefoot) seeds clearly dominate the record of potential wild plant food products from the Late Archaic-early Basketmaker site occupation. This is a record repeated consistently north, east, and southeast of Chaco. On the Navajo Indian Irrigation Project, burned goosefoot seeds are common, with pigweed seeds far less abundant, and a few other annuals very rare (Struever and Knight 1979; Toll and Donaldson 1981; Donaldson and Toll 1981, 1982). In the Alemita Wash, goosefoot is the principal wild species, accompanied by some early corn (Donaldson 1982). At present, flotation samples from the Elena Gallegos land exchange (LA

Table 1. Flotation Scan Results, LA 59958

Taxa	Hearth F. 3 FS 179	Hearth F. 22 FS 180	Pit F. 1 FS 181	Hearth F. 9 FS 182	Hearth F. 10 FS 183	Hearth F. 6 FS 184	Hearth F. 5 FS 185	Hearth F. 4 FS 186	Pit F. 8 FS 187	Stain F. 21 FS 188	Hearth F. 2 FS 189	Pit F. 13 FS 198	Hearth F. 12 FS 199	Pit F. 7 FS 200	Pit F. 15 FS 201	Hearth F. 23 FS 225	% samples n = 16
Annuals																	
Amaranthus pigweed	+			+					+								19%
Chenopodium goosefoot	++	+	+	+	+	+*	+*	+++*		++*	++	++		++*	++*		81%
Compositae sunflower		+															6%
Euphorbia spurge											+						6%
Portulaca purslane				+					+	+*							19%
Perennials																	
Juniperus juniper	Tw			Tw	Tw	Tw	Tw	Tw	Tw+*	Tw							44%
Charcoal?[a]	yes			yes		yes	yes	yes	yes				yes	yes	yes		
Total Taxa	3	2	0	4	2	2	2	2	3	2	2	1	0	1	1	0	
Burned Taxa	0	0	0	0	1	1	1	1	2	0	0	0	1	1	0	1	1

\+ 1-10 seeds
++ 11-25 seeds
+++ > 25 seeds
* some or all items charred
Tw Twigs
[a] sufficient charcoal to identify 10 pieces from the 4mm screen and 10 from the 2 mm screen

Table 2. Full Sort Flotation Results, LA 59958

Taxa	Hearth F. 6 FS 184	Hearth F. 5 FS 185	Hearth F. 4 FS. 186	Pit F. 8 FS 187	Stain F. 21 FS 188	Pit F. 7 FS 200	Pit F. 15 FS 201
Potential Economics							
Chenopodium goosefoot	9/ 14.4*	8/ 13.3*	114/ 724.6*		351/ 450.7*	45/ 50.4*	13/ 13.0*
Sporobolus dropseed					1/ 0.7*		
Juniperus juniper				1/ 0.5*			
Unknown						3/ 2.4*	
Total Seeds Recovered	9	8	114	1	352	48	13
Per Liter	14.4	13.3	724.6	0.5	451.4	52.8	13.0
Total Taxa	1	1	1	1	2	[1]	1
Probable Contaminants							
Amaranthus pigweed				6/ 4.3	2/ 5.0		
Portulaca purslane			1/ 1.5	1/ 1.9			
Sporobolus dropseed			1/ 5.1				
Gramineae Grass family							
Juniperus juniper	SL+	TW+	TW+	TW+++ MC+++			
Pinus edulis piñon pine	N+						
Total Seeds Recovered	0	0	2	7	2	0	0
Per Liter	0	0	6.6	6.2	5.0	0	0
Total Taxa	2	1	3	4	1	0	0

* some or all specimens carbonized
a/b: number before slash indicates actual number of seeds recovered; number after slash indicates estimated number of seeds present in total sample, taking subsampling into account
SL: scale leaves
TW: twigs
MC: male cones
N: needles

Table 3. Species Composition of Charcoal from Flotation Samples, LA 59958

FS	Provenience	Juniper	*Pinus edulis*	Undeter. conifer	Total
184	Feature 6, Hearth	3 0.1g	13 0.3g	4 <0.05g	20 0.4g
185	Feature 5, Hearth	1 <0.05g	10 0.3g	9 0.2g	20 0.5g
186	Feature 4, Hearth	19 1.0g	1 <0.05g		20 1.0g
187	Feature 8 Pit		15 0.3g	5 <0.05g	20 0.3g
200	Feature 7, Pit		13 0.3g	7 0.1g	20 0.4g
201	Feature 15, Pit		16 0.5g	4 0.1g	20 0.6g
Total Pieces Percent Pieces		23 19	68 57	29 24	120 100
Total Weight Percent Weight		1.1g 34	1.7g 53	0.4g 13	3.2g 100

33908, Toll 1989) may provide the only clear, dated record of Archaic plant utilization (goosefoot plus shrubby and riparian perennials) in the Puerco drainage. Carbonized grass seeds (dropseed and ricegrass) are present but relatively rare at Whitehorse and on the NIIP blocks, but they form a significant portion of the assemblage at certain early sites in the Four Corners-Navajo Mines project (Toll 1983). The tendency of Archaic sites to be shallow and eroded, with consequent poor preservation of perishables, is the major culprit in the dim record of Archaic plant remains, either at sites dated to the Archaic period (Toll 1988, 1989, 1990) or at undated open sites (largely lithic scatters), that may belong to the local Archaic occupation (Toll 1981; Karen Adams, pers. comm.). The Archaic-early Basketmaker pattern of a narrow range of wild economic plants, dominated by goosefoot, stand in contrast to the wider taxonomic diversity witnessed repeatedly at Anasazi sites throughout the San Juan Basin.

The Whitehorse samples are an important contribution to our confidence in interpreting these early botanical records, so frequently subject to serous biases from poor preservation. We must certainly be wary that assemblages consisting of very few seeds of only a few taxa could be nothing more than a glimpse at the peak of a longer-tailed distribution curve, especially when better-preserved Puebloan assemblages in the same regions show exactly such shapes. The sheer numbers of identifiable, carbonized goosefoot seeds at Whitehorse (and goosefoot/dropseed at some of the early Navajo Mines project sites, ricegrass at others) suggest that we are looking at a taxonomically limited assemblage (such as might occur at a limited-activity or short-term occupation site) rather than an broad array assemblage.

References Cited

Bohrer, Vorsila L., and Karen R. Adams

1977 *Ethnobotanical Techniques and Approaches at the Salmon Ruin, New Mexico.* San Juan Valley Archeological Project, Technical Series 2. Eastern New Mexico University Contributions in Anthropology 8(1).

Donaldson, Marcia L.

1982 Flotation Analysis of Samples from Six Archeological Sites in the Gallo Wash Mine Lease. In *Prehistoric Adaptive Strategies in the Chaco Canyon Region, Northwestern New Mexico,* vol. 1, *Introduction, Environmental Studies, and Analytical Procedures,* assembled by Alan H. Simmons. Navajo Nation Papers in Anthropology 9, Navajo Nation Cultural Resource Management Program, Window Rock, Arizona.

Donaldson, Marcia L., and Mollie S. Toll

1981 *A Flotation Study with Implications for the Planning of Archeological Testing Programs: Navajo Indian Irrigation Project Blocks VII and IX.* On file, Cultural Resources Management Program, Navajo Nation, Window Rock, Arizona, and Castetter Laboratory for Ethnobotanical Studies, Technical Series 35.

1982 *Analysis of flotation Samples and Macrobotanical Remains: Navajo Indian Irrigation Project Blocks VII and IX Mitigation and X and XI Testing.* On file, Cultural Resources Management Program, Navajo Nation, Window Rock, Arizona, and Castetter Laboratory for Ethnobotanical Studies, Technical Series.

Donart, G. B., D. D. Sylvester, and W. C. Hickey

1978 *Potential Natural Vegetation, New Mexico.* New Mexico Inter-Agency Range Committee, Report 2. USDA, Soil Conservation Service.

Struever, Mollie, and Paul J. Knight

1979 *Analysis of Flotation Samples and Macrobotanical Remains: Block III Mitigation, Navajo Indian Irrigation Project.* On file, Cultural Resources Management Program, Navajo Nation, Window Rock, Arizona, and Castetter Laboratory for Ethnobotanical Studies, Technical Series 3.

Toll, Mollie S.

1981 *Flotation Remains from Two Hearths: The McBeth Land Exchange Survey Area, Puerco River Valley, New Mexico.* Castetter Laboratory for Ethnobotanical Studies, Technical Series 51.

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

1988 *Flotation from Three Sites in the Rio Puerco Valley, West Central New Mexico.* Castetter Laboratory for Ethnobotanical Studies, Technical Series 215.

1989 *Floral Remains from Archaic to Late Pueblo Sites of the Rio Puerco Valley, New Mexico: Elena Gallegos Land Exchange.* Castetter Laboratory for Ethnobotanical Studies, Technical

Series 250.

1990 *Flotation and Macrobotanical Remains from Hawk Battalion Sites: Middle Rio Puerco Valley, Bernalillo County, New Mexico.* Castetter Laboratory for Ethnobotanical Studies, Technical Series 276.

Toll, Mollie S., and Marcia L. Donaldson
1981 *Analysis of Flotation Samples and Macrobotanical Materials: Blocks VI and VII Mitigation, Navajo Indian Irrigation Project.* Castetter Laboratory for Ethnobotanical Studies, Technical Series 29.

APPENDIX 3. RESULTS OF THE POLLEN ANALYSIS

Dr. Richard S. Holloway[1]

Introduction

Twelve pollen samples were recovered during excavation of LA 59958 by personnel of the Museum of New Mexico. These pollen samples were sent for preliminary analysis to the Castetter Laboratory for Ethnobotanical Studies at the University of New Mexico. Initially, scans of the pollen residues were requested to evaluate the potential for pollen recovery from this site.

Methods and Materials

Initially, 25 ml of soil were subsampled and prior to chemical extraction, three tablets of concentrated *Lycopodium* spores were added to each subsample. This was done to permit the later calculation of pollen concentration values and secondly, to serve as a marker against accidental destruction of the pollen assemblage by laboratory methods. The samples were initially treated with 35 percent HCl to remove carbonates. The residues were then treated with cold 50 percent HF overnight, and then treated with a heavy density separation using zinc chloride (S.G. 1.99-2.00) to remove other inorganic particles. The lighter, organic portion was removed by pipet, concentrated, and subjected to a short acetolysis (Erdtman 1960) of 10 minutes to remove extraneous organic matter. The residue was dehydrated and stained with safranin and transferred to a mounting media of 1000 centistoke silicon oil using methanol.

A drop of the polleniferous residue was mounted on a microscope slide for examination. The slide was examined using 250X magnification. A minimum count of 200 grains/sample, as suggested by Barkley (1934), was not attempted for these samples as only limited microscopy was initially requested. This procedure involved counting a minimum of 50 marker grains and tabulating the pollen concentration values on this basis. Pollen concentration values were computed for each sample using the following formula:

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

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

[1] Castetter Laboratory for Ethnobotanical Studies Technical Series Report No. 280.

Table 1. Raw Pollen Counts, LA 59958

Provenience	FS#	CLES#	*Pinus*	*Juniperus*	*Populus*	*Quercus*	*Salix*	Liliaceae	Fabaceae	*Eriogonum*	Poaceae	Chenoam	Asteraceae hs
Modern surface	1000	90134	53	3		1		1			3	52	2
146N/78-79E F.1	193	90136	4								3	3	
146N/78-79E F.2	192	90140	4		3		1		1	1	2	5	
146N/78-79E F.2	104	90133	2								3	8	3
146N/78-79E F.3	196	90141	1	2		1						2	1
146N/78-79E F.5	197	90143	1									1	
146N/78-79E F.6	203	90142	1									2	
128N/100E F.8	195	90138	1									13	1
125N/99E F.9		90135	1									3	
140N/83E F.10	190	90137	2								1	6	1
160N/76E F.13	202	90139	1								3	11	3
160N/76E F.23		90132	2		1		1				3	13	4

Table 1. Raw Pollen Counts, LA 59958, Continued.

Provenience	FS#	CLES#	Asteraceae ls	*Artemisia*	Cactaceae	*Ephedra*	Indeter.	Marker	Pollen sum	Pollen concentration (grains/ml)
Modern surface	1000	90134	5	1	2	1	23	56	147	2439
146N/78-79E F.1	193	90136					9	54	19	327
146N/78-79E F.2	192	90140	1				4	82	22	249
146N/78-79E F.2	104	90133					5	63	21	310
146N/78-79E F.3	196	90141					5	51	12	219
146N/78-79E F.5	197	90143			1		3	54	6	103
146N/78-79E F.6	203	90142					3	51	6	109
128N/100E F.8	195	90138			1		8	51	24	437
125N/99E F.9		90135					5	59	9	142
140N/83E F.10	190	90137	1				2	67	13	180
160N/76E F.13	202	90139	2				6	61	26	396
160N/76E F.23		90132		3			10	53	37	649

Table 2. Pollen Concentration Values, LA 59958

Provenience	FS#	CLES#	*Pinus*	*Juniperus*	*Populus*	*Quercus*	*Salix*	Liliaceae	Fabaceae	*Eriogonum*	Poaceae	Chenoam	Asteraceae hs
Modern surface	1000	90134	1372	78	0	26	0	26	0	0	78	1346	52
146N/78-79E F.1	193	90136	107	0	0	0	0	0	0	0	81	81	0
146N/78-79E F.2	192	90140	71	0	53	0	18	0	18	18	35	88	0
146N/78-79E F.2	104	90133	46	0	0	0	0	0	0	0	69	184	69
146N/78-79E F.3	196	90141	28	57	0	28	0	0	0	0	0	57	28
146N/78-79E F.5	197	90143	27	0	0	0	0	0	0	0	0	27	0
146N/78-79E F.6	203	90142	28	0	0	0	0	0	0	0	0	57	0
128N/100E F.8	195	90138	28	0	0	0	0	0	0	0	0	369	28
125N/99E F.9		90135	25	0	0	0	0	0	0	0	0	74	0
140N/83E F.10	190	90137	43	0	0	0	0	0	0	0	22	130	22
160N/76E F.13	202	90139	24	0	0	0	0	0	0	0	71	261	71
160N/76E F.23		90132	55	0	27	0	27	0	0	0	82	355	109

Table 2. Pollen Concentration Values, LA 59958, Continued.

Provenience	FS#	CLES#	Asteraceae ls	*Artemisia*	Cactaceae	*Ephedra*	Indeter.	Marker	Pollen sum	Pollen concentration (grains/ml)
Modern surface	1000	90134	129	26	52	26	595	56	147	2439
146N/78-79E F.1	193	90136	0	0	0	0	242	54	19	327
146N/78-79E F.2	192	90140	18	0	0	0	71	82	22	249
146N/78-79E F.2	104	90133	0	0	0	0	115	63	21	310
146N/78-79E F.3	196	90141	0	0	0	0	142	51	12	219
146N/78-79E F.5	197	90143	0	0	27	0	81	54	6	103
146N/78-79E F.6	203	90142	0	0	0	0	85	51	6	109
128N/100E F.8	195	90138	0	0	28	0	227	51	24	437
125N/99E F.9		90135	0	0	0	0	123	59	9	142
140N/83E F.10	190	90137	22	0	0	0	43	67	13	180
160N/76E F.13	202	90139	48	0	0	0	143	61	26	396
160N/76E F.23		90132	0	82	0	0	273	53	37	649

Statistically, the concentration values provide a more reliable estimate since a minimum number of marker grains were counted rather than relying upon the fossil grains.

Results and Discussion

Table 1 contains the results of the pollen analysis. Very little pollen was present in any of these samples. Primarily, the pollen present were those of taxa normally resistent to deterioration. The concentration values of all archaeological samples are well below 1000 grains per ml which is generally considered to be the cutoff for conducting the analysis. In fact, nine of the twelve samples contained pollen concentration values below 400 grains/ml. The only sample that produced both good pollen recovery and adequate pollen concentration values was the surface sample which was taken for control purposes.

The assemblages are all severely altered. Even if a 200-grain pollen count had been attempted, the data recovery would have been minimal. The highest number of fossil pollen grains recovered was only 37, and these were primarily those taxa resistant to deterioration. The number of indeterminate pollen grains are high within each sample, which indicates that none of these samples are good candidates for full microscopy. It is interesting that in these samples, no pollen from economic-type plants were recovered in contrast to a small portion of economic pollen recovered from Cuba North (Holloway 1990).

Conclusions

The pollen assemblages of the twelve samples are so severely deteriorated that no interpretation of the pollen results is possible. The prognosis for obtaining meaningful results from these sediments is not hopeful. My recommendation is that no further analyses from these samples be conducted.

References Cited

Barkley, F. A.
1934 The Statistical Theory of Pollen Analysis. *Ecology* 15:283-289.

Erdtman, G.
1960 The Acetolysis Method: A Revised Description. *Svensk. Bot. Tidsft. Bd* 4.

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REPORT OF RADIOCARBON DATING ANALYSES

FOR: David A. Phillips, Jr.
Museum of New Mexico

DATE RECEIVED: March 5, 1990
DATE REPORTED: March 29, 1990
SUBMITTER'S PURCHASE ORDER #

OUR LAB NUMBER	YOUR SAMPLE NUMBER	C-14 AGE YEARS B.P. ± 1σ	C13/C12	C13 adjusted age
Beta-36182	LA 59958 FS 165 (charcoal)	2120 +/- 90 BP	-22.6 0/00	2160 +/- 90 BP
Beta-36183	LA 59958 FS 166 (charcoal)	2120 +/- 80 BP	-22.1 0/00	2170 +/- 80 BP
Beta-36184	LA 59958 FS 167 (charcoal)	1660 +/- 70 BP	-21.4 0/00	1720 +/- 70 BP
Beta-36185	LA 59958 FS 168 (charcoal)	1880 +/- 50 BP	-21.8 0/00	1930 +/- 50 BP
Beta-36186	LA 59958 FS 169 (charcoal)	1940 +/- 70 BP	-21.6 0/00	1990 +/- 70 BP
Beta-36187	LA 59958 FS 204 (charcoal)	110 +/- 50 BP	-21.8 0/00	160 +/- 50 BP
Beta-36188	LA 59958 FS 206 (charcoal)	2190 +/- 90 BP	-22.2 0/00	2230 +/- 90 BP
Beta-36189	LA 59958 FS 211 (charcoal)	1930 +/- 50 BP	-20.2 0/00	2010 +/- 50 BP

Note: Beta-36183, 36185, 36188 and 36189 were given extended counting time.

These dates are reported as RCYBP (radiocarbon years before 1950 A.D.). By international convention, the half-life of radiocarbon is taken as 5568 years and 95% of the activity of the National Bureau of Standards Oxalic Acid (original batch) used as the modern standard. The quoted errors are from the counting of the modern standard, background, and sample being analyzed. They represent one standard deviation statistics (68% probability), based on the random nature of the radioactive disintegration process. Also by international convention, no corrections are made for DeVries effect, reservoir effect, or isotope fractionation in nature, unless specifically noted above. Stable carbon ratios are measured on request and are calculated relative to the PDB-1 international standard; the adjusted ages are normalized to -25 per mil carbon 13.

BETA ANALYTIC INC.
RADIOCARBON DATING LAB
CALIBRATED C-14 DATING RESULTS

Calibrations of radiocarbon age determinations are applied to convert results to calendar years. The short-term difference between the two is caused by fluctuations in the heliomagnetic modulation of the galactic cosmic radiation and, recently, the advent of large-scale burning of fossil fuels and nuclear devices testing. Geomagnetic variations are the probable cause of medium-term differences and long-term (greater than 8000 B.P.) are still unknown.

Radiocarbon-dating laboratories have analyzed hundreds of samples obtained from known-age tree rings of oak, sequoia, and Douglas fir. Curves generated from the results depicting the atmospheric carbon content at specific time periods have been incorporated in computer programs. The result of the calibration analysis applicable to your research follows.

(Caveat: these calibrations assume that the material dated was short lived, i.e., living for 20 years, like branches, some shells, small plants, a collection of individual tree rings, etc. For other materials, the "Old Wood Effect" would produce uncertainties; both the maximum and minimum ranges of age possibilities could be overstated by that error source. Also, but less likely, in extreme cases they might even turn out to be understated.)

Calibration file: ATM20.14C

Beta-36182

Radiocarbon Age B.P.	2160 ± 90	
Calibrated age(s)	cal	B.C. 196
	cal	B.P. 2145

cal A.D./B.C. (cal B.P.) age ranges obtained from intercepts (Method A):

one sigma**	cal	B.C. 375-100 (2324-2049)
two sigma**	cal	B.C. 400-cal A.D. 20 (2349-1930)

Summary of above:

minimum of cal age ranges (cal ages) maximum of cal age ranges:

one sigma	cal	B.C. 375 (196) 100
	cal	B.P. 2324 (2145) 2049
two sigma	cal	B.C. 400 (196) cal A.D. 20
	cal	B.P. 2349 (2145) 1930

Beta-36183

Radiocarbon Age B.P.	2170 ± 80	
Calibrated age(s)	cal	B.C. 331, 329, 200
	cal	B.P. 2280, 2278, 2149

cal A.D./B.C. (cal B.P.) age ranges obtained from intercepts (Method A):

one sigma**	cal	B.C. 375-109 (2324-2058)
two sigma**	cal	B.C. 400-10 (2349-1959)

Summary of above:

minimum of cal age ranges (cal ages) maximum of cal age ranges:

one sigma	cal	B.C. 375 (331, 329, 200) 109
two sigma	cal	B.C. 400 (331, 329, 200) 10
	cal	B.P. 2349 (2280, 2278, 2149) 1959

Beta-36184

Radiocarbon Age B.P. 1720 ± 70

Calibrated age(s)	cal	A.D. 265, 281, 333
	cal	B.P. 1685, 1669, 1617

cal A.D./B.C. (cal B.P.) age ranges obtained from intercepts (Method A):

one sigma**	cal	A.D. 233-406 (1717-1544)
two sigma**	cal	A.D. 130-440 (1820-1510)

Summary of above:

minimum of cal age ranges (cal ages) maximum of cal age ranges:

one sigma	cal	A.D. 233 (265, 281, 333) 406
	cal	B.P. 1717 (1685, 1669, 1617) 1544
two sigma	cal	A.D. 130 (265, 281, 333) 440
	cal	B.P. 1820 (1685, 1669, 1617) 1510

Beta-36185

Radiocarbon Age B.P. 1930 ± 50

Calibrated age(s)	cal	A.D. 72
	cal	B.P. 1878

cal A.D./B.C. (cal B.P.) age ranges obtained from intercepts (Method A):

one sigma**	cal	A.D. 14-119 (1936-1831)
two sigma**	cal	B.C. 40-cal A.D. 150 (198901800) 159-203 (1791-1747)

Summary of above:

minimum of cal age ranges (cal ages) maximum of cal age ranges:

one sigma	cal	A.D. 14 (72) 119
	cal	B.P. 1936 (1878) 1831
two sigma	cal	B.C. 40 (cal A.D. 72) cal A.D. 203
	cal	B.P. 1989 (1878) 1747

Beta-36186

Radiocarbon Age B.P. 1990 ± 70

Calibrated age(s)	cal	A.D. 8
	cal	B.P. 1942

cal A.D./B.C. (cal B.P.) age ranges obtained from intercepts (Method A):

one sigma**	cal	B.C. 96-cal A.D. 77 (2045-1873)
two sigma**	cal	B.C. 180-cal A.D. 130 (2129-1820)

Summary of above:

minimum of cal age ranges (cal ages) maximum of cal age ranges:

one sigma	cal	B.C. 96 (cal A.D. 8) cal A.D. 77
	cal	B.P. 2045 (1942) 1873
two sigma	cal	B.C. 180 (cal A.D. 8) cal A.D. 130
	cal	B.P. 2129 (1942) 1820

Beta-36187

Radiocarbon Age B.P. 160 ± 50

Calibrated age(s) cal A.D. 1679, 1743, 1802, 1938, 1955*
cal B.P. 271, 207, 148, 12, 0*

cal A.D./B.C. (cal B.P.) age ranges obtained from intercepts (Method A):

one sigma** cal A.D. 1663-1704 (287-246)
1717-1880 (233-70), 1916-1954 (34-0*)

APPENDIX 5. DEBITAGE ANALYSIS FORMAT CODES

Grid North (1-3) Grid East (4-6)
Feature (7-8) Stratum (9)
Auger Test = 90
Level (10)
Specimen No. (11-13)
Artifact No. (14-15)

Material Type (16-17)

8 pedernal chert
9 speckled
10 chert
11 Washington Pass
12 Chinle
13 Brushy Basin
14 fossiliferous--little fossils
15 clastic--circular, swirl w/ depth
16 oolitic--dense fossiliferous
17 mottled
18 banded
19 gray and tan banded?
20 silicified wood
21 yellow wood
23 palm wood
30 chalcedony
31 mossy chalcedony
40 quartzite
43 quartz sandstone
50 speckled
51 basalt
52 vesicular basalt
53 andesite
54 rhyolite
55 clear obsidian
56 Jemez obsidian
57 Polvadera
58 gray transparent w/ flow lines and sparse feldspar inclusions
59 Grants obsidian
60 clear obsidian w/ flow lines
61 black opaque w/ white
70 metamorphic
71 gneiss
72 schist
73 meta-siltstone
80 limestone
90 siltstone

Material Texture (18)
1 fine **2** medium **3** coarse **4** glassy

Color (19-20)

1 clear
2 white
3 black
4 gray
5 brown
6 lt. brown
7 dk. brown
8 cream
9 yellow
10 orange
11 red
12 pink
13 red-orange
14 red-brown
15 red-gray
16 gray-brown
17 green
18 purple
19 pink-brown
20 yellow-orange
21 purple-gray
22 yellow-brown

Debitage Type (21)

1 core flake	6 biface flake
2 manufacturing flake	7 undetermined flake
3 bipolar flake	8 rejuvenation flake
4 angular debris	9 hammerstone spall
5 uniface flake	

Portion (22)

0 undetermined	6 midsection
1 whole/feather	7 lateral
2 whole/hinge	8 angular debris
3 proximal	
4 distal/feather	
5 distal/hinge	

Cortex (23-24)
0-99% by tens

Platform (25-26)

0 absent	8 single faceted/abraded
1 cortical	9 multifaceted/abraded
2 collapsed	10 retouched/abraded
3 single faceted	11 multifaceted collapsed
4 multifaceted	12 abraded/collapsed
5 battered/crushed	
7 retouched	

Platform Lipped (27)
0 n/a 1 yes 2 no

Thermally altered (28)

0 n/a	5 flake/potlid
1 core	6 flake/potlid only
2 core/potlid	
3 core/potlid only	
4 flake	

Metric Information

Length mm (29-31)	Thickness mm (35-37)
Width mm (32-34)	Weight mg (38-40)

Edge Utilization

Retouch (Edge 1:41-42) (Edge 2:46-47) (Edge 3: 51-52) (Edge 4:56-57)

0 absent	10 2 and 6
1 noncultural	11 2 and 7
2 unidirectional retouch	12 5 and 8
3 bidirectional retouch	13 3 and 8
4 unidirectional rounding	14 3, 5, and 8
5 bidirectional rounding	15 3 and 4
6 abraded, edge prep.	16 3 and 7
7 unidirectional scarring	17 3 and 5
8 bidirectional scarring	
9 rotary	

Edge Outline (Edge 1: 43) (Edge 2: 48) (Edge 3: 53) (Edge 4: 58)

1 straight	4 straight/concave
2 concave	5 straight/convex
3 convex	6 concave/convex

Edge Angle (Edge 1: 44-45) (Edge 2: 449-50) (Edge 3: 54-55) (Edge 4: 59-60)

APPENDIX 6. OBSIDIAN SOURCE DATA

by Dr. Bart Olinger

Obsidian from LA 59958, 45 miles north of Grants, 25 miles southeast of Pueblo Bonito

Specimen #	Fe	Rb	Sr	Y	Zr	Nb	Cnts	Source
958-081-02	13.5	16.4	18.5	08.1	37.3	06.3	6925	S. A unknown
958-081-03	16.6	16/7	19/1	08/8	33.3	05.5	6010	S. A unknown
958-081-04	13.3	15.6	20.1	07.9	36.2	06.9	6968	S. A unknown
958-081-05	13.2	17.5	20.5	08.2	33.9	06.7	8353	S. A unknown
958-081-06	14.4	15.4	19.2	07.2	37.7	06.1	7778	S. A unknown
958-081-07	13.0	15.4	19.6	07.9	34.4	09.8	7580	S. A unknown
958-127-05	15.3	15.3	20.2	09.0	33.2	06.9	6013	S. A unknown
958-127-06	16.1	19.2	01.5	10.5	34.7	18.0	7323	#78 Valle Grande
958-218-01	16.4	16.3	01.0	11.7	32.2	22.5	6525	#78 Valle Grande
958-221-01	08.0	28.0	00.6	12.7	16.3	34.3	14445	#84 Grants Ridge
958-141-01	08.3	27.5	00.5	14.2	16.8	32.6	12898	#84 Grants Ridge
958-137-01	17.8	16.0	00.7	12.0	36.4	17.1	5825	#78 Valle Grande
958-223-01	10.4	24.8	01.7	11.2	28.6	23.3	5815	#85 Polvadera
958-121-01	14.7	20.9	02.8	12.9	23.6	25.2	4703	#85 Polvadera
958-048-02	11.6	22.8	02.5	10.9	28.6	23.5	5498	#85 Polvadera
958-220-01	15.0	17.7	00.8	10.9	37.2	18.4	8160	#78 Valle Grande
958-099-01	15.4	17.7	01.2	12.0	38.7	15.0	7298	#78 Valle Grande
958-125-01	16.0	16.7	00.6	12.2	36.0	18.5	8242	#78 Valle Grande
958-091-01	13.4	22.9	01.5	15.1	24.8	22.3	4075	#85 Polvadera
958-091-02	15.7	22.0	02.2	11.1	21.7	27.3	3008	#85 Polvadera
958-050-01	15.2	18.7	00.8	09.7	31.3	24.5	5510	#82 Obsidian Ridge
958-012-04	07.4	34.4	00.9	14.9	12.9	29.5	11085	#84 Grants Ridge
958-110-01	15.9	16.3	01.3	10.3	37.1	19.0	7968	#78 Valle Grande
958-175-01	12.4	15.0	20.3	06.9	36.7	08.8	6020	S. A unknown
958-010-10	16.3	17.7	01.5	12.2	36.0	16.2	7098	#78 Valle Grande

Specimen #	Fe	Rb	Sr	Y	Zr	Nb	Cnts	Source
958-057-01	18.7	17.7	01.5	09.7	35.1	17.3	5898	#78 Valle Grande
958-126-05								Insufficient
958-126-14	17.2	16.4	01.3	09.0	37.2	18.9	7045	#78 Valle Grande
958-014-03	10.2	17.5	00.2	14.3	33.5	24.3	10730	#82 Obsidian Ridge
958-157-26	05.8	32.8	00.5	14.8	14.5	31.7	13788	#84 Grants Ridge

S. A unknown means that the obsidian came from a particular source A that has not yet been identified. The number IDs are those of Fred Nelson; they and the sources are described in *New Mexico Obsidian Sources and Exchange on the Southern Plains* by Timothy G. Baough and Fred W. Nelson, Jr. Journal of Field Archaeology 14:313-329. 1987.

APPENDIX 7. MISCELLANEOUS LITHIC ARTIFACT DESCRIPTIONS, LA 59958

Specimen Number: FS 14
Artifact Type: exhausted core
Material: fine-grained, light gray and cream banded silicified wood
Grid: 148N/80E
Level: surface strip
Measurements: 4.6 by 2.7 by 2.7 cm (39.8 g)
Cortex: 10%
Flake Removal: unidirectional

Specimen Number: FS 113
Artifact Type: core/hammerstone
Material: purple, medium-grained quartzite
Grid: 148N/104E
Level: surface
Measurements: 5.8 by 5.4 by 3.3 cm (97 g).
Cortex: 50%
Flake Removal: three flakes multidirectionally removed
Comments: The core is battered on one of its cortical edges, battered and step-fractured on another. It also exhibits bidirectional scarring and rounding on one of its sharp edges. It appears to have been used as a hammerstone after flakes were removed from it.

Specimen Number: FS 41
Artifact Type: exhausted core/hammerstone
Material: fine-grained, dark gray and cream streaked.
Grid: 140N/88E
Level: surface
Measurements: 7 by 5.4 by 4.2 cm (172.7 g).
Cortex: 25%
Flake Removal: unidirectional
Comments: Battered on its cortical edges and appears to have been used as a hammerstone.

Specimen Number: FS 17
Artifact Type: core/hammerstone
Material: fine-grained, dark gray and cream streaked.
Grid: 136N/76E
Level: surface
Measurements: 7.8 by 7.3 by 5 cm (282 g).
Cortex: 20%
Flake Removal: unidirectional
Comments: Battered on three of its edges and appears to have been used as a hammerstone.

Specimen Number: FS 81
Artifact Numbers: 2-7
Artifact Types: nodules, small cores
Material: glassy, transparent, gray obsidian with flow lines and sparse feldspar inclusions
Grid: 208N/76E
Level: surface

Artifact 2
Measurements: 3.3 by 2.9 by 1.6 cm (18.3 g).
Cortex: 90%
Flake Removal: none
Comments: The nodule has a prepared, single faceted platform with abraded edges.

Artifact 3
Measurements: 3.5 by 2.4 by 1.9 cm (26.8 g).
Cortex: 100%
Flake Removal: none

Artifact 4
Measurements: 3.5 by 3.1 by 9 cm (10.3 g).
Cortex: 20%
Flake Removal: two flakes unidirectionally removed

Artifact 5
Measurements: 3.2 by 2.7 by 8 cm (8.9 g).
Cortex: 30%
Flake Removal: two flakes bidirectionally removed

Artifact 6
Measurements: 3.4 by 2.2 by 6 cm (6.6 g).
Cortex: 10%
Flake Removal: two flakes bidirectionally removed

Artifact 7
Measurements: 5.1 by 2.6 by 1.3 cm (19.5 g).
Cortex: 60%
Flake Removal: three flakes multidirectionally removed

Specimen Number: FS 36
Artifact Type: manuport
Material: smooth fine-grained quartzite river cobble
Grid: 148N/96E
Level: surface
Measurements: 3.7 by 3 by 1.3 cm (21.9 g).
Cortex: 100%
Alteration: none

Specimen Number: FS 214
Artifact Type: manuport
Material: smooth fine-grained quartzite river cobble
Grid: 144/88
Level: surface
Measurements: 5.5 by 3.4 by 1.9 cm (50.2 g).
Alteration: none

APPENDIX 8. PROJECTILE POINT AND GROUND STONE DATA
BIFACE AND UNIFACE DATA

Provenience	Level	Specimen Number	Material Type	Material Texture	Color	Tool Type	Portion	Cortex	L x W x T (mm)	Weight (g)	Art. Shape	Manu. Stage	Edge 1 Damage	Edge 1 Outline	Edge 1 Angle (°)	Edge 2 Damage	Edge 2 Outline	Edge 2 Angle (°)
124N 104E	0	223-1	57	1	4	2	0	0	36 x 20 x 6	44	0	1	14	6	36	14	1	34
84N 100E	0	86-2	20	1	6	2	0	0	23 x 13 x 5	12	0	3	3	3	46	2	6	55
144N 92E	0	127-3	17	1	2	4	1	1	48 x 13 x 12	65	2	1	15	6	68			
144N 92E	0	127-9	10	1	2	2	2	0	9 x 11 x 3	2	4	1	14	6	54	14	6	46
148N 76E	0	18-3	18	1	12	2	2	0	11 x 13 x 5	4	3	1	14	6	44	14	1	39
140N 120E	0	99-1	55	4	4	4	1	0	23 x 16 x 3	11	6	1	14	6	41	14	6	36
104N 96E	0	121-1	58	1	4	4	4	0	14 x 12 x 4	9	6	1	13	6	43			
166N 104E	0	48-2	57	1	4	1	1	0	28 x 14 x 6	2	0	2	11	6	63	11	6	46
160N 76E	1	220-1	55	4	4	2	2	0	25 x 17 x 5	12	4	1	14	6	50	14	6	55
160N 76E	1	126-2	10	1	7	2	3	0	29 x 25 x 5	43	6	1	13	6	48			
140N 84E	0	218-1	59	1	3	2	0	0	12 x 10 x 4	3	6	3	3	3	57			

Material Type: 10 = chert; 17 = mottled chert; 18 = banded chert; 55 = clear obsidian; 57 = Polvadera obsidian; 58 = gray transparent with flow lines and sparse feldspar inclusions; 59 = Grants obsidian.
Texture: 1 = fine; 4 = glassy
Color: 2 = white; 3 = black; 4 = gray; 6 = light brown; 7 = dark brown; 12 = pink
Tool type: 1 = core flake; 2 = manufacturing flake; 4 = angular debris
Portion: 0 = indeterminate; 1 = whole/feathered; 2 = whole/hinge; 3 = proximal; 4 = distal/feather
Cortex: 0 =absent; 1 = present
Artifact shape: 0 = n/a; 2 =ovate; 3 = ovoid; 4 = triangular; 6 =other
Manufacture stage: 1 = early; 2 = middle; 3 = late
Edge damage: 2 = unidirectional retouch; 3 = bidirectional retouch; 11 = unidirectional retouch and scarring; 13 = bidirectional retouch and bidirectional scarring; 14 = bidirectional retouch, rounding and scarring; 15 = bidirectional retouch, unidirectional rounding
Edge outline: 1 = straight; 3 = convex; 6 =concave/convex

PROJECTILE POINT DATA

Provenience	Level	Specimen Number	Material Type	Material Color	Material Texture	L x W x T (mm)	Weight	Condition	Neck Width (mm)	Stem Length (mm)	Blade Shape	Blade Condition	Cross Section	Hafting Type	Stem Edge Shae	Stem Edge Condition	Base Shape	Base Condition	Edge 1 Damage	Edge 1 Outline	Edge 1 Angle (°)	Edge 2 Damage	Edge 2 Outline	Edge 2 Angle (°)
152N 80E	0	144-1	26	22	1	22 x 27 x 6	44	6	19	6	4	0	1	2	4	1	3	2	3	1	34	16	6	42
152N 88E	0	141-1	59	3	4	14 x 14 x 4	8	6	10	12	6	1	5	2	4	2	1	4	3	1	38	3	1	39
160N 76E	0	217-1	59	3	4	11 x 10 x 4	5	6	9	5	0	0	5	2	4	2	2	4	13	6	37	13	6	44
136N 88E	0	137-1	58	4	4	14 x 13 x 4	4	7	0	0	1	4	5	0	0	0	0	0	13	6	36	13	6	43
124N 104E	0	221-1	59	3	1	16 x 16 x 4	12	6	8	6	0	0	1	2	4	2	3	4	14	6	41	14	1	40
124N 104E	0	74-10	10	12	1	9 x 8 x 2	1	8	0	0	0	1	4	0	0	0	0	0	14	6	27	14	1	30
144N 104E	0	215-1	10	2	1	9 x 9 x 3	6	5	0	0	7	2	4	0	0	0	0	0	14	1	38	14	1	40
152N 76E	0	142-5	10	2	1	10 x 9 x 4	3	3	6	8	0	0	4	1	4	1	1	2						
140N 108E	0	98-1	19	4	1	24 x 8 x 5	13	7	0	0	1	3	5	0	0	0	0	0	17	6	47	17	6	49
140N 88E	0	222-1	10	12	1	13 x 23 x 4	13	2	0	0	0	0	4		0	0	1	2	3	1	37	3	1	42
136N 88E	0	136-1	20	22	1	28 x 16 x 5	22	1	9	0	3	3	2	2	0	0	3	2	14	6	36	14	6	40
140N 80E	1	133-1	10	2		36 x 14 x 5	30	1	7	7	2	1	1	2	4	1	2	2	13	3	47	13	1	54
144N 176E	1	125-1	60	4		26 x 13 x 4	18	6	12	6	2	1	4	2	4	2	1	2	14	1	43	14	1	40
164N 112E	0	104-1	17	12		41 x 22 x 5	45	1	12	10	1	3	5	2	4	2	3	2	17	5	58	17	32	52

Material type: 10 = chert; 17 = mottled chert; 19 = gray and tan banded chert; 20 = silicified wood; 58 = gray transparent with flow lines and sparse feldspar inclusions; 59 = Grants obsidian; 60 = clear obsidian with flow lines. Material color: 2 = white; 3 = black; 4 = gray; 12 = pink; 22 = yellow-brown. Material texture: 1 = fine; 4 = glassy. Condition: 1 = whole; 2 = base; 3 = midsection; 5 = edge; 6 = proximal and medial midsection and base; 7 = midsection and tip; 8 =base and edge. Blade shape: 1 = undetermined; 2 = straight; 3 = convex; 4 = concave; 6 = parallel; 7 = irregular. Blade condition: 1 = undetermined; 2 = serrated; 3 = ground; 4 = smooth flaked edge. Cross section: 1 = undetermined; 2 = plano-convex; 4 = bi-plano; 5 = bi-convex. Hafting type: 1 = undetermined; 2 =side-notched. Stem edge shape: 4 = bulbous. Stem edge condition: 1 = undetermined; 2 = unground. Base shape: 1 = undetermined; 2 = concave; 3 = convex. Base condition: 2 = no alteration; 4 = ground. Edge damage: 3 = bidirectional retouch; 13 = bidirectional retouch and scarring; 14 = birdirectional retouch, rounding, and scarring; 16 = bidirectional retouch and unidirectional scarring; 17 = bidirectional retouch and bidirectional rounding. Edge outline: 1 = straight; 3 = convex; 5 = straight/convex; 6 = concave/convex.

MANOS

FS#	Material Type	Size	Condition	Cross Section	Shape Modification	No. and Orientation of Ground Surfaces	Ground Surface Description	Ground Surface Shape	Striations	Comments
20	fine-grained indurated quartzite	5.8 x 4.6 x 3.2cm 94.2g	fragment	irregular	absent	2 perpendicular	fine-grained ground	flat	longitudinal	fire-cracked
156	friable quartzitic sandstone	8.0 x 8.0 x 3.3cm 205g	fragment	wedge-shaped	3 edges rounded by pecking/ grinding	1	ground	flat	absent	
134	coarse-grained indurated quartzite	6.4 x 4.2 x 4.5 cm 154g	fragment	irregular	edges rounded by grinding	1	fine-grained polished	convex	absent	used as a hammerstone
140	medium-grained split granite cobble	10.6 x 6.0 x 4.6cm 395.5g	whole	biconvex	3 edges battered and ground	2 parallel surfaces	polished	convex	perpendicular to long axis	
151	medium-grained rectangular slab friable sandstone	12.6 x 8.8 x 5.4cm 955.1g	whole	plano-convex	4 edges pecked and ground	1	coarse-grained slightly ground	convex	absent	pecked indentations on 2 sides
25	medium-grained indurated quartzite	9.2 x 7.6 x 4.6cm 474g	whole	wedge-shaped	3 edges rounded, 1 flattened	2	ground smooth	convex	absent	used as a hammerstone
95	medium-grained indurated quartzite	9.9 x 7.1x 3.4cm 368.4g	whole	wedge-shaped	edges rounded by pecking/ grinding	1	ground smooth	flat	perpendicular to long axis	
24	medium-grained indurated quartzite	9.2 x 7.2 x 3.8cm 408.1g	whole	biconvex	edges rounded by pecking/ grinding	2 parallel surfaces	ground	convex	perpendicular to long axis	used as a hammerstone
149	fine-grained friable sandstone	8.5 x 7.3 x 3.2cm 364.1g	whole	biconvex	absent	1	pecked on both sides	convex	perpendicular	found with metate, FS162

FS#	Material Type	Size	Condition	Cross Section	Shape Modification	No. and Orientation of Ground Surfaces	Ground Surface Description	Ground Surface Shape	Striations	Comments
148	medium-grained friable sandstone	11.0 x 8.0 x 4cm 540g	whole	biconvex	battered edges	2	pecked and ground	convex	perpendicular	used as a hammerstone
58	fine-grained indurated quartzite	10 x 7.0 x 3.7cm 540g	whole	biconvex	absent	0	pecked slightly on one side	n/a	absent	possible use as a hammerstone
205	medium-grained friable sandstone	10 x 7.9 x 3.8cm 493g	whole	wedge-shaped	edges rounded by pecking and grinding	1	smooth on one side, rough on the other	convex	perpendicular	possible use as a hammerstone

METATES

FS#	Material Type	Size	Condition	Shape	Location of Ground Surface	Shape of Ground Surface	Ground Surface Measurements	Ground Surface Texture	Striations	Comments
163	indurated sandstone	33 x 29 x 3.8cm 7.4kg	whole	amorphous slab	extends across long axis	flat	22 x 20 cm 440 sq cm	medium-smooth	absent	ground edges
164	indurated sandstone	42 x 20 x 4.2 cm 8.6kg	whole	rectangular slab	limited to central portion	concave	26 x 13 cm 338 sq cm	smooth	longitudinal	
161	indurated sandstone	42 x 24 x 5 cm 12.2 kg	whole	amorphous slab	central portion	flat	15 x 12 cm 180 sq cm	smooth	absent	
178	indurated sandstone	35 x 26 x 3.5 cm 8.2kg	whole	diamond-shaped slab	central portion	flat	12 x 10 cm 120 sq cm	coarse	absent	pecked, limited use, edges ground
162	indurated sandstone	46 x 32 x 5 cm 10.4 kg	whole	oval slab	central portion	concave	26 x 12 cm 312 sq cm	medium-smooth	longitudinal	pecked, edges ground; found with mano FS149
224	indurated sandstone	50 x 40 x 7 cm 15 kg	whole	amorphous	central portion	concave	25 x 12 cm 270 sq cm	medium-smooth	absent	pecked

APPENDIX 9. X-RAY FLUORESCENCE ANALYSIS

John L. Montgomery

Introduction

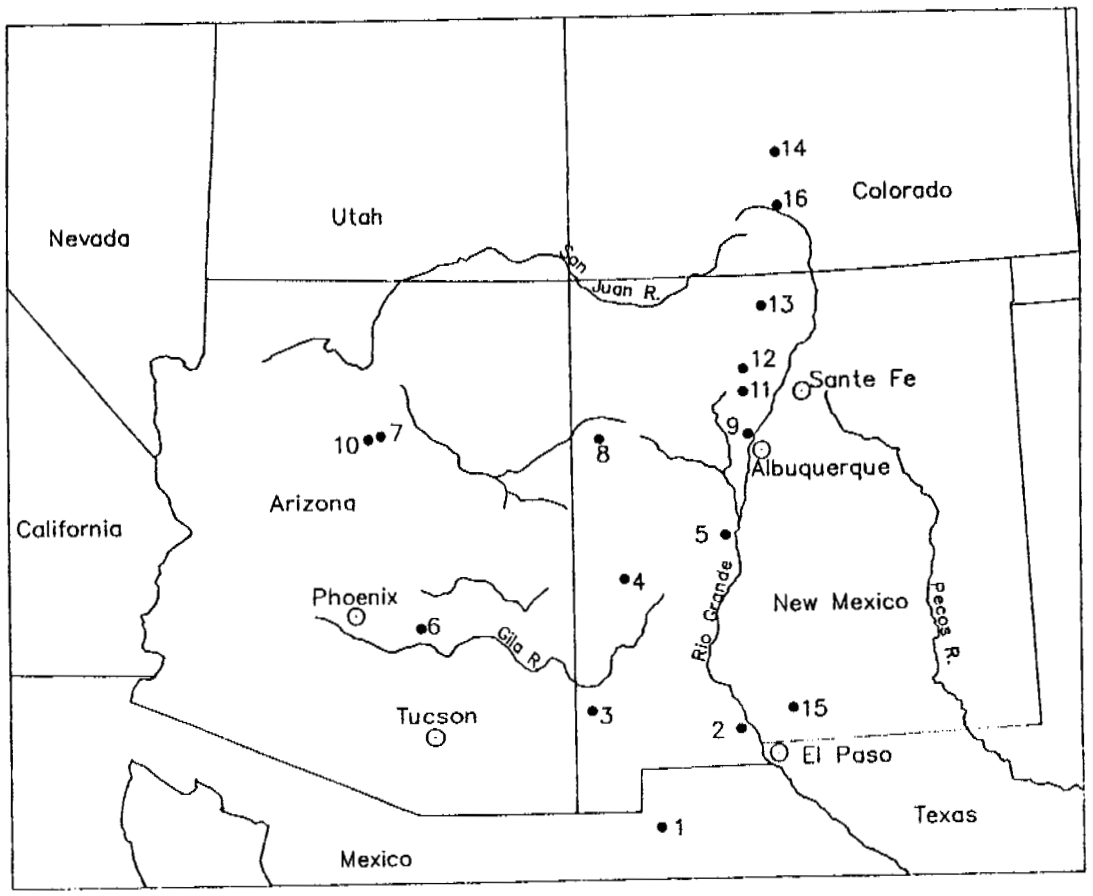
Geochemical characterization of known and unknown samples was carried out using rapid XRF at the trace elemental level. XRF analysis is a nondestructive, yet powerful and rapid method for determining chemical characterization of materials (Hoffer 1985; Lister 1975). An extensive literature indicates that XRF provides a rapid and economic way of isolating distinct obsidian sources (Jack 1976; Ericson et al. 1976; Stross et al. 1976; Reeves and Ward 1976; Dixon 1976). Rapid XRF can detect the presence of trace elements as infrequent as 10 parts per million. This degree of resolution distinguishes sources that are otherwise similar in major elemental or compound composition. Other investigations of geochemical characterization of obsidians have resulted in similar conclusions (Jack 1976; Ericson et al. 1976; Stross et al. 1976; Reeves and Ward 1976; Dixon 1976; Michels and Tsong 1980). In addition to a fine-grained examination of samples, representative and thorough sampling of source areas is necessary to increase the probability of accurate classification.

Source areas shown in Figure 1 were characterized by ENMU-OHL prior to this project. In all instances, those samples submitted for XRF characterization were selected because they are considered to be macroscopically representative of a particular geologic deposit or flow. Further, no source was characterized with fewer than five samples. Many sources were sampled more extensively because of their macroscopic variability and their spatial and/or temporal extent.

Several other investigators have attempted to define obsidian sources in the New Mexico region. Some of these are more successful than others, and some provide data that cannot be easily compared to the results of this report. Most of these research endeavors are programmed along the methodology outlined by Ward (1974). But all have flaws that limit their usefulness. For example, the sourcing research reported by Newman and Nielsen (1985) uses only one example from a source and examines the chemical composition of obsidian for 10 elements. They note that two of these elements (Sr and K) are poor contributors to source discrimination. Tripolar graphs, chi-square analysis, and cluster analysis are the analytical techniques used to assign artifacts to particular sources. While useful in several ways, this research is hindered primarily by the fact that the variability *within* a source is not described.

Methods

The one obsidian artifact submitted by the Laboratory of Anthropology for sourcing was sent to the New Mexico Bureau of Mines and Mineral Resources where x-ray fluorescence (XRF) analysis was done by Mr. Chris McKee. The sample was powdered prior to XRF analysis to homogenize it and its concomitant XRF values. In addition, powdering provides a relatively uniform target area for x-rays. Consequently this procedure minimizes any variation caused by goechemical changes in the hydrated zone and the underlying material, as well as differences in x-ray values caused by subtle variations in the geometry of the target areas.



1. Cave Creek, Northern Old Mexico
2. Rio Grande Terrace Gravels, Southcentral N.M.
3. Mule Creek, Southwest N.M. (3540)
4. Red Hill, Western N.M.
5. Sante Fe Formation Gravels Dalles–Puerco Siding(3511)
6. Superior, Southeastern Arizona (3602)
7. San Francisco Mts. Northcentral Arizona
8. Grants Ridge, Northwest N.M. (3510)
9. Rio Grande Terrace Gravels, Central N.M.
10. Government Mt.,Northeast Arizona
11. Jemez Mts., Northcentral N.M.(3520-26)
12. Polvadera Peak, Northern N.M.(3530)
13. San Antonio Mt.,Northern N.M.
14. Cochetopa, Central CO.
15. Tularosa Basin, Southcentral N.M.
16. Beaver Creek, Southcentral CO.

Figure 1.

Discriminant Function Analysis

Rather than attempting to compare the geochemistry of known and unknown samples using frequencies of a few "key" elements or a few of the major chemical compounds, comparisons were accomplished using a multivariate statistic, discriminant function analysis. It is capable of classifying unknown observations into known populations considering all known variables and their range of variation within and between groups, in this case, source areas of obsidian. Statistical analyses of XRF data were conducted with the statistical software SYSTAT.

An excellent discussion of the different ways to "fingerprint" obsidian to particular sources is found in Hughes (1986). He notes that ternary diagrams (which depict the relative frequency of three elements of a group of samples) often cannot clearly distinguish sources with overlapping plots. These diagrams also are complicated by "the fact that specimens from the same source will

not plot in the same location on the graph if different measurement units are employed" (Hughes 1986:53). Multivariate techniques, specifically discriminant analysis procedures, have long been used to more clearly determine sources for lithic materials (Ericson 1981; Ward 1974; Nelson and Holmes 1979; Luedtke 1979). While also noting in detail the statistical assumptions of discriminant analysis, Hughes (1986:56-57) summarizes the strengths of using this procedure:

> Discriminant analysis, then, accomplishes two objectives: first it *describes* or *identifies* groups of objects on the basis of distinctive combinations of discriminating variables; and second, it *predicts* group membership or *classifies* ungrouped cases into one or the another of the mathematical equations derived from known groups. Thus, the *descriptive* aspect of discriminant analysis simply derives allocation rules to characterize the differences between obsidian sources on the basis of major, minor, trace, or rare earth elements. Once this step has been accomplished, discriminant analysis can be employed to *classify* cases of unknown origin (these are usually obsidian artifacts) on the basis of allocation rules derived from the analysis of known obsidian sources.

Discriminant function analysis uses either the discriminant variable scores or the canonical discriminant functions to predict the source to which a particular sample most likely belongs. In multivariate space, this procedure compares the unknown sample's position to each source group's centroid to determine the source most similar to the unknown sample. In this case, classification of known sources by discriminant function analysis resulted in a 99 percent correct solution. Seventeen elements were used for the analysis. They are V, Zn, Mo, Nb, Th, Rb, Zr, TiO_2, Fe_2O_3-T, MgO, CaO, Al_2O_3, Na_2O, K_2O, MnO.

Sources and Assumptions

Results of the XRF and discriminant function analysis are interpreted as indicating that the obsidian sample is from an unknown source (i.e., a source not in ENMU-OHL's base of known sources). The statistical procedure classified the sample as coming from the Beaver Creek, Colorado, source. However, an examination of the Mahalanobis Distance (D_2) values indicates that this is a misclassification. Discriminant analysis will classify an artifact even if the correct source is not in the database of known sources (see Hughes 1986:78-85). Hughes (1986) discusses ways of using D_2 to identify correctly classified artifacts. The Beaver Creek source has a D_2 range of 3.519-4.396, a mean of 3.9598, and a standard deviation of 0.3491. Artifact 8-81-5 has a D_2 of 13.579, which is well outside of the acceptable range for Beaver Creek.

Obsidian Hydration Analysis

Methods

The samples were prepared using the methods outlined by Michels and Tsong (1980) and Michels and Bebrich (1971). The first step in the procedure was to apply isotropic epoxy to the surface of the obsidian sample. The obsidian was then heated in a kiln at 140 degrees F (60 degrees C) for two hours to insure maximum cure. It has been demonstrated that the epoxy protects the hydration

surface of the obsidian during sawing (Katsui and Kondo 1976).

Next, a wedge was cut from each sample by making two parallel cuts perpendicular to the edge of the artifact. An oil-cooled Raytech trimsaw with a 4-inch diamond edge blade was used. The wedge was then removed from the artifact. The wedge was cleaned with soap and ethyl alcohol to remove any remaining traces of oil.

The initial grinding phase was begun by mounting the wedge onto a glass microscope slide. Lakeside thermoplastic (quartz) cement was used as the mounting medium. The catalog number of the sample was etched onto the slide to protect provenience. The wedge was ground to approximately half of its original thickness using a slurry of water and fine-grained (400) corundum grit. All grinding was done by hand on a glass plate using a "figure-8" motion.

After the wedge was ground halfway, the slide was cleaned to remove traces of grit, a pencil line was drawn on the wedge to mark the hydrated surfaces of the piece, and the wedge was now ground (in the same manner as described above) to an approximate thickness of .003 inch. This maximizes the optical qualities of the obsidian under the microscope.

The final stage of sample preparation was the application of the cover slip. All cover slips were applied using heated Canada Balsam instead of the Lakeside thermoplastic (quartz) cement. The mounting medium was change at this point simply because it was found that fewer and smaller air bubbles are created using the Canada Balsam during cover slip application. The clarity of the slide was greatly improved using Canada Balsam.

The hydration rim was observed and measured using a Nikon Labophot POL petrographic microscope with a polarized light source (X-Nichols) and ¼ wave/red tint plate at 600 diameters. The tint plate creates a dark background upon which the hydration rim appears blue due to the difference in the biofringence. This helps to differentiate the interior of the hydration rim, thus making measurements more accurate.

All measurements were done with a filiar eyepiece interfaced with a TI-50 calculator for automatic data recording. The optics of the microscope were calibrated against a standard to compensate for any changes in barometric pressure and temperature. Measurements were taken by one observer. Exterior sides of the samples were scanned to find the widest and narrowest portions of the hydration rim. Five measurements were made at five different locations. These measurements were then averaged and the depth of the hydration rim (in microns) and the standard deviation were calculated.

Results

Obsidian hydration dates were determined using hydration rate constants derived by Michels (1984, 1985, 1987) for the Polvadera Peak, Obsidian Ridge, and Cerro del Medio Peak sources. The necessary temperature data was obtained from recorded data at the Chaco Canyon weather station. This was the closest to the project area. The rim measurements, standard deviations, and determined dates are summarized in Table 1. Artifact 8-99-1 was cut in two different places as requested. Measurements were obtained only from cut 2. Cut 1 was prepared twice and it was still not possible to get a measurable rim on it. In addition, Artifact 8-220-1 was prepared twice and in neither case could a rim be measured.

Table 1. Results of Obsidian Hydration Analysis on Artifacts from LA 59958

Artifact No.	Source	Rim Depth	Standard Deviation	Hydration date
8-223-1	Polvadera Peak	3.1	0.1	1746
8-48-2	Polvadera Peak	4.9	0.2	
8-110-1	Valle Grande	4.0	0.1	
8-125-1	Valle Grande	3.3	0.2	
8-99-1 (cut 2)	Valle Grande	3.3	0.2	
8-14-3	Obsidian Ridge	2.8	0.2	

Please be aware that there are a number of factors that could affect the accuracy of the hydration dates. These include the condition of the artifacts (surface vs. subsurface), accuracy of the hydration rate constant, accuracy of the source determinations, and accuracy of the temperature data. It would be best to use these results in conjunction with other chronometric data from the site, rather than by themselves.

References Cited

Dixon, J. E.
1976 Obsidian Characterization Studies in the Mediterranean and the Near East. In *Advances in Obsidian Glass Studies: Archaeological and Geochemical Perspectives,* edited by R. E. Taylor, pp. 288-333. Noyes Press, New Jersey.

Ericson, J. E.
1881 *Exchange and Production Systems in California Prehistory: The Results of Hydration Dating and Chemical Characterization of Obsidian Sources.* British Archaeological Reports, International Series 110. Oxford, England.

Ericson, J. E., T. A. Hagan, and C. W. Chesterman
1976 Prehistoric Obsidian in California II: Geologic and Geographic Aspects. In *Advances in Obsidian Glass Studies: Archaeological and Geochemical Perspectives,* edited by R. E. Taylor, pp. 218-239. Noyes Press, New Jersey.

Hoffer, J. M.
1985 Chemical Analysis of Archaeological Samples by Energy Dispersive X-Ray Fluorescence. Ms. in possess of author.

Hughes, R. E.
1986 *Diachronic Variability in Obsidian Procurement Patterns in Northeastern California and South-central Oregon.* University of California Publications in Anthropology 17.

Jack, R. N.
1976 Prehistoric Obsidian in California I: Geochemical Aspects. In *Advances in Obsidian Glass Studies: Archaeological and Geochemical Perspectives,* edited by R. E. Taylor, pp. 183-217. Noyes Press, New Jersey.

Katsui, Y., and Y. Kondo
1976 Variations in Obsidian Hydration Rates for Hokaido, Northern Japan. In *Advances in Obsidian Glass Studies: Archaeological and Geochemical Perspectives,* edited by R. E. Taylor, pp. 120-140. Noyes Press, New Jersey.

Lister, D. B.
1975 Application of Energy Dispersive X-Ray Fluorescence. *Instrument Society of America AID* 75437:143-151.

Luedtke, B. E.
1979 The Identification of Sources of Chert Artifacts. *American Antiquity* 44(4):744-757.

Michels, J. W.
1984 *Hydration Rate Constants for Rio Grande Gravels Group 3530, Sandoval County, New Mexico.* Mohlab Technical Report No. 39. Mohlab, State College, Pennsylvania.

1985 *Hydration Rate Constants for Obsidian Ridge/Rabbit Mountain (Jemez) Obsidian, Sandoval County, New Mexico.* Mohlab Technical Report No. 39. Mohlab, State College, Pennsylvania.

1987 *Hydration Rate Constants for Cerro Del Medio (Jemez Mtn.) Obsidian, Sandoval County, New Mexico.* Mohlab Technical Report No. 31. Mohlab, State College, Pennsylvania.

Michels, J. W., and C. A. Bebrich
1971 Obsidian Hydration Dating. In *Dating Techniques for the Archaeologist,* edited by N. H. Michael and E. K. Ralph, pp. 164-221. MIT Press, Cambridge, Massachusetts.

Michels, J. W., and I. S. T. Tsong
1980 Obsidian Hydration Dating: A Coming of Age. In *Advances in Archaeological Method and Theory,* vol.3, edited by M. B. Schiffer, pp. 405-444. Academic Press, New York.

Nelson, F. W., and R. D. Holmes
1979 *Trace Element Analysis of Obsidian Sources and Artifacts from Western Utah.* Antiquities Section Selected Papers 15. Utah State Historical Society, Salt Lake City.

Newman, J. R., and R. L. Neilsen
1985 Initial Notes on the X-ray Fluorescence Sourcing of Northern New Mexico Obsidians. *Journal of Field Archaeology* 12(3):377-383.

Reeves, R. D., and G. K. Ward
1976 Characterization Studies of New Zealand Obsidians: Toward a Regional Prehistory. In *Advances in Obsidian Glass Studies: Archaeological and Geochemical Perspectives,* edited by R. E. Taylor, pp. 259-287. Noyes Press, New Jersey.

Stross, F. H., T. R. Hester, R. F. Heizer, and R. N. Jack
1976 Chemical and Archaeological Studies of Mesoamerican Obsidian. In *Advances in Obsidian Glass Studies: Archaeological and Geochemical Perspectives,* edited by R. E. Taylor, pp. 240-258. Noyes Press, New Jersey.

Ward, G. K.

1974 Comparison of Source and Artifact Characterization Data Using a Generalized Distance Measure. *American Antiquity* 39(3):473-477.

Warren, A. H.
1977 Geology and Prehistoric Mineral Resources: White Rock Canyon, Sandoval County, New Mexico. In *Archaeological Investigations in Cochiti Reservoir, New Mexico,* vol. 1, *A Survey of Regional Variability,* edited by Jan V. Biela and Richard C. Chapman, pp. 15-30. Office of Contract Archeology, University of New Mexico, Albuquerque.

Warren, A. H. (compiler)
1979 *Lithic Identification and Quarry Source Workshop.* New Mexico State University, Cultural Resources Management Workshop, February 22-23, 1979, Las Cruces.

APPENDIX 10. HISTORIC ARTIFACT CODES

```
Category
     0. Unassignable
     Type 00 Unidentifiable
          Func 000 Unidentifiable
                    001 Bottle
                    002 Bottle fragment
                    003 Can
                    004 Can fragment
                    005 Canvas
                    006 Rubber or plastic fragment
                    007 Unknown glass
                    008 Aerosol can
                    009 Wire handle
                    010 Jar
                    011 Cast metal frame
                    012 Unident. sheet metal frame
                    013 Unident. sheet metal
                    014 Cap or plug
                    015 Metal trim
                    016 Metal frame
                    017 Rubber tip
                    018 Wooden wheel
                    019 Rivet
                    020 Cap
                    021 Jug
                    022 Spring


1. Subsistence/Production
Type 00 Unidentifiable

     01 Agricultural Implements
     Func 000 Unidentifiable

     02 Stock Supplies
     Func 000 Unidentifiable
          001 Horseshoe
          002 Buckle
          003

     03 Mining
     Func 000 Unidentifiable
          001 Slag
          002 "Acid tube"

     04 Hunting
     Func 000 Unidentifiable
          001 Cartridge, center-fire
          002 Cartridge, rim-fire
          003 Shotgun shell
          004 .22 cal. shell
```

005 Steel shot

2. Food
Type 00 Unident.
01 Baking goods
Func 000 Unidentifiable
001 Baking powder

02 Canned goods
Func 000 Unidentifiable
001 Meat can
002 Vegetable can - plain
003 Fruit can - plain
004 Sardine can
005 Lard can
006 Vegetable or fruit can - ribbed
007 Condensed milk
008 Morrell Lard can
009 Coffee can - plain
010 Juice can - plain
011 Juice can - ribbed
012 Coffee can - ribbed
013 Fruit can - ribbed
014 Vegetable can - ribbed
015 Unidentified - ribbed
016 Vegetable or fruit - ribbed
017 Wiener can

022,027 Dried eggs

03 Condiments
Func 000 Unidentifiable
001 Ketchup bottle
002 Coffee creamer
003 Syrup bottle

04 Bone
Func 000 Unident

05 Storage
Func 000 Unidentifiable
001 Olive jar

06 Glass containers
Func 000 Unidentifiable
001 juice

3. Indulgences
Type 00 Unidentifiable
001 Beer or soda can
01 Soda pop

Func 000 Unidentifiable
001 Bottle
002 Can

02 Alcohol-wine
Func 000 Unidentifiable
001 bottle
002 Garden Deluxe

03 Alcohol-beer
Func 000 Unidentifiable
001 Bottle

04 Alcohol-liquor
Func 000 Unidentifiable
001 Bottle - whiskey
002 Bottle stopper

05 Alcohol-other
Func 000 Unidentifiable
001 Bottle

06 Tobacco-smoking
Func 000 Unidentifiable
001 Tobacco tin

07 Tobacco-chewing
Func 000 Unidentifiable
001 Snuff can lid

4. Domestic
Type 00 Unidentifiable
01 Cutlery and siverware
Func 000 Unidentifiable
001 Carving knife
002 Spoon

02 Pots and pans
Func 000 Unident.
001 Enamel pot
002 Baking pan
003 Coffee pot

03 Dishes, serving and eating
Func 000 Unident.
001 Plate
002 Saucer
003 Bowl
004 Cup
005 Pitcher

04 Glassware
Func 000 Unident.

001 Bowl
002 Vase
003 Drinking glass
004 Mug

05 Cleaning
Func 000 Unident.
001 Scrub pad

5. Household Equipment
Type 00 Unident.
01 Appliances
Func 000 Unident.
001 Stove pipe
002 Stove burner
003 Stove leg
004 Stove door

02 Furniture and furnishings
Func 000 Unident.
001 Drawer handle
002 Dinette chair
003 Furniture leg

03 Lighting and lamps
Func 000 Unident.
001 Hurricane lamp wick adjuster
002 Lamp part
003 Flashlight
004 Flashlight bulb
005 Lantern mantle

04 Storage
Func 000 Unident.
001 Trunk handle
002 Barrel hoop

6. Construction/Maintenance
Type 00 Unident.
01 Tools
Func 000 Unident.
001 Axe
002 File
003 Bucket

02 Hardware
Func 000 Unident.
001 Nail-common
002 Bolt-square
003 Nail-box
004 Nail-finish
005 Nut-square

006 Screw
007 Wire
008 Spike
009 Roofing nail
010 Riveted strap
011 Nut-hexagonal
012 Handle
013 Metal band
014 Steel cable
015 Lock case
016 Washer
017 Bundle strap
018 Metal pan
019 Bucket handle
020 Door plate
021 Baling wire spool
022 Bracket
023 Cast iron pipe casing
024 Gear
025 Rod
026 Metal bar
028 Hasp
029 Hinge
030 Padlock
031 Padlock key

03 Building materials
Func 000 Unident.
001 Brick
002 Window glass
003 Tar shingle
004 Sheet metal
005 Lumber
006 Paint can
007 Wire fencing
008 Solvent can

04 Electrical
Func 000 Unident.
001 Insulator
002 Conductor-coated
003 Electrical box
004 Battery core

05 Storage
Func 000 Unident.
001 55 gallon drum

7. Personal Effects
Type 00 Unident.
01 Clothing
Func 000 Unident.
001 Towel

002 Button (one-hole)
003 Slip lace
004 Garter clip
005 Rivet
006 Stud

02 Boots and shoes
Func 000 Unident.
001 Spur strap and buckle
002 Shoe sole

03 Jewelry
Func 000 Unident.
001 Bead
002 Pocket watch part

04 Grooming items
Func 000 Unident.
001 Perfume
002 Facial cream (Noxema)

003 Beauty cream (Pond's)
004 Comb
005 Enameled wash basin

05 Medicine
Func 000 Unident.
001 Ointment or petroleum jelly
002 Analgesic
003 Band-aids
004 Ampule

06 Outdoor gear
Func 000 Unident.
001 Umbrella

8. Entertainment
Type 00 Unident.
01 Toys
Func 000 Unident.
001 Plastic wheel
002 Truck
003 Baby carriage
004 Propeller
005 Marble
006 Rubber ball
007 Porcelain bird

02 Books
Func 000 Unident.
001

03 Writing equipment and material

Func 000 Unident.
001 Ink bottle
002 Brass pencil

04 Music
Func 000 Unident.
001 Speaker
002 Harmonica

9.Transportation
Type 00 Unident.
01 Wagons
Func 000 Unident.
001 Hitch part

02 Automobiles/trucks
Func 000 Unident.
001 Oil can
002 Clutch and/or brake cable
003 Suspension spring
004 Radiator hose
005 Water hose
006 Motor coil (wire bundle)
007 Antifreeze can
008 Auto/truck tire
009 Inner tube
010 Tire repair patch
011 Fan belt
012 Gas can lid
013 Tire valve
014 Alternator case
015 Flywheel
016 Gauge dial part
017 Spark plug
018 Valve cap

MATERIAL - GLASS

Manufacturer
000 unident.
001 Obear-Nestor Glass Co.
002 Knox Glass Co.
003 Ripley and Co.
004 Adolphus Busch
005 Adolphus Busch
006 AHK
007 Pepsi
008 7-up
009 -makers mark
010 -makers mark
011 Owens Illinois

012 -makers mark
013 Sparkle
014 Nesbitt's
015 Karo Syrup
016 Vess Cola
017 Coca-Cola
018 R.C. Cola
019 -makers mark
020 Pond's
021 Vick's
022 -makers mark
023 -makers mark
024 LePage's
025 NEHI

Technique
00 Unident.
01 Automatic machine
02 2-piece mold
03 3-piece mold
04 1-piece mold
05 Flat, sheet machine (post 1915)
06 Turn mold
07 Hand, mold unknown
08 Post-bottom mold
09 Semi-automatic machine
10 Flat, cylinder machine (1885-1915)
11 Flat, hand cylinder (pre-1885)
12 Mold, non bottle

Labelling/lettering
00 Unident.
01 Embossed
02 Paper
03 "Applied Color"
04 Embossed and "applied color"
99 None

Shape
00 Unident.
01 Cylindrical
02 Rectangular
03 Artifact specific
04 Multi-agonal
05 Circular
06 Flat
07 Triangular
08 Oblong
09 Wide mouth

Seams
00 Unident./ Not applicable
01 Full height
02 Body and neck

Finish

00 Unident./Not applicable
01 Crown
02 Brandy
03 Packer
04 External continuous thread
05 Patent
06 Ring or oil
07 Extract

Closure

00 Unident./Not applicable
01 Crown cap
02 Cork
03 Stopper
04 Continuous thread
05 Canning lid

Color

00 Unident.
01 Clear
02 Amethyst
03 Amber
04 Brown
05 White
06 Blue
07 Aqua-green
08 Aqua-blue
09 Green
10 Purple (not amethyst)
11 Black
12 Red
13 Milk green

Decoration

00 Unident./Not applicable
01 Pressed
02 Embossed
03 "Applied color"
04 Embossed and "applied color"
05 Ribbed
99 None

MATERIAL - METAL

Material

00 Unident.
01 Iron
02 Cast iron
03 Steel
04 Aluminum
05 Brass
06 Aluminum alloy

07 Paper and steel
08 Copper
09 Enameled
10 Stainless
11 Galvanized
12 Steel and wood
13 Lead

Manufacturer
000 Unident.
001 Union Metallic Cartridge Co.
002 Peter's
003 Anacin
004 Winchester
005 Speas
006 Remington RMC
007 Circle K
008 Pepsi
009 Surfine
010 Tonka
011 Coca-Cola
012 Crush
013 Shasta
014 Mission
015 A&W
016 Hunt's
017 Citrus World Inc.
018 Texaco
019 Johnson & Johnson
020 Western
021 Owens Illinois
022 U.S. Tobacco Co.
023 K.C. Baking Powder
024 Conoco
025 Copenhagen Tobacco Co.
026 Wear-ever
027 General Can Co.
028 The Texas Co.
029 Eveready-Prestone
030 Skyway Motor Oil
033 Uruguay 1
034 Hills Bros. Coffee
035 Schilling Coffee
037 Graham-Penn
050 EKCO
051 Eveready
052 U.S. Government
053 Levi-Strauss
054 Autolite

Technique
00 Unident.
01 Cut-wire (nail)
02 Cut-sheet (nail)

03 Sheet
04 Cast
05 Forged
06 Drawn
07 Molded
08 Cut-wire (wire)
09 Impact extrusion
10 Machined
11 Cable
12 Coated cable
13 Assembled
14 Extruded (LA 59958)
14 Riveted (LA 59962)
15 Stamped
16 Pressed

Labelling/lettering
00 Unident./Not applicable
01 Embossed
02 Paper
03 Silk-screen
04 Applied
05 Stamped
99 None

Shape
00 Unident.
01 Artifact specific
02 Cylindrical
03 Circular
04 Wire-like
05 Rectangular
06 Spherical
07 Hexagonal
08 Tubular
09 Dish-shaped
10 Triangular
11 Diamond

Seams
00 Unident./Not applicable
01 None
02 Soldered
03 Lapped
04 Interlocking

Seal
00 Unident.
01 Interlocking (sanitary can)
02 Stamped can end
03 Stamped can end hole-in-top
04 Replaceable lid-plug
05 Threaded
06 Push-top

Opening
- 00 Unident./Not applicable
- 01 Crown cap
- 02 Geared rotating opener
- 03 Strip/key
- 04 Knife
- 05 Replaceable lid-plug
- 06 Pop-top
- 07 Puncture can opener (church key)
- 08 Hinged lid
- 09 Pull-top
- 10 Replaceable push-top
- 11 Lugged screw cap
- 12 Threaded screw cap
- 13 Push-in corner

Decoration
- 00 Unident.
- 01 Surfine Lemon-Lime Soda
- 02 Stamped design (LA 59958)
- 02 Geometric (LA 59962)
- 03 USMC Coat of arms
- 99 None

Identifying Code Present?
- 1 Yes, embossed
- 2 Yes, computer
- 3 No

Can Number
- 00 Unident./Not applicable
- 01 6oz
- 02 8oz
- 03 8oz tall
- 04 No. 1 Picnic
- 05 No. 1 Tall
- 06 No. 2
- 07 No. 2 1/2
- 08 No. 3 (4 7/8)
- 09 1/4 drawn (sardine)
- 10 No. 10
- 11 12oz soda/beer beverage can

MATERIAL - CERAMIC

Manufacturer
- 000 Unident.
- 001 J. Bourne and Son
- 002 A1 and M Co.
- 003 Made in Japan

Technique
- 00 Unident./Not applicable

01 Coil and scrape
02 Slab
03 Mold
04 Wheel

Labelling/lettering
00 Unident.
01 Embossed
02 Painted
99 None

Shape
00 Unident.
01 Artifact specific
02 Circular
03 Rectangular
04 Cylindrical
05 Spherical

Opening
00 Unident./Not applicable

Paste
0 Unidentifiable
1 Porcelain
Ware 01 Hard paste
02 Soft paste
03 Bisque

2 Fine earthenware
Ware 01 Pearlware
02 Whiteware
03 Ironstone
04 Semi-porcelain

3 Stoneware
Ware 01

4 Coarse earthenware
Ware 01

Glaze
00 Unident.
01 Fused porcelain
02 Clear
03 Salt
04 Lead
99 None

Decoration
00 Unident.
01 Transfer
02 Paint under glaze
03 Decalomania

04 Transfer and paint
05 Pressed
99 None

MATERIAL - MISCELLANEOUS

Material
01 Wood
02 Leather
03 Clay
04 Ivory
05 Brass wire
06 Bone
07 Tarpaper
08 Rubber
09 Plastic
10 Cloth
11 Rubber and leather
12 Carbide
13 Leather and metal
14,16 Metal and rubber
15 Shell
17 Glass and metal

Manufacturer
000 Unident.
001 Sure Fine Paris France
002 Motorcraft
003 Bowes

Technique
00 Unident.
01 Fired
02 Twisted wire
03 Carved wood
04 Woven material
05 Lumbered wood
06 Molded

Labelling/lettering
00 Unident.
01 Carved
02 Printed
99 None

Shape
00 Unident.
01 Artifact specific
02 Circular
03 Cylindrical
04 Rectangular
05 Wedge

Color
- 00 Unident.
- 01 Orange
- 02 Off-white "ivory"
- 03 "Brass"
- 04 Gray
- 05 Red
- 06 Black
- 07 White
- 08 Brown
- 09 Green
- 10 Multi-color
- 11 Blue
- 12 Purple
- 13 Yellow
- 14 Aqua
- 15 Pink

Decoration
- 00 Unident.
- 01 Floral design
- 99 None

INDETERMINATE ARTIFACTS

Material
- 1 Glass
- 2 Metal
  - 00 Unident.
  - 01 Iron
  - 02 Cast iron
  - 03 Steel
  - 04 Aluminum
- 3 Ceramic
- 4 Miscellaneous

Seams
Entries are according to the material categories above.

Color
Entries are according to the material categories above

ALL ARTIFACTS

Amount Recovered
- 0 Unident.
- 1 Whole

2 Fragment or sherd

Fragment or Sherd Type
00 Unident./Not applicable
01 Finish
02 Rim
03 Neck
04 Shoulder
05 Body
06 Base
07 Lid
08 Whole
09 Scrap
10 Key strip
11 Body and seam
12 Handle
13 Spoke
14 Heel

Reconstructable?
Y Yes, comments on back
N No.

Measurements
If measurements are in increments other than those specified, note on the form by the measurment in question.

Height - in1/16 inch if possible.
Diameter - in 1/16 inch if possible.
Volume - in ounces if known.
Length - in 1/16 inch if possible and reasonable.
Width - in 1/16 inch if possible and reasonable,
Thickness - in 1/16 inch if possible and reasonable.

Collected
1 Yes
2 No

Description
The entries ae self explanatory. Indeterminate artifacts are those which possess little information beyond that involved ir recording their presence. Consequently, they may be grouped t gether by provenience and material, and counted.

Aging?
0 Unidentifiable or None
1 Patination
2 Amethyst glass
3 Amber glass
4 "Sick glass"
5 Rust

Comments on back? The entries are self explanatory.

APPENDIX 11. THE IDENTIFICATION AND ANALYSIS OF THE WHITEHORSE PROJECT FAUNAL ASSEMBLAGES

Linda Mick-O'Hara

Introduction

Faunal remains were recovered from three sites (LA 59958, LA 59959, and LA 59962) during the excavation phase of the Whitehorse project. The three sites produced 519 fragments of bone, which are covered in this analysis. The majority of this bone was recovered from LA 59962 (504 pieces or 97.1 percent of the total sample). The remains recovered from the other sites will be dealt with briefly in the following analysis. The in-depth analysis will concentrate on the remains retrieved from LA 59962. This site produced faunal remains from good excavation context and can be used in addressing some of the research questions put forward in the research design for this project (Post 1987).

The following report will include an overview for each of the sites from which faunal remains were recovered. The analysis of the remains from LA 59962 will approach questions on economic change and the changing subsistence strategies at this historic Navajo farmstead. The significance of sheep and goat to Navajo farm economies and the subsequent change to canned goods and a cash economy will be explored.

Methods

All bone was identified using the comparative materials housed at the Office of Archaeological Studies, Santa Fe, and the osteological collection maintained at the Museum of Southwest Biology, University of New Mexico, Albuquerque. Gilbert's (1980, 1981) and Olsen's (1964, 1979) guides for the osteological identification of birds and mammals were used as preliminary aids in identification. Boessneck (1969) was used along with comparative materials in the differentiation of sheep and goat remains.

All specimens were identified to the most specific taxonomic levels possible. Other variables identified include element, portion, side, and relative age. Processing and taphonomic alterations were also considered and recorded if present. The variables documented include environmental alterations, animal alterations, burning, and butchering marks. These alterations will be discussed as appropriate in reviewing the assemblage analysis.

LA 59958

Only 14 fragments of bone were isolated from the excavations at LA 59958. All remains were recovered from the surface of this site, which is evident from the degree of weathering noted on the specimens. Moderate to heavy weathering was apparent on 12 of the recovered bone fragments (85.7 percent of the site sample). This would indicate that the remains had been exposed on the present ground surface for a considerable length of time prior to their retrieval during excavation.

Table 1. Summary of Faunal Remains from the Whitehorse Project

SPECIES	LA 59958 FREQ/PERCENT	LA 59959 FREQ/PERCENT	LA 59962 FREQ/PERCENT
Small Mammal	1/ 7.1%		3/ 0.6%
Medium Mammal			324/ 64.3%
Large Mammal			12/ 2.4%
Sylvilagus auduboni (Desert cottontail)			2/ 0.4%
Lepus californicus (Black-tailed jackrabbit)	1/ 7.1%		1/ 0.2%
Canis sp. (Dog/coyote)	4/ 28.6%		2/ 0.4%
Bovidae (Cattle/Bison)			5/ 1.0%
Bos taurus (Cattle)	1/ 7.1%		
Ovis/Capra (Sheep/Goat)	1/ 7.1%	1/100.0%	117/ 23.2%
Ovis aries (Domestic sheep)	6/ 42.9%		35/ 6.9%
Equus caballus (Horse)			3/ 0.6%
SUBTOTAL	14/ 99.9%	1/100.0%	504/100.0%
TOTAL		519 Fragments	

Only two specimens exhibited any evidence of burning, but five pieces (35.7 percent of the sample) had been gnawed by carnivores and may have been brought to the site location by scavenging dogs.

Table 1 provides a summary of the species identified at this site. The limited sample recovered precludes any significant conclusions but presents an interesting picture of surface debris occurring near a modern sheep pen.

The remains collected from the surface of this site included one rib fragment that was sawn at both ends and could be identified only as medium mammal. The remaining 13 specimens could be identified at least to the genus and many to the species level. One lightly burned specimen could be identified as the right humerus of a black-tailed jackrabbit. Four elements were assigned to *Canis* sp. (dog/coyote/wolf) but were probably the remains of a domestic dog that died near the area. Five limb bones and one innominate fragment were identified as the remains of domestic sheep. These specimens were heavily weathered and exhibited some evidence of carnivore gnawing. One thoracic vertebra fragment could be assigned only to the combined genera *Ovis/Capra* (sheep/goat) though it was probably another fragment from the sheep remains already identified. One sawn piece of a distal femur could be identified as domestic cattle and was the remains of an O-bone (round) roast introduced fairly recently to the site.

Butchering marks were noted on eight of the elements recovered. These were chop and splitting marks from the processing of the carcass. Most long bones had been split and subsequently gnawed by carnivores.

The remains as a whole represent fairly recent deposits in the site area. They may be directly associated with the nearby sheep pen as refuse scavenged by dogs in the area.

LA 59959

Only one proximal metatarsal was recovered from the surface of this site. This specimen could be assigned to the combined genera *Ovis/Capra* (sheep/goat). The bone fragment was heavily weathered from exposure on the present ground surface for an indefinite period of time. This specimen was probably the remains from fairly recent butchering activities in the area.

LA 59962

The majority of the faunal remains recovered during the excavation phase of the Whitehorse project came from LA 59962. The 504 bone fragments were recovered from two trash pits designated Features 2 and 9. The faunal remains recovered from these features provide evidence on economic change and subsistence practices at this historic Navajo farmstead. Table 1 summarizes the remains isolated by species in comparison with LA 59958 and LA 59959. Domestic animals predominate in these assemblages, but greater diversity can be seen in the assemblage from LA 59962 because of the larger sample size available for analysis (see Binford et al. 1982 or Mick 1983 on species diversity and sample size).

The following analysis will review the species identified from LA 59962. The remains will then be discussed according to their context of recovery and the implications this may have for interpreting a changing economic base at the site. An emphasis will be placed on the *Ovis/Capra* and *Ovis aries* remains which comprise 30.1 percent (152 bone fragments) of the site sample. The elemental analysis of these sheep/goat and domestic sheep remains will be used to approach butchering patterns and changing meat utilization throughout the occupation of the site.

Of the sample recovered from LA 59962, 339 bone fragments or 67.3 percent of the assemblage were highly fragmented and could only be identified to the general categories of small, medium, or large mammal. The majority of these fragments (324 bones or 64.3 percent of the sample) were placed in the medium mammal category (see Table 1). These were probably remains from the sheep/goat component that had been fragmented and burned to the degree that they could no longer be more specifically identified. Within this category of remains, 286 bone fragments or 71.7 percent of the sample identified to class were burned black to calcined. This level of burning would suggest that these bone fragments had been discarded into an active fire in a stove or hearth before being removed to the farmstead dumping area.

Leporidae (Rabbits). As mentioned above, the assemblage is dominated by the elements of domestic animals, especially sheep. A cottontail humerus and tibia were recovered from levels one and two of Feature 2 along with a burned jackrabbit femur. These were the only identifiable nondomesticates.

***Canis* sp. (Dog, Coyote, Wolf).** The other species identified include a burned maxilla and a burned femur isolated in Level 1 of Feature 2 and assigned to *Canis* sp. These were most likely the remains

of a farm dog. The burning, again, suggests that these elements were discarded into an active fire and that other elements from this individual might have been completely consumed during burning.

Bovidae (Cattle, Bison). Five bone fragments, the glenoid fossa from a right scapula and four rib fragments from Level 2 of Feature 2 could be assigned to the family Bovidae. All fragments exhibited evidence of butchering with both transverse and oblique splitting apparent on the bone. All specimens had also been burned black before their discard into the trash pit.

***Equus caballus* (Horse).** Two third phalange fragments from Level 1 of Feature 2 and one distal metapodial from Level 2 of the same feature were identified as *Equus caballus* (horse). All of these elements were from an young mature individual. All of the specimens were burned black from initial discard into an active fire.

***Ovis/Capra* (Sheep/Goat) and *Ovis aries* (Domestic sheep).** The majority of the identified bone from LA 59962 was assigned to the combined genera *Ovis/Capra* (sheep/goat). There were 117 bone fragments identified to this category, which amounts to 23.2 percent of the sample from this site. There were 35 more elements or 6.9 percent of the sample that could be clearly assigned to *Ovis aries* (domestic sheep) using criteria established by Boessneck (1969). Since the more fragmentary remains were probably the result of the butchering and discard of sheep, these two categories will be combined in looking at element use, butchering, and discard in this sample.

Burning to a black to calcined state associated with primary discard into a fire was noted on 457 bone fragments or 90.7 percent of the faunal sample from LA 59962. Of the burned bone noted, 403 specimens or 80.0 percent of the sample were recovered from Feature 2 while 54 fragments or 10.7 percent of the sample were recovered from Feature 9. This corresponds to the large difference in the number of specimens isolated from each of these features and suggests that both features were secondary disposal areas for trash initially thrown into a fire. Since sheep and sheep/goat remains constitute the majority of the specimens isolated, burning will be discussed again along with the more intensive analysis done on those specific remains.

Table 2 presents the bone assemblage for LA 59962 segmented by species, feature, and level. This table shows that 87.9 percent of the remains were recovered from Feature 2 and that 94.3 percent of the sample from Feature 2 were medium mammal, sheep/goat, or sheep. All of the species identified from the site assemblage were present in the first two levels of Feature 2 and the only species represented in Feature 9 (12.1 percent of the site sample) are remains from sheep butchering that were reduced to the degree that not all were identifiable at that level of specificity.

Table 3 divides the *Ovis/Capra* and *Ovis aries* remains from both Feature 2 and Feature 9 by element. Feature 9 presents a scattering of elements from the front legs of at least one individual (left and right radii), along with fragments from the pelvis and ribs. The front leg fragments represent low meat utility elements while the pelvis and rib fragments represent the use of a primary meat mass from a sheep carcass (see Table 3).

Table 2. Summary of Faunal Remains Recovered from Features 2 and 9 at LA 59962.

SPECIES	FEATURE 2			FEATURE 9	
	1	2	3	0	1
Small Mammal		2			1
Medium Mammal	196	77	2	43	6
Sylvilagus auduboni	1	1			
Lepus californicus		1			
Canis sp.	2				
Bovidae		4		1	
Ovis/Capra	69	34	6	9	
Ovis aries	15	19		1	
Equus caballus	2	1			
SUBTOTAL	296	139	8	54	7
TOTAL	443			61	

The elemental diversity and frequency for sheep/goat and domestic sheep remains is much greater in the Feature 2 deposits. The elemental distribution in Table 3 shows that nearly all skeletal elements are represented in this feature but not in their correct anatomical frequencies. The small number of lower limb bones represented, and the greater frequency of lumbar vertebrae and pelvis segments along with scapulae would indicate a bias against low meat utility limb bones (Binford 1978) in this assemblage and toward elements associated with high quality meat mass. This distribution would suggest the disposal of bone into a fire after consumption of the meat on high meat utility elements. This element pattern could result from a processing pattern that removed low meat utility limb elements prior to the introduction of meat to the household.

Figure 1 presents a graphic display of the elemental distribution between Feature 2 and Feature 9. It is apparent that lumbar vertebrae, ribs, scapulae, and innominate segments dominate the identifiable elements from Feature 2. The few cranial elements and long bones represented would suggest that their occurrence in these features may be a result of secondary processing of meat segments in the household prior to their cooking and consumption. Since many of these elements were also burned black to calcined, they were probably discarded in the same manner as bone resulting from a meal.

The difference in the amount of faunal remains and the elemental distribution (Table 3 and Fig. 1) isolated from Feature 2 versus those recovered from Feature 9 may have some interesting implications for the research questions on economic change at this farmstead. Feature 2 appears to have been earlier deposits than those in Feature 9, and Feature 2 contains remains from at least six different sheep/goat carcasses (MNI=6 assessed from pelvis/ acetabulum fragments) while there is only one individual represented in Feature 9 (MNI=1 assessed from radii fragments). Excavation of Feature 2 also resulted in the recovery of predominately high meat utility elements while the elements recovered from Feature 9 represent more of the entire carcass.

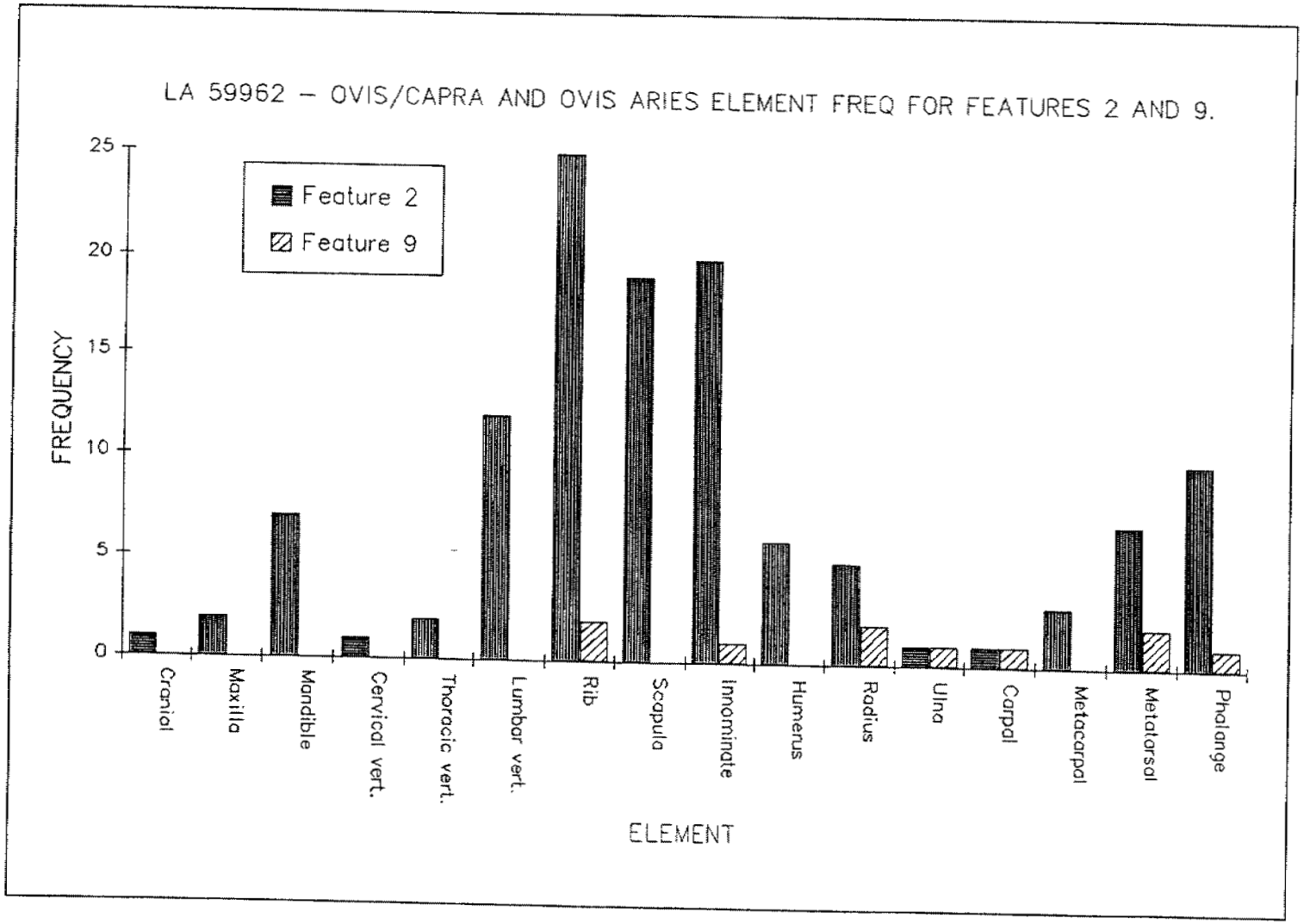


Figure 1. Elemental distribution between Feature 2 and Feature 9.

Table 3. Elements Identified among *Ovis/Capra* and *Ovis aries* Remains in Features 2 and 9 at LA 59962

ELEMENT	FEATURE 2			FEATURE 9	
LEVEL	1	2	3	Surface	1
cranial	1	4	1		
mandible	4	3			
vertebrae/cervical		1			
vertebrae/thoracic		1	1		
vertebrae/lumbar	10	2			
rib	20	4	1	2	
pelvis/acetabulum	11	2		1	
pelvis/other	2	4	1		
scapula	5	14			
humerus	3	3			
radius	3	2		2	
ulna	1			1	
carpal	1			1	
metacarpal		3			
metapodial	5		1	1	
phalange (gen)	9	1		1	
femur	2				
patella		1			
tibia	3	1			
calcaneum		1			
astragalus	3				
metatarsal	2	4	1	1	
sesamoid	1				
TOTAL	84	53	6	10	

Gilpin (1983:1405-1414) suggests that a change in economic focus from the average herding families through the stock reduction period (1933-1950) resulted in the butchering of less of the farmstead stock. This decrease was then supplemented by the use of goods and meat purchased away from the farmstead. Feature 9 contained the remains of a store cut beef 'O' (round) bone roast and fewer selected sheep remains than Feature 2. This farmstead may have followed the pattern of behavior outlined by Gilpin for economic changes among the Navajos.

Summary and Discussion

The three sites from the project area that produced faunal remains are dominated by sheep/goat and domestic sheep butchering refuse. Other common domesticates were also identified in these assemblages along with a few small, wild species. The assemblages are all historic in nature, and with the exception of LA 59962 were recovered from only surface areas.

LA 59958 produced a surficial scatter of faunal remains that reflect the use of the area by dogs scavenging from butchering refuse at the nearby sheep pens and taking some wild small game species from the surrounding area. This pattern of canid behavior associated with Navajo sheep camps and farmsteads has been described by Kelley (1982) in her ethnoarchaeological research among the Navajo. The one element assigned to *Bos taurus* represented the refuse from a roast that may have been purchased at a store and discarded in the same area as the sheep remains.

Only a single heavily weathered sheep/goat metatarsal was recovered from the surface of LA 59959. This could have easily been brought onto the site by scavenging carnivores, but the absence of distinct carnivore gnawing on the element does not add support to this interpretation.

The faunal remains recovered from LA 59962 were isolated from Feature 2 and Feature 9. Sheep/goat and domestic sheep dominate the assemblage. The large amount of bone associated with high meat utility segments of the carcass indicates that these were not features used for discard during the initial processing of a carcass, although some limb elements were part of the assemblages from these two features. The bone recovered from these features that exhibited some evidence of burning suggests that primary discard was into a hearth or stove and that the features excavated were the secondary discard context of these remains. Thus, the primary purpose of these features was for the disposal of household waste. The difference between the amount and kind of bone recovered from Feature 2 versus that from Feature 9 may be a result of the length of use or a reduction in the consumption of homestead butchered meat products between the periods represented by the two features (Gilpin 1983).

Conclusions

The three sites that produced faunal remains during the Whitehorse project excavation provided evidence of the use of sheep around sheep pens and on farmsteads both by the human and canid populations of the area. The secondary use and redistribution of sheep/goat remains by canids was predominant in the bone assemblage recovered from LA 59958. The assemblage from LA 59962 was from two features that were used as secondary dumping areas for household garbage. The difference in use periods for these two features by one of the families occupying the farmstead suggests a change in their general subsistence practices over the occupation period of the site.

The remains from LA 59962 can be used to support the argument of economic change through time at that historic farmstead. The remains also suggest a standard use and disposal pattern of household trash that may be the same at many contemporary farmsteads in the general area.

References Cited

Binford, Martha, W. Doleman, N. Draper, and K. Kelley
1982 Anasazi and Navajo Archeofauna. In *Anasazi and Navajo Land Use in the McKinley Mine Area Near Gallup, New Mexico,* vol. 1, pt 1, edited by C. Allen and B. A. Nelson. Office of Contract Archaeology, University of New Mexico, Albuquerque.

Boessneck, J.
1969 Osteological Differences between Sheep *(Ovis aries Linne)* and Goats *(Capra hircus Linne)*. In *Science in Archaeology,* edited by Don Brothwell and Eric Higgs, pp. 331-358. Praeger Publishers, New York.

Gilbert, B. Miles
1980 *Mammalian Osteology*. Modern Printing Company, Laramie.

Gilbert, B. Miles, L. D. Martin, and H. G. Savage
1981 *Avian Osteology*. Modern Printing Company, Laramie.

Gilpin, Dennis
1983 Patterns and Processes of Material Culture Change, Gallegos Mesa, 1907-1950. In *Cultural Resource Investigations in Blocks VIII and IX, and Testing Operations in Blocks X and XI, Navajo Indian Irrigation Project, San Juan County, New Mexico*, vol. 3, pp. 1405-1414.

Kelley, Klara B.
1982 *Anasazi and Navajo Land Use in the McKinley Mine Area near Gallup, New Mexico,* vol. 2, *Navajo Ethnohistory*. Office of Contract Archaeology, University of New Mexico, Albuquerque.

Mick, Linda S.
1983 Ecological Diversity within the Central Plains Tradition. M. A. Thesis, University of Nebraska, Lincoln.

Olsen, Stanley J.
1964 *Mammal Remains from Archaeological Sites.* Papers of the Peabody Museum of Archeology and Ethnology 56(1). Harvard University, Cambridge, Mass.

1979 *Osteology for the Archaeologist.* Papers of the Peabody Museum of Archaeology and Ethnology 56(4-5). Harvard University, Cambridge, Mass.

Post, Stephen S.
1987 *An Archaeological Survey Report and Research Design for Eight Sites Located Along Proposed State Road 509, near Whitehorse, McKinley County, New Mexico*. Museum of New Mexico, Laboratory of Anthropology Notes no. 400. Santa Fe.

APPENDIX 12. ETHNOHISTORICAL STUDY QUESTIONNAIRES

State Highway 509 Cultural Survey
Projects LA 59959 and 59961

I. Statement of Purpose and Goals of the Interview:

The New Mexico State Highway Department has proposed the construction of State Highway 509 between Hospah ans Whitehorse. We have been hired by the Museum of New Mexico to interview the residents of this area to determine with your help, the origin and history of a number of sites in the area that the road will impact.

II. Interview Questions:

1. Would you mind if we asked you some questions about the area?

2. May we use your name in the report if needed?

3. Name.
   Age.
   Clan.

4. How long have you and your family lived in this area?

5. Describe site(s).

6. What is the importance of the sweat lodge to the Navajo?

7. Do the Navajo people consider the sweat lodge sacred?

8. When was the sweat lodge used? How many years ago?

9. Who used the sweat lodge?

10. How often was it used?

11. What were the names of the people that used it?

12. Were they related?

13. What clan were they?

14. Is the sweat lodge associated with the masonary hogan to the east?

15. Who lived there? For how long?

16. Why did they leave?

17. Why was the sweat lodge abandoned?

18. How should the sweat lodge be disposed?

19. Would you visit the site with us?

20. What other activities occurred here?

21. Is there anything else that we cannot see that may be harmed by the construction of the road?

22. Is there anyone else that we need to contact about the history of this site?

State Highway 509 Cultural Survey
Projects LA 59958 and 59962

I. Statement of Purpose and Goals of the Interview:

The New Mexico State Highway Department has proposed the construction of State Highway 509 between Hospah ans Whitehorse. We have been hired by the Museum of New Mexico to interview the residents of this area to determine with your help, the origin and history of a number of sites in the area that the road will impact.

II. Interview Questions:

1. Would you mind if we asked you some questions about the area?

2. May we use your name in the report if needed?

3. Name.
   Age.
   Clan.

4. How long have you and your family lived in this area?

5. Describe site(s).

6. When was this area occupied?

7. Who lived here?

8. What were their clan affiliations?

9. What were their names?

10. What were their ages?

11. How were they related?

12. How many hogans were there?

13. How did the people who lived there make a living?

14. What was important to them at the time?

15. When was the site abandoned?

16. Why was the site abandoned?

17. Where are the people living today?

18. Who else should we talk to to learn more about the site?

19. Would you visit the site with us?

20. Would you describe the structures that are here?

21. What should be done with these remains?

22. Are there any other things that we cannot see that the construction of the highway might disturb?

State Highway 509 Cultural Survey
Projects LA 59963

I. Statement of Purpose and Goals of the Interview:

The New Mexico State Highway Department has proposed the construction of State Highway 509 between Hospah ans Whitehorse. We have been hired by the Museum of New Mexico to interview the residents of this area to determine with your help, the origin and history of a number of sites in the area that the road will impact.

II. Interview Questions:

1. Would you mind if we asked you some questions about the area?

2. May we use your name in the report if needed?

3. Name.
   Age.
   Clan.

4. How long have you and your family lived in this area?

5. Describe site(s).

6. What is the purpose of the rock cairn?

7. Would it be considered sacred by the Navajo?

8. Why?

9. What activities occurred here with regards to the cairn?

10. Are there stories about the cairns?

11. What is the purpose of the white feather?

12a. Does the cairn mark a burial?

12b. Is it still used?

13. Who used this area?

14. Where are they now?

15. What is their clan affiliation?

16. What should be done with the cairn?

17. Would you visit the site with us?

18. What other activities occurred here?

19. Is there anything else that we cannot see that may be harmed by the construction of the road?

20. Is there anyone else that we need to contact about the history of this site?

Additional questions in reference to the general history of the area:

When was the chapter established?

What was the purpose of the chapter?

When was the store built?

How were purchases made (money, trade, credit, etc.)?

What types of transportation were available?

How were wood and water collected?

When was the windmill built?