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Department of Energy Land Conveyance Data Recovery Plan and Research Design for the Excavation of Archaeological Sites Located within Selected Parcels to be Conveyed to the Incorporated County of Los Alamos, New Mexico

Cultural Resources Report No. 201

Prepared for the Department of Energy Office of Los Alamos Site Operations

ESH-20 Cultural Resources Management Team
Environment, Safety and Health Division
Los Alamos National Laboratory

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Department of Energy Land Conveyance Data Recovery Plan and Research Design for the Excavation of Archaeological Sites Located within Selected Parcels to be Conveyed to the Incorporated County of Los Alamos, New Mexico

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CHAPTER 1
INTRODUCTION

STEVEN R. HOAGLAND AND JOHN S. ISAACSON

The Department of Energy (DOE) manages Los Alamos National Laboratory (LANL), which is located in north-central New Mexico (NM) approximately 100 km north-northwest of Albuquerque and 40 km northwest of Santa Fe (Figure 1.1). The DOE is scheduled to convey properties at or in the vicinity of LANL to the County of Los Alamos (County), NM, or its designee and to transfer properties to the Secretary of the Interior in trust for the Pueblo of San Ildefonso. The land conveyance and transfer (LCT) undertaking is directed by Section 632 of PL 105-119, *the Departments of Commerce, Justice, and State, the Judiciary, and Related Agencies Appropriations Act, 1998*, that was passed by Congress on November 26, 1997.

In response to this Act, the DOE examined ten tracts of land (1942 ha; 4796 ac) proposed for the LCT undertaking. As a result of this examination, a July 2002 report entitled *Cultural Resource Assessment for the Department of Energy Conveyance and Transfer Project* (Hoagland et al. 2000) was produced and submitted by DOE to the NM State Historic Preservation Officer (SHPO) for comments. SHPO concurrence with the recommended National Register of Historic Places (NRHP) eligibility for the 213 documented archaeological sites was issued on October 6, 2000. One hundred and eighty of the sites are eligible or have an undetermined eligibility (i.e., potentially eligible).

Portions of three tracts will be transferred to San Ildefonso Pueblo; whereas, whole tracts or portions of the ten tracts will be conveyed to the County. NRHP eligible sites (i.e., historic properties) are located within five of the tracts that will be conveyed to the County. Three of these tracts are scheduled for commercial and/or residential development. These are the Airport Tract (83 ha; 205 ac), the White Rock Tract (40 ha; 100 ac), and the Rendija Canyon Tract (369 ha; 910 ac). A small portion along the northern boundary of the original White Rock Tract will be transferred to San Ildefonso Pueblo.

The Airport Tract is located east of the Los Alamos town site (Figure 1.2). It is situated along the north and south sides of State Road 502 (East Road) a short distance west of the East Gate Business Park. It is situated on the mesa between Pueblo Canyon and DP Canyon.

The White Rock Tract is located directly north of the community of White Rock and State Road 4. The western boundary runs northward from the State Road 4 and Pajarito Road intersection. It includes the southern tip of Mesita del Buey and portions of the Cañada del Buey floodplain.

The Rendija Canyon Tract is located to the north of the Los Alamos town site’s Barranca Mesa residential subdivision. It is situated within Rendija Canyon and Cabra Canyon. Barranca Mesa forms the southern boundary and Guaje Mountain forms most of the northern boundary. The tract is bounded by U.S. Forest Service property to the north, east, and west and County lands to the south.

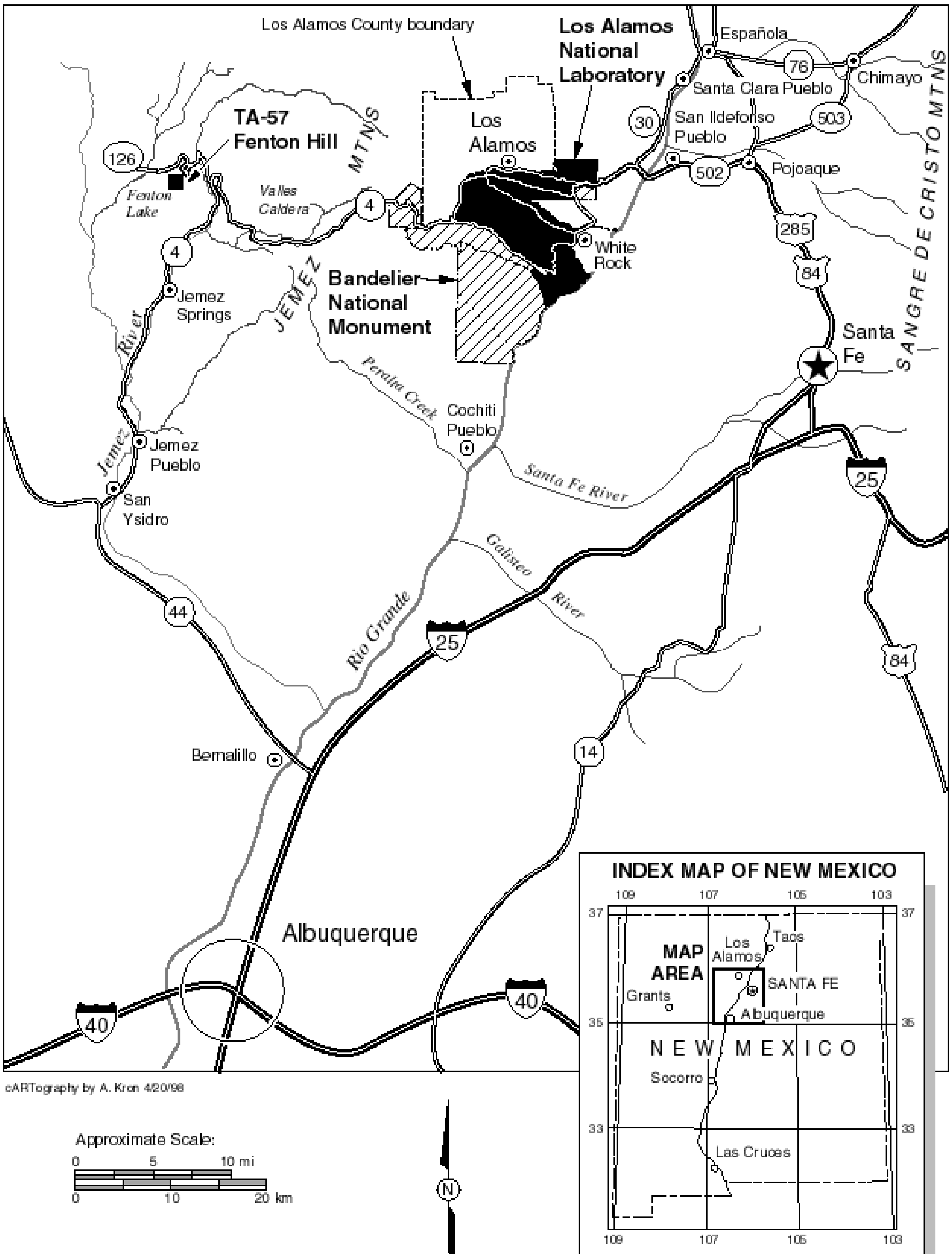


Figure 1.1. Location of Los Alamos National Laboratory.

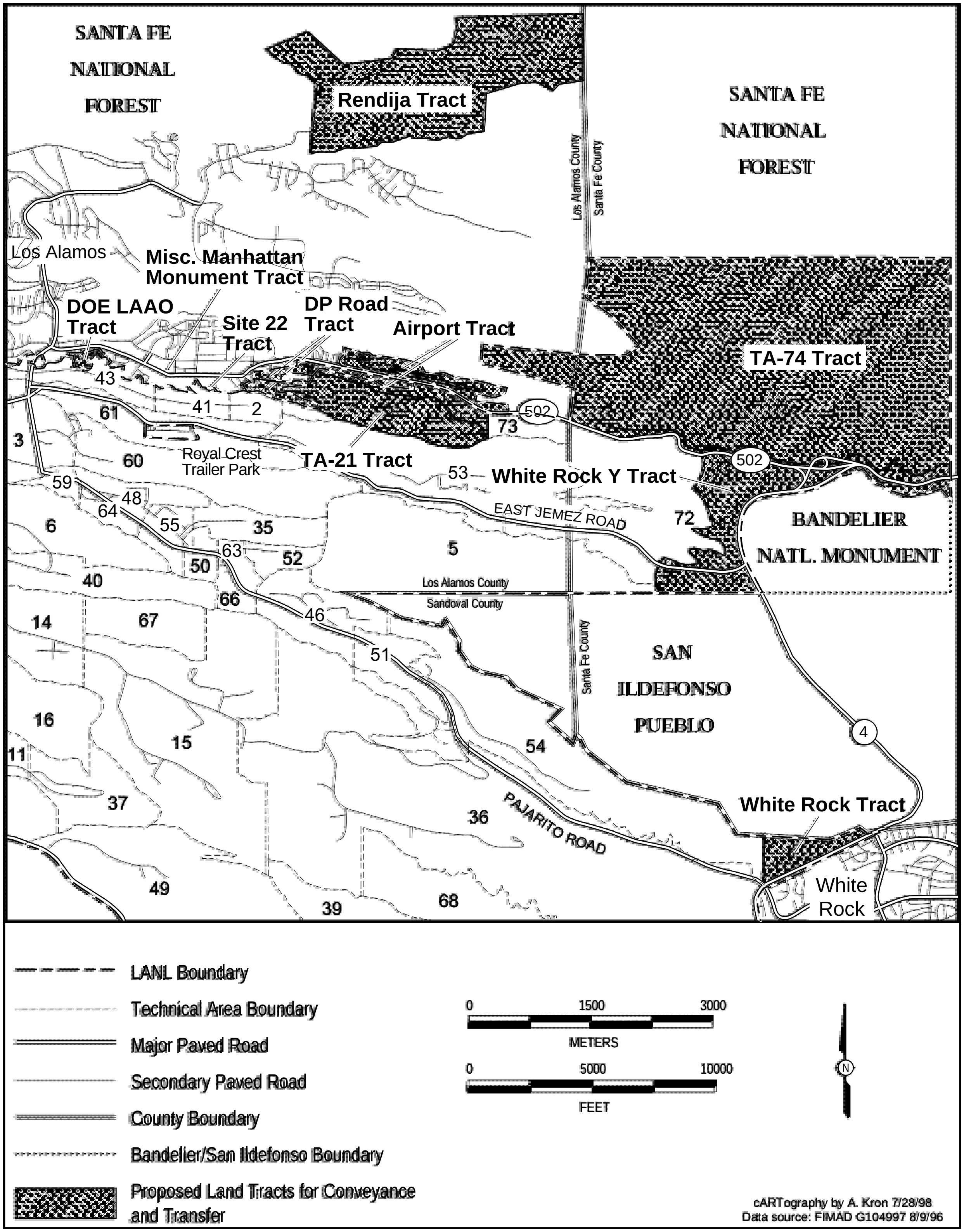


Figure 1.2. Locations of the LCT tracts.

The Airport Tract contains four archaeological sites, three of which are eligible to the NRHP (see Table 1.1). The White Rock Tract contains 10 archaeological sites of which nine are NRHP eligible or have an undetermined eligibility. Two eligible sites, approximately 80% of a third eligible site, and the single non-eligible site are situated on a small portion of land that will be transferred to San Ildefonso Pueblo. The remaining six sites and approximately 20% of another site are within the section that will be conveyed to the County. The Rendija Canyon Tract contains 61 archaeological sites of which 47 are eligible to the NRHP or have an undetermined eligibility. Eight of these sites have been identified as Traditional Cultural Properties (TCPs) by San Ildefonso Pueblo and are therefore considered eligible to the NRHP. All of the remaining sites have been deemed eligible or potentially eligible under Criterion D of the NRHP. That is, they are likely to yield information important to NM's prehistory and/or history.

Land transferred to the Department of the Interior to hold in trust for San Ildefonso Pueblo is not an "undertaking" under the National Historic Preservation Act. Therefore, no further compliance is required for the properties that will be transferred to San Ildefonso Pueblo. However, under 36 CFR 800.5(vii), the conveyance of lands to the County is considered an adverse effect to historic properties, if adequate and legally enforceable restrictions or conditions to ensure the long-term preservation of these properties' historic significance are not established. Consultation is ongoing between San Ildefonso Pueblo, the County, and DOE to determine the future of all historic properties that are within the White Rock Y and TA-74 Tracts that are not scheduled for development and the eight TCPs that are within the Rendija Canyon Tract. The intent of the consultation is to ensure the long-term preservation of these historic properties. The preservation of these properties will be accomplished through the establishment of protective covenants, through the establishment of archaeological conservation zones, and/or through the nomination of historic properties to the New Mexico State Official Register. Based on the ongoing consultation, it is assumed that the historic properties located in the White Rock Y and TA-74 Tracts and the eight TCP properties located within Rendija Canyon will be preserved, thus not adversely affected by the proposed conveyance to the County. An agreement to this effect shall be formalized before conveyance of these properties.

PL 105-119 provides lands to the County for economic development. As a result, the County intends to develop portions, if not all, of the Airport Tract, the Rendija Canyon Tract, and their section of the White Rock Tract constituting an adverse effect to the historic properties within. To resolve this adverse effect, DOE has developed a data recovery strategy for those properties that will be unavoidably destroyed or impacted through development. Excluding the 15 archaeological sites that are not eligible to the NRHP and the eight TCP sites, the data recovery strategy incorporates the 49 Airport Tract, White Rock Tract, and Rendija Canyon Tract sites that are eligible to the NRHP or that have an undetermined eligibility. The 49 historic properties include 41 prehistoric sites, five historic sites, a prehistoric/historic site, and two sites with an unknown temporal affiliation. Should consultation resolve that any of the TCPs and/or White Rock Y Tract or TA-74 Tract historic properties cannot be preserved, the data recovery strategy will be amended for their inclusion.

Table 1.1. Land Conveyance and Transfer Project Site Summary Table

Cultural Resource Sites for the Airport Tract

Site Number	Site Type	Cultural Affiliation	Eligibility	Transfer To
LA 86533	lithic scatter	Late Archaic period	Eligible, Criterion D	L. A. County
LA 86534	single roomblock pueblo	Coalition period	Eligible, Criterion D	L. A. County
LA 135290	single roomblock pueblo	Coalition period	Eligible, Criterion D	L. A. County

Cultural Resource Sites for the White Rock Tract

Site Number	Site Type	Cultural Affiliation	Eligibility	Transfer To
LA 12587	artifact scatter/single roomblock pueblo	Archaic/Coalition	Eligible, Criterion D	L. A. County
LA 86637	one- to three-room structure/ artifact scatter	Classic/Archaic/ Historic periods	Eligible, Criterion D	San Ildefonso/ County
LA 127625	artifact scatter	Coalition/Classic	Potentially eligible, Criterion D	L. A. County
LA 127631	one- to three-room structure	Coalition period	Potentially eligible, Criterion D	L. A. County
LA 128803	garden plot	Ancestral Pueblo	Potentially eligible, Criterion D	L. A. County
LA 128804	water control device	Unknown	Potentially eligible, Criterion D	L. A. County
LA 128805	one- to three-room structure	Coalition period	Eligible, Criterion D	L. A. County

Cultural Resource Sites for the Rendija Canyon Tract

Site Number	Site Type	Cultural Affiliation	Eligibility	Transfer To
LA 15116	one- to three-room structure	Ancestral Pueblo	Eligible, Criterion D	L. A. County
LA 70025	one- to three-room structure	Coalition/Classic	Eligible, Criterion D	L. A. County
LA 70026	log enclosure	Undetermined Historic	Potentially eligible, Criterion D	L. A. County
LA 85402	one- to three-room structure	Classic period	Potentially eligible, Criterion D	L. A. County
LA 85403	one- to three-room structure	Ancestral Pueblo	Eligible, Criterion D	L. A. County
LA 85404	one- to three-room structure	Coalition/Classic	Eligible, Criterion D	L. A. County
LA 85405	one- to three-room structure	Classic period	Eligible, Criterion D	L. A. County
LA 85407	homestead	NM Statehood	Eligible, Criterion D	L. A. County
LA 85408	one- to three-room structure	Classic period	Eligible, Criterion D	L. A. County
LA 85409	one- to three-room structure	Classic period	Eligible, Criterion D	L. A. County
LA 85412	one- to three-room structure	Ancestral Pueblo	Eligible, Criterion D	L. A. County
LA 85413	one- to three-room structure	Classic period	Eligible, Criterion D	L. A. County
LA 85414	one- to three-room structure	Ancestral Pueblo	Eligible, Criterion D	L. A. County
LA 85417	one- to three-room structure	Coalition/Classic	Eligible, Criterion D	L. A. County
LA 85859	lithic scatter	Early Archaic	Eligible, Criterion D	L. A. County
LA 85861	one- to three-room structure	Coalition/Classic	Eligible, Criterion D	L. A. County
LA 85864	tipi/wickiup ring	Unknown Historic	Eligible, Criterion D	L. A. County
LA 85867	one- to three-room structure	Classic period	Eligible, Criterion D	L. A. County
LA 85869	tipi/wickiup ring	Unknown Historic	Eligible, Criterion D	L. A. County
LA 86553	wagon road	NM Statehood	Potentially eligible, Criterion D	L. A. County
LA 86605	one- to three-room structure	Classic period	Eligible, Criterion D	L. A. County
LA 86606	one- to three-room structure	Ancestral Pueblo	Potentially eligible, Criterion D	L. A. County
LA 86607	one- to three-room structure	Ancestral Pueblo	Eligible, Criterion D	L. A. County

Cultural Resource Sites for the Rendija Canyon Tract (cont.)

Site Number	Site Type	Cultural Affiliation	Eligibility	Transfer To
LA 87430	one- to three-room structure	Classic period	Eligible, Criterion D	L. A. County
LA 99396	lithic scatter	Early Archaic	Eligible, Criterion D	L. A. County
LA 99397	lithic scatter	Archaic period	Eligible, Criterion D	L. A. County
LA 127626	one- to three-room structure	Ancestral Pueblo	Potentially eligible, Criterion D	L. A. County
LA 127627	one- to three-room structure	Ancestral Pueblo	Eligible, Criterion D	L. A. County
LA 127628	one- to three-room structure	Classic period	Potentially eligible, Criterion D	L. A. County
LA 127629	one- to three-room structure	Ancestral Pueblo	Eligible, Criterion D	L. A. County
LA 127630	one- to three-room structure	Ancestral Pueblo	Potentially eligible, Criterion D	L. A. County
LA 127632	one- to three-room structure	Ancestral Pueblo	Potentially eligible, Criterion D	L. A. County
LA 127633	one- to three-room structure	Unknown	Potentially eligible, Criterion D	L. A. County
LA 127634	one- to three-room structure	Classic period	Eligible, Criterion D	L. A. County
LA 127635	one- to three-room structure	Classic period	Eligible, Criterion D	L. A. County
LA 135291	one- to three-room structure	Ancestral Pueblo	Eligible, Criterion D	L. A. County
LA 135292	one- to three-room structure	Classic period	Eligible, Criterion D	L. A. County
LA 135293	one- to three-room structure	Ancestral Pueblo	Eligible, Criterion D	L. A. County
LA 135294	one- to three-room structure	Ancestral Pueblo	Eligible, Criterion D	L. A. County

CHAPTER 2
ENVIRONMENTAL SETTING

ALAN L. MADSEN

Los Alamos National Laboratory (LANL) is situated on the Pajarito Plateau. The plateau consists of a series of narrow mesas and deep canyons that trend east-southeast from the Jemez Mountains to the Rio Grande. The defining feature of the plateau is the Tshirege Member of the Bandelier Tuff, a massive series of ignimbrites or "ash-flow tuffs" that erupted from the Jemez Mountains caldera. The Tshirege Member buried most of the former topography between the mountains and the Rio Grande thereby creating a new landscape. The subsequent erosion of this formation has resulted in the distinctive topography of the plateau and LANL (Reneau and McDonald 1996:3, LASL 1976:4–6).

LANL contains several distinct environmental zones. The elevation gradient at LANL is approximately 800 m (2400 ft), ranging from the Rio Grande Valley (1620 m; 5400 ft) to the base of the Jemez Mountains (2340 m; 7800 ft). This elevation change and a complex geological history has created several different climatic zones, soil types, vegetative zones, and animal habitats (Reneau and McDonald 1996:1–3; Balice 1998:4–6; LASL 1976:2–6; Burton 1982:1–6).

The topography for the land conveyance and transfer (LCT) tracts is typically rugged and undulating, containing a number of mesa tops and canyon bottoms and their associated steep talus slopes and cliffs. The tracts are primarily situated at the lower elevations in the piñon-juniper woodland, with the upper portions of the tracts containing sizable stands of ponderosa pine. Soils in the canyon bottoms and on the mesa tops of the south and southeastern part of LANL are mostly Aridisols and Entisols. Throughout the tracts there is an abundance of alluvium on the steep slopes, large tuff rock outcrops, volcanic rock outcrops, talus slopes, and gravelly and sandy loams. Both the White Rock Tract and Rendija Canyon Tract are located in areas with a high agricultural potential.

GEOLOGIC HISTORY

The Pajarito Plateau is located along the western part of the Rio Grande Rift, a structural depression formed by faulting, extending from southern Colorado to northern Mexico. In the LANL area, the rift is approximately 60 km (36 mi) wide and includes the Española Valley, the Pajarito Plateau, and the Jemez Mountains (Reneau and McDonald 1996:1–3; LASL 1976:5–7; Nyhan et al. 1978:4–14; Burton 1982:1–10). The rift is bounded by the Sangre de Cristo Mountains to the east and the southern extension of the Rocky Mountains, the Sierra Nacimientos, to the west.

The geologic formations at LANL were created by volcanism and sedimentation that began in the late Oligocene or early Miocene (18 to 25 million years ago) (Burton 1982:3–6; Reneau and McDonald 1996:1–5). The oldest rocks in the Los Alamos area are the siltstones and sandstones of the Tesuque Formation. The formation was deposited on a broad floodplain of the Rio Grande Rift. The formation underlies the Española Valley and outcrops along the lower edges of the Puye Escarpment and White Rock Canyon.

The Tschicoma Formation overlies the Tesuque Formation in the western part of the Los Alamos area and forms the volcanic highlands of the Sierra de los Valles. This formation consists of andesites, dacites, rhyodacites, and quartz latites. Radiometric dates of the flow rocks range from 3.7 to 6.7 million years ago. The thickness of this formation is estimated to exceed 800 m (2640 ft) (LASL 1976:5; Nyhan et al. 1978:13–15).

The Puye Formation is a fanglomerate made up of volcanic debris eroded from the volcanic pile. This formation is exposed in grayish-buff cliffs along the Puye Escarpment and White Rock Canyon. This formation is also exposed in deeper canyon cuts on the eastern edge of the plateau. The Puye Formation consists of angular to sub-rounded boulders and cobble rocks in the matrix of sand and gravels. Thin beds of ash and pumice are common. The thickness of the conglomerate exceeds 200 m (660 ft) near the center of the Pajarito Plateau.

The basaltic rocks of Chino Mesa are present in outcrops along White Rock Canyon and overlay the Tesuque Formation and interface to the west into the Puye Formation. The dark gray basalts originated as a series of flows and interbedded sediments that exceed a thickness of 350 m (1155 ft) (LASL 1976:8).

The Bandelier Tuff forms the upper surface of the Pajarito Plateau. The lower Guaje Member is an air-fall pumice with a thickness that ranges up to 10 m (33 ft). The middle Otowi Member is a massive-nonwelded rhyolite tuff laid down as an ash-flow. Its thickness is as much as 80 m (264 ft). The upper Tsirege Member is a series of ashflow and ashfall nonwelded to welded units of rhyolite tuff. It is a cliff-forming unit found in canyons cut into the plateau. The thickness in the western part of the plateau exceeds 250 m (LASL 1976:8; Reneau and McDonald 1996:7–16).

SOILS

In the LANL area there are several different types of soils and unconsolidated materials that overlay the natural bedrock. Out of the 10 different soil orders, only five exist on LANL property: Alifisols, Aridisols, Entisols, Inceptisols, and Mollisols. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. The Entisols are an exception to this and can occur in many different kinds of climates (LASL 1976:14, Nyhan et al. 1978:14–25). The Inceptisols and Mollisols are generally confined to the higher elevations at LANL. As they make up only a small portion of LANL soils and are lacking from most of the LCT tracts, they will not be further considered here.

Approximately 80% of Los Alamos County soils can be grouped into the Alfisol, Entisol, and Aridisol soil orders. Aridisols are soils that in arid climates commonly go through prolonged periods–greater than 90 consecutive days–in which they have no water available for plants. Aridisols primarily occur at the lower elevations in the southeastern portion of the Laboratory, and are present in most of the LCT tracts. Plant communities found in association with Aridisols at LANL consist primarily of piñon-juniper woodlands, with ephemeral grasses and forbs and other scattered plants such as cacti.

Alfisols have water available for plants during at least 90 days when the soil is warm enough for plant growth. In this area these soils occur at higher elevations along the base of the Jemez Mountains. They have significantly more clay and develop in forested areas (for example, ponderosa pine).

The Entisols have little or no evidence of development, in contrast to the Alfisols. The Entisols are found intermingled with the Aridisols and Alfisols on several low elevation areas in the southern and southeastern portions of LANL mesa and canyon landscapes. Entisols are found on the erosional surfaces of steep slopes, or on floodplains that frequently receive new deposits of alluvium (Nyhan et al. 1978:14–25; LASL 1976:14–16).

There are several different soil series at LANL. It is noteworthy that that some of these soils have a greater agricultural potential than others due to topographic location. The agricultural potential is based on soil depth, water capacity, and slope. This soil information comes from two different studies, one for Los Alamos County and one for Santa Fe County. As is common for Soil Conservation Service reports for adjacent counties, the names of soil series differ. Due to these differences in nomenclature, we cannot exactly match the series in each study. Unfortunately, portions of the Rendija Canyon Tract and the Airport Tract have not been subjected to formal survey and classification. The following is a list of each soil series at LANL:

Hackroy sandy loam (Los Alamos County)–The Hackroy series consists of very shallow to shallow, well-drained soils that formed in material weatherd from tuff on mesa tops. The native vegetation is mainly piñon pine, one-seed juniper, scattered ponderosa pine, and blue grama. The surface layer is a brown sandy loam about 10 cm (4 in.) thick. The subsoil is a reddish brow clay, gravelly clay, or clay loam, approximately 20 cm (8 in.) thick. The depth to tuff bedrock and the effective rooting depth are 20 to 50 cm (8 to 20 in.) (Nyhan et al. 1978:24–25). This soil type has a high potential for agricultural use.

Rock outcrop, mesic (Los Alamos County)–This soil series is found on moderately sloping to steep mesa tops and edge and consists of about 65% tuff rock outcrop. Native vegetation is blue grama, piñon pine, and one-seed juniper. Included in this series are about 5% very shallow, undeveloped soils on tuff bedrock, 5% Hackroy soils, and 25% narrow escarpments (Nyhan et al. 1978:28). The agricultural potential for this soil is very poor.

Rendija-Bayo complex (Los Alamos County)–This complex contains deep, well-drained soils that weathered from materials derived from tuff (Rendija series) or pumice (Bayo series). These soils are found on moderately steep to very steep mountain sideslopes vegetated by piñon-juniper woodlands. These soils have a light gray gravelly sandy loam surface layer approximately 5 cm (2 in.) thick. The subsoil is a dark grayish brown or light yellowish brown clay, or clay loam, about 30 cm (12 in.) thick underlaid by a light gray loam or sandy loam substratum greater than 100 cm (40 in.) thick. The depth to bedrock and the effective rooting depth are greater then 153 cm (61 in.). The soils in this complex have moderate permeability, high available water capacity, and moderate to high erodibility (Nyhan et al. 1978:54–55). This soil complex has moderate to high potential for agricultural use.

Rock outcrop, steep (Los Alamos County)–This series has slopes greater then 30% on steep to very steep mesa breaks and canyon walls and consists of approximately 90% rock outcrop. The rocks are mainly tuff except at the lower end of some canyons where basalt is present. The south-facing canyon walls are steep and have little or no soil matrix or vegetation. The north-facing walls have areas of very shallow, dark-colored soils. Vegetation is ponderosa pine, spruce, and fir (Nyhan et al. 1978:28–29). This soil type has a very low agricultural potential.

Sanjue-Arriba complex (Los Alamos County)–This complex consists of deep, well-drained soils with weathered materials derived from pumice (Sanjue series) or dacites of the Puye Conglomerate (Arriba series). This complex is found on moderately steep to very steep mountainside slopes forested with ponderosa pine. The surface layer is typically a grayish brown or light brownish gray gravelly sandy loam or loamy sand about 20 cm (8 in.) thick. These soils have rapid to very rapid permeability and a very low available water supply (Nyhan et al. 1978:59–60). This soil complex has a low to moderate agricultural potential.

Penistaja series (Los Alamos County and Santa Fe County)–This series consists of deep, well-drained soils that formed in material weathered from alluvial and eolian deposits on basalt, found on nearly level to gently sloping topography in the White Rock and Pajarito Acres area. Slopes range up to 5%. Native vegetation is mainly blue grama, piñon pine, and one-seed juniper. The surface layer is a brown sandy loam approximately 8 cm (3 in.) thick. The subsoil is a light brown clay loam and heavy fine sandy loam approximately 95 cm (38 in.) thick. The available water capacity is high, and the rooting depth is 150 cm (60 in.) or more (Nyhan et al. 1978:26; Folks 1975:41). This soil type has a high agricultural potential.

Potrillo series (Los Alamos County)–This series consists of deep, well-drained soils that formed in alluvial and colluvial sediments derived from tuff and pumice. Potrillo soils are found on level to gently sloping canyon floors and on small, flat benches along the Rio Grande Gorge. The native vegetation for this soil is blue grama, piñon pine, one-seed juniper, and annual grasses and forbs. When the Potrillo series is found in canyon floors the surface layer is typically a brown loam about 10 cm (4 in.) thick. The subsoil is a brown loam, or a sandy loam, about 30 cm (12 in.) thick. The available water capacity is high and the effective rooting depth is 150 cm (60 in.) or more. When the Potrillo series is found along the Rio Grande, the surface layer is typically a brown gravelly sandy loam about 15 cm (6 in.) thick. The subsoil is a brown gravelly sandy loam about 25 cm (10 in.) thick. The available water capacity is medium to high with an effective rooting depth of 150 cm (60 in.) or more (Nyhan et al. 1978:27). This soil type has a high agricultural potential.

Typic Usthorthents–Rock outcrop complex (Los Alamos County)–This complex consists of deep, well-drained soils that weathered from dacites and latites of the Puye Conglomerates. This complex is found on very steep to extremely steep mountainside slopes vegetated with a piñon-juniper woodland. The surface layers are generally a pale brown stony or gravelly sandy loam approximately 5 cm (2 in.) thick. These soils have a rapid to very rapid permeability and a very low available water capacity (Nyhan et al. 1978:65–66). This soil type has a low agricultural potential.

Totavi series (Los Alamos County)–This series consists of deep, well-drained soils that formed in alluvium in canyon bottoms. Native vegetation is blue grama, piñon pine, one-seed juniper, and annual grasses and forbs. The surface soil is a brown gravelly sand, or sandy loam, to 150 cm (60 in.) or more, with 15% to 20% gravel. The available water capacity in this soil is low (Nyhan et al. 1978:31). Totavi soils have a high agricultural potential.

Guaje sandy gravelly loam (Santa Fe County)–This type is part of the Guaje series, consisting of well-drained soils that formed in pumice and other volcanic debris on slopes and foothills. At LANL this soil is found on strongly sloping to moderately steep areas. The vegetation is mostly middle-sized grasses, shrubs, and trees. The surface layer is a light brownish gray gravelly sandy loam approximately 24 cm (9.6 in.) thick. The available water capacity is 2.5 to 5 cm (1 to 2 in.) (Folks 1975:27–28). Agricultural potential is moderate to high.

Tuff Rock land (Santa Fe County)–This type consists of exposed areas of welded tuff and pumice and, in places, extremely stony talus slopes. The tuff and pumice are along very steep canyon walls. During heavy storms this series yields large amounts of surface water (Folks 1975:49). The agricultural potential is very low.

Los Alamos-Silver complex (Santa Fe County)–This complex consists of the related Los Alamos series and the Silver series. The Silver series is found outside of the LCT area. The Los Alamos series consists of well-drained soils that formed in material weathered from pumice and other volcanic debris on uplands. Depth to pumice is approximately 50 to 125 cm (20 to 50 in.). The soils in this complex range from level to strongly steep sloping. The vegetation is mostly mid grasses, annuals, and trees. The soil is a light brown sandy loam about 12.5 cm (5 in.) thick. The subsoil is a brown clay loam and light brown loam approximately 50 cm (20 in.) thick. Los Alamos-Silver sand loams consist of about 55% Los Alamos sandy loam and 35% Silver sandy loam. Available water capacity is between 10 and 15 cm (4 and 6 in.) in the Los Alamos series and 27 to 29 cm (10.8 to 11.6 in.) in the Silver series (Folks 1975:32–33). The agricultural potential is moderate to high.

Bluewing gravelly sandy loam (Santa Fe County)–This soil consists of excessively drained soils on terraces. This soil is present on level to gently sloping areas. The available water holding capacity is 7.5 to 10 cm (3 to 4 in.). Permeability in this soil is rapid. The surface layer is grayish brown gravelly sandy loam approximately 10 cm (6 in.) thick. The subsoil layer is brown and about 40 cm (16 in.) thick (Folks 1975:15–16). This soil type has a moderate agricultural potential.

Basalt rock land (Santa Fe County)–This series is located on very steep areas. In places where this land type is less sloping are small benchlike areas. These areas formed as a result of slipping and falling basalt boulders that became lodged and partly stabilized. Slopes are 50% to 90%. There are several areas of exposed rock, cliffs, and ledges (Folks 1975:15). The potential for this soil type to be used for agriculture is very low.

CLIMATE

Los Alamos has a semiarid, temperate mountain climate. Mean temperatures vary with altitude, averaging 5°F (3°C) higher in and near the Rio Grande Valley (1980 m, 6500 ft) and 5°F to 10°F (-3°C to -5.5°C) lower in the nearby Jemez Mountains (2600 to 3050 m, 8500 to 10,000 ft) (Bowen 1990:3–17).

Winter temperatures range from 15°F to 25°F (-9°C to -4°C) during the night and from 30°F to 50°F (-1°C to 10°C) during the day. Cold arctic air masses occasionally invade the Los Alamos area from the north and east, but often the shallow layer of coldest air is dammed to the east by the Sangre de Cristo Mountains. Temperatures in the Los Alamos area occasionally will drop to 0°F (-18°C) or below. The freeze-free growing season of 157 days in Los Alamos is relatively short. The normal growing season in White Rock is even shorter at 145 days. Above 2743 m (9000 ft), frosts can occur during any time throughout the year (Bowen 1990:3–17; Reneau and McDonald 1996:2–3; Nyhan et al. 1978:9).

The normal annual precipitation, including rainfall and snowfall, totals approximately 46 cm (18 in.). Annual precipitation decreases rapidly toward the valley, with the normal White Rock precipitation at 33 cm (13 in.). Annual precipitation in the Jemez Mountains is normally higher than 51 cm (20 in.). The precipitation in the area is characteristic of a semiarid climate where variations in precipitation are quite large from year to year. The annual precipitation extremes range from 17.77 to 77.06 cm (6.08 to 30.34 in.) over a 69-year period (Bowen 1990:3–17, Nyhan 1978:9–12, Balice 1998:1–12).

Over the months of July and August is the monsoon season. Convection of warm air over the Jemez Mountains causes thundershowers to develop during the afternoons and early evenings that drift out over the Pajarito Plateau, causing brief, but intense, rains (Bowen 1990:3–17). Westerly winds push the thunderstorms above the Jemez Mountains towards Los Alamos. Up to 40% of the annual precipitation falls during these two months. Winter precipitation falls primarily as snow, with accumulation of approximately 130 cm (51 in.) seasonally. Snowfall varies considerably from year to year.

PLANT COMMUNITIES

The diversity in the ecosystems at LANL are due to the dramatic 1500-m (4950-ft) elevation gradient from the Rio Grande Valley on the east to the Jemez Mountains to the west, and the many canyons with abrupt surface slope changes that parallel this gradient. The mesa orientation, solar radiation, and the differences in soils and moisture create several ecotones throughout the Pajarito Plateau. The elevation gradient and the corresponding variable climatic conditions in the LANL region are reflected by the presence of five major vegetational cover types. These major cover types are defined by their dominant tree species and by their structural characteristics as follows: juniper savannas, piñon-juniper woodlands, ponderosa pine forests, mixed conifer forests, and spruce-fir forests. Figure 2.1 illustrates the distribution of these land cover types across LANL.

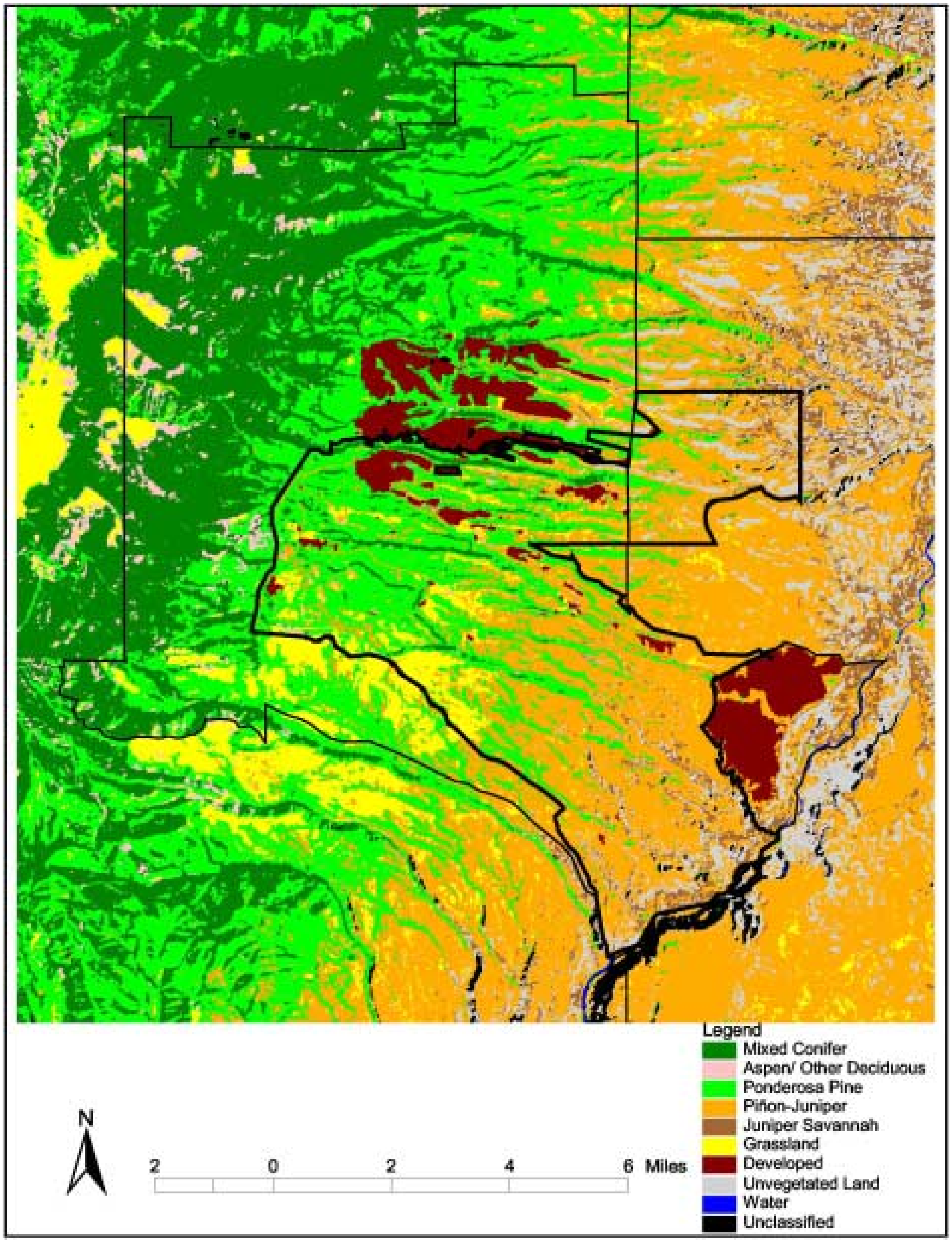


Figure 2.1. Distribution of land cover types across LANL.

In contrast to these five general cover types, several specific vegetation communities contained within the general cover types are not primarily influenced by elevation and climatic gradients. These communities are the aspen forests, grasslands, shrublands, open water, and non-vegetated lands, which are controlled instead by topographic features such as soils, geologic structures, and moisture conditions (LASL 1976; Balice 1998:4–29; Balice et al. 1997:3–29).

Juniper savannas are common between elevations of 1768 m (5800 ft) and 1951 m (6400 ft). One-seed juniper is typically the only overstory species in the juniper savanna. Grama grasses dominate the understory but blue grama, hairy grama, and false buffalo grass are also widely distributed as a codominant species. The average annual precipitation in this zone is approximately 25.4 cm (10 in.) (Balice et al. 1997:17).

Piñon-juniper woodlands are found between 1890 m (6200 ft) and 2195 m (7200 ft) in Ancho, Water, Sandia, and Los Alamos Canyons. On mesa tops they are the predominant vegetation type. Juniper is codominant with piñon in this coverage especially at lower elevations. Piñon increases in importance at higher elevations. The average annual precipitation in this area is approximately 30.5 to 35.5 cm (12 to 14 in.) (Balice et al. 1997:18).

Ponderosa pine forests extend to as low as 1890 m (6200 ft) in some of the protected canyons such as Ancho and Water. In more open canyons, like Sandia and Los Alamos, ponderosa pine is not normally found below 1921 m (6300 ft). On the mesa tops and the lower slopes of the Sierra de los Valles, ponderosa pine forests extend to 2378 m (7800 ft) in elevation. The ponderosa pine is the only overstory species throughout most of the elevation range of this community type. However, at lower elevations juniper may also be present and at higher elevations an occasional Douglas fir may be found. The understory commonly consists of kinnikinnik, Colorado barberry, and Gambel oak along with numerous species of herbs and grasses in the forb layer (Balice et al. 1997:19; Balice 1998:14–18).

Mixed conifer forests appear at higher elevations in the mountains and consist of trees that are at least 5 m (16 ft) tall. Douglas fir or white fir are the dominant overstory species, although other tree species may also be present in the overstory or midstory. On north aspects of canyons and on the canyon bottoms above 2104 m (6900 ft), the mixed conifer forest intergrades with ponderosa pine communities. In flat areas or on eastern exposures the mixed conifer forest extends to 2591 m (8500 ft). In protected drainage bottoms and on southern exposures, mixed conifer forests extend to 2744 m (9000 ft). Some limber pine may be present sporadically. The understory may consist of several shrubs, including ninebark, wild rose, cliffbush, and dwarf juniper along with numerous species of herbs and grasses. The average annual precipitation ranges from 51 to 76 cm (20 to 30 in.) (Balice et al. 1997:23; Balice 1998:17).

Spruce-fir forests are widely distributed throughout the highest elevations in northern New Mexico. They can be found on north aspects as low as 2439 m (8000 ft) and on more exposed slopes as low as 2591 m (8500 ft). The spruce-fir communities continue to the highest elevations in the Los Alamos region, approximately 3138 m (10,441 ft). Engelmann spruce and Douglas fir are the dominant tree species. Aspen is also a major overstory species on exposed slopes above 2683 m (8800 ft) that have been burned in recent decades (Balice et al. 1997:28–29, Balice 1998:23–24).

Aspen forest communities are common at mid-elevations in the mountains. They range in elevation from approximately 2700 to 3030 m (8900 to 9950 ft). Below 2820 m (9250 ft), aspen stands occupy north and northeast aspects; whereas, above this elevation they are mostly found on southeast- to southwest-facing positions. Aspen is present in the overstory with at least 20% coverage. Combinations of Douglas fir, ponderosa pine, white fir, or Englemann spruce are also present but do not dominate the overstory, either as an individual species or together (Balice et al. 1997:27; Balice 1998:21–22).

Shrublands are identified by the presence of shrub species that are greater then 0.46 m (1.5 ft) in height and with at least 15% cover. Trees species are absent or, if present, only occupy less then 10% of the coverage (Balice et al. 1997:31).

Grasslands are identified as areas dominated by grasses and grasslike plant species. Forbs and other non-shrubby species may be codominant. Trees and shrubs taller then 0.46 m (1.5 ft) or less then 15% coverage are absent. Subalpine grasslands occur above 2743 m (9000 ft) on steep, southerly and southwesterly slopes. Subalpine grasslands occur in stony or bouldery soils that create conditions that are not moist enough to support the establishment of tree species. They may also be perpetuated by the effects from fire (Balice et al. 1997:32; Balice 1998:26).

ANIMAL COMMUNITIES

Several animal communities of both invertebrates and vertebrates are represented at LANL. Many species of small mammals such as mice, woodrats, moles, squirrels, and chipmunks occur in the area, some of which are specific to certain elevation gradients. Other small mammals, such as bats, are present within the Laboratory boundaries as well, and consist of at least 15 different species (Biggs et al. 1997:1–3, LASL 1976:24–27). The area also contains mule deer and elk. Little is known about other large and medium size mammals of the area, but based on observations and current studies, a minimum of 12 species of carnivores are present. Among these are black bear, mountain lion, bobcat, fox, and coyote (Biggs et al. 1997:1–3, LASL 1976:24–27).

Cold-blooded animals in the area include several species of fish found in the Rio Grande. The carp, chub, white sucker, and carp-sucker are abundant in the waters of the Rio Grande on the eastern boundary of LANL. There are a few brown trout found in the area but not enough to represent a significant population, probably due to the turbidity of the river (LASL 1976:25).

There are approximately nine species of reptiles in the LANL area including small lizards and king, bull, garter, and rattlesnakes. The Jemez Mountains salamander is a rare amphibian that is found in the area (LASL 1976:25).

There are some 187 bird species from 44 families reported in the area, some of which are permanent residents and some transients. Observed permanent residents include the common raven, pygmy nuthatch, western bluebird, gray-headed junco, and rufous-sided towhee. Summer birds include the turkey vulture, red-tailed hawk, American kestrel, peregrine falcon, chipping sparrow, and violet-green swallow (LASL 1976:25).

The ecological relationships to the topography are interesting. In the lower elevation zone (1700 to 2000 m [5610 to 6600 ft]) are coyote, rattlesnake, bobcat, gray fox, red-tailed hawk, spiny lizard, mule deer, deer mouse, and the mountain cottontail. In the middle elevation zone (2000 to 2400 m [6600 to 7920 ft]), especially in the canyons, are coyote, raccoon, mountain lion, American black bear, turkey vulture, American kestrel, golden eagle, gopher snake, rock squirrel, and mule deer. In the same elevation zone (2000 to 2400 m [6600 to 7920 ft]) on the mesa tops are American black bear, mountain lion, common raven, pygmy nuthatch, Colorado chipmunk, pine squirrel, and mule deer. In the upper elevations (2400 to 3200 m [7920 to 10,560 ft) are American black bear, mountain lion, green-tailed towhee, hairy woodpecker, Rocky Mountain elk, mule deer, western bluebird, and gray-headed junco (LASL 1976:24–26).

ENVIRONMENTAL CHARACTERISTICS OF SPECIFIC TRACTS

Airport Tract

The approximate 82 ha (205 ac) Airport Tract is located near the eastern end of the mesa that is located between Pueblo and DP Canyons. This narrow stretch of mesa is located east of the Los Alamos town site. The tract boundary is defined by the mesa edge to the north and the bottom of DP Canyon to the south. It ranges in elevation from 2153 to 2196 m (7060 to 7200 ft). The tract includes land on both sides of State Road 502 that serves as the main entrance to the community of Los Alamos. The northeastern portion of the tract has been disturbed by construction of the Los Alamos Airport. State Road 502 and parking lots, runway, and buildings associated with the Los Alamos Airport have disturbed approximately 40% of the tract. The approximate 60% of the tract that is undisturbed is located south of State Road 502 and east of the airport. The vegetation in these areas is primarily piñon-juniper woodland with areas of ponderosa pine forest and native grasses and shrubs. The soil within the tract is a Hackroy sandy loam that generally has a high potential for agriculture (Nyhan: 1978). However, with the tract being near the tip of the mesa the soil deposit is fairly thin and often absent along the mesa edges. The lack of soil depth thus rooting depth severely limits the potential to support agriculture.

White Rock Tract

The White Rock Tract contains approximately 40 ha (100 ac) that range in elevation from 2133 to 2186 m (6400 to 6560 ft). The eastern tip of Mesita del Buey is located in the west-central portion of the tract. The remaining tract area is situated within the Cañada del Buey floodplain or along the cliff face and talus slope that form the northern edge of the canyon. Approximately 20% of the tract has been disturbed by development (roadway, electrical substation, power lines, pump station, and visitor center). Of the 80% of the tract that is undisturbed, about 75% is covered with vegetation associated with a piñon-juniper woodland. Shrubs, grasslands, and wildflowers occupy the remaining areas of the tract. The floodplain contains sandy, silty, or gravelly loams of which two (Penistaja sandy loam and Totavi gravelly loamy sand) have a high agricultural potential (Nyhan et al. 1978).

Rendija Canyon Tract

Rendija Canyon contains approximately 364 ha (910 ac) that range in elevation from 2293 to 2426 m (6880 and 7280 ft). The tract contains portions of Rendija and Cabra Canyons. Barranca Mesa forms the southern boundary and Guaje Mountain forms most of the northern boundary. Rendija Canyon is a relatively broad, flat-bottomed canyon that serves as a major drainage basin for the Jemez Mountains. Cabra Canyon that is also fairly broad and flat-bottomed feeds into Rendija Canyon. Benches and ridge fingers that have formed along the lower reaches of Guaje Mountain dominate the terrain located to the north of the Rendija Canyon floodplain. The terrain situated to the south of Rendija Canyon contains the talus slope, alluvial fan, and benches that formed along the north side of Barranca Mesa. Approximately 8 ha (20 ac) of the tract have been developed as the Los Alamos Sportsman's Club (clubhouse, one residence, and rifle, pistol, and archery shooting ranges). The only other structures or development within the tract are pumping stations and utility or roadway corridors. Approximately 80% of the tract vegetation communities are ponderosa pine forest and piñon-juniper woodland. Mixed conifers and aspen are also present. Shrubs, grasslands, and wildflowers occupy the remaining areas within the tract. Two of the tract soils (Sanjue-Arriba complex, Rendija-Bayo complex) that are primarily within the Rendija Canyon and Cabra Canyon floodplains and along the lower benches and ridge fingers have a moderate to high agricultural potential (Nyhan et al. 1978).

CHAPTER 3
CULTURE HISTORY OVERVIEW

BRADLEY J. VIERRA AND STEVEN R. HOAGLAND

Overviews of the regional culture history are presented in Cordell (1979a, 1979b, 1997), Stuart and Gauthier (1981), and Riley (1995). The chronological sequence was developed by Wendorf (1954) and later modified by Wendorf and Reed (1955) for the northern Rio Grande. Table 3.1 illustrates the regional chronologies as defined by Cordell (1979a), Irwin-Williams (1973), and Wendorf and Reed (1955). The following outline briefly summarizes each cultural period as it is understood for the central portion of the Pajarito Plateau.

Table 3.1. Culture Historical Chronology for the Northern Rio Grande

Culture	Period	Dates
Paleoindian	Clovis	9500–9000 BC
	Folsom	9000–8000 BC
	Late Paleoindian	8000–5500 BC
Archaic	Jay	5500–4800 BC
	Bajada	4800–3200 BC
	San Jose	3200–1800 BC
	Armijo	1800–800 BC
	En Medio	800 BC–AD 400
	Trujillo	AD 400–600
Ancestral Pueblo	Early Developmental	AD 600–900
	Late Developmental	AD 900–1150
	Coalition	AD 1150–1325
	Classic	AD 1325–1600
Native American, Hispanic, and Euro-American	Spanish Colonial	AD 1600–1821
	Mexican	AD 1821–1846
	U.S. Territorial	AD 1846–1912
	Statehood to World War II	AD 1912–1945
	Recent	AD 1945–present

PALEOINDIAN PERIOD: 9500 BC to 5500 BC

Small groups of Paleoindian hunter-gatherers may have followed bison herds up and down the Rio Grande, with trips onto the Pajarito Plateau to procure obsidian and other subsistence resources. This period is represented on Los Alamos National Laboratory (LANL) land by a Folsom point found by Steen (1977:7) on a mesa north of Ancho Canyon. Clovis, Folsom, and Planview points have also been identifed at other locations on the plateau (Acklen 1993, 1997; Lent et al. 1986; Traylor et al. 1990; Wiseman 1992). Obsidian obtained from Jemez Mountains sources has been found on Paleoindian sites located as far away as northern Colorado (Wilmsen 1974:114).

ARCHAIC PERIOD: 5500 BC to AD 600

Archaic hunter-gatherer groups relied on a variety of small game and plant species, while hunting with the spear and atlatl. Piñon-juniper woodlands on LANL land contain evidence of these temporary campsites as scatters of obsidian lithic tools, chipping debris, and diagnostic projectile points (Biella 1992; Moore et al. 1998; Baker and Winter 1981). These sites presumably reflect the seasonal use of these upland settings during the fall for pine nut collecting, hunting, and lithic procurement activities. Winter sites with structures have been excavated at lower elevations near Otowi at the Rio Grande (Lent 1991) and at Abiquiu Reservoir (Stiger 1986). The Late Archaic continues the hunting and gathering pattern with the addition of maize cultivation to the subsistence base. Maize has been directly dated to 2440 ± 250 BP (uncorrected; M-466; Crane and Griffin 1958) and 2410 ± 360 BP (Arizona; Long in Ford 1985) at Jemez Cave located near the Soda Dam at State Road 4.

EARLY DEVELOPMENTAL PERIOD: AD 600 to AD 900

Maize horticulturists who lived in semi-subterranean pithouses characterized the Early Developmental period. They began to make painted pottery with simple designs (e.g., Lino Gray or Kana'a Gray) and used the bow and arrow. Most habitation sites are located at lower elevations near the Rio Grande, with the plateau continuing to be used on a seasonal basis. There is no archaeological evidence for this period at LANL.

LATE DEVELOPMENTAL PERIOD: AD 900 to AD 1150

Late Developmental horticulturists still relied to a great extent on hunting and gathering. Pithouses persisted in some places, but sites are typically small adobe masonry structures that are found at wider range of altitudes. Kawhe'e Black-on-white is a mineral-painted pottery that is produced during this time period. Indented corrugated wares are used as cooking and storage vessels. Only a few possible pithouse locations and associated artifacts have been identified on LANL land.

COALITION PERIOD: AD 1150 to AD 1325

The Coalition period saw a substantial increase in the number, size, and distribution of aboveground habitation sites, with year-round settlements expanding into upland areas on the Pajarito Plateau. The long-term process of site aggregation begins during this period, with early sites containing adobe and masonry rectangular structures with 10 to 20 rooms. These small rubble mound sites are the most common at LANL. In contrast, later sites of this period consist of large masonry enclosed plaza pueblos that contain over 100 rooms. Figure 3.1 provides site type illustrations of a Coalition roomblock (LA 4715), Late Coalition plaza pueblo (LA 4665), and Classic period plaza pueblo (LA 170). The construction of agricultural features such as terraces, gravel mulch gardens, and dams suggest an even greater reliance on horticulture. Most

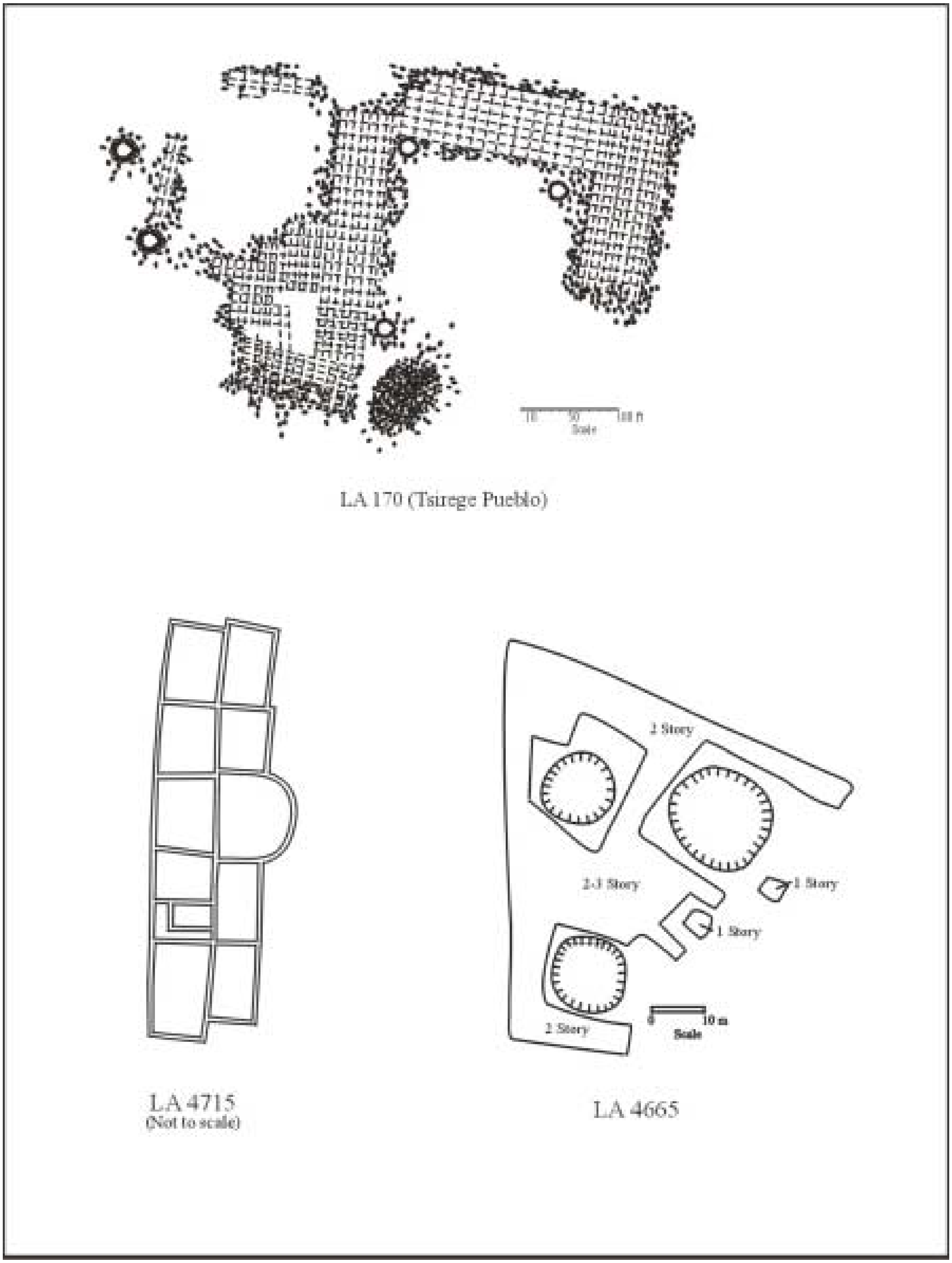


Figure 3.1. Site type illustrations for Coalition (lower left), Late Coalition (lower right), and Classic (top) periods.

researchers attribute the increase in site density to migration (Wendorf and Reed 1955; Cordell 1979b; Hill and Trierweiler 1986, Hill et al. 1996), but others see the increase in site numbers a result of local population growth (Steen 1982). The beginning of the Coalition period coincides with the shift from mineral- to organic-painted pottery, including Santa Fe Black-on-white. Ceramic cooking and storage vessels are mainly produced using a smeared-indented corrugated style.

CLASSIC PERIOD: AD 1325 to AD 1600

The Classic period is characterized by intensive maize agriculture. Ancestral Pueblo settlements on the Pajarito Plateau are aggregated into three population clusters with outlying one- to two-room fieldhouses. The central site cluster consists of four temporally overlapping sites: Tsirege, Navawi, Tsankawi, and Otowi. Otowi and Tsirege are located on LANL land. Mera (1935) suggested that the initial occupation of these pueblos had occurred during the 14th century. Tsirege, Tsankawi, and Otowi continued to be occupied during the 15th century, with only Tsirege and Tsankawi remaining by the 16th century. Oral traditions at San Ildefonso indicate that Tsankawi was the last of the plateau pueblos to be abandoned. The introduction of glaze-painted ceramics to the south of Frijoles Canyon and the production of biscuitwares in the northern Rio Grande area mark the beginning of the Classic period. These biscuitwares include a temporal sequence from Biscuit A (Abiquiu Black-on-gray), Biscuit B (Bandelier Black-on-gray), to Biscuit C (Cuyamungue Black-on-tan). Sankawi Black-on-cream, Potsuwi'i Incised, and plainware cooking vessels are also produced during this time period. The latter utility pottery can include micaceous types. This central group of four Classic period ruins is ancestral to the Tewa speakers now living at San Ildefonso Pueblo.

SPANISH COLONIAL PERIOD: AD 1600 to AD 1821

Due to a series of droughts, the plateau was eventually abandoned during the mid-1500s. New pueblos were occupied in the Rio Grande Valley. Although the historic period begins with Coronado's exploratory expedition up the Rio Grande in 1540–1541, most researchers date the period from about AD 1600. This date corresponds with Oñate's settlement in New Mexico and imposition of the Spanish *encomienda/estancia* system on Rio Grande populations. The Spanish controlled Pueblo pottery production requiring the manufacturing of European vessel forms and taxation jars. These jars were sized to provide specific volumes for grain taxation and often exhibited a distinctive shoulder at the mid-point of the vessel. Historic ceramic types include Tewa Polychrome, Kapo Gray or Black, and Ogapoge Polychrome. The Pueblo Indians revolted against the Spanish in 1680, with some sites on the plateau being reoccupied during this refugee period (e.g., Nake'muu).

With the reconquest and resettlement of New Mexico by de Vargas (1693–1696), the economic and settlement systems were completely overhauled (Simmons 1969). The huge mission establishments disappeared as did the *estancias* of the *encomienderos*. In their place land was granted to dozens of Hispanic communities and individuals that worked the property themselves. Hundreds of these small landholdings were scattered throughout the *Rio Arriba* and *Rio Abajo*.

Athabaskans have been present in northwestern New Mexico since the 15th century; however, the ethnohistorical evidence for Navajos and Jicarilla Apaches in the northern Rio Grande begins with the Spanish Colonial period (Forbes 1960; Friedlander and Pinyan 1980; Marshall 1995; Marshall and Hogan 1991; Opler 1936, 1971; Tiller 1992). The Navajos primarily resided in the Gobernador region, but made periodic visits to the Rio Grande Valley and Jemez Mountains. The presence of Tewa Polychrome and Jemez obsidian at Pueblito sites attests to these contacts. Some Jicarilla groups wintered in the area of Abiquiu, with seasonal hunting and gathering trips made to the nearby mountains. Two rock rings that could possibly represent the remains of a tipi or wickiup were recorded in Rendija Canyon (Peterson and Nightengale 1993). Test excavations identified the presence of a hearth inside one of the structures that yielded a radiocarbon date of 130 ± 60 BP (Beta-58428). This would reflect a calibrated date for the feature within the 18th or 19th[h] centuries. A single obsidian flake was the only artifact recovered. Possible Jicarilla rock ring sites with associated micaceous pottery have been reported for the Rio del Oso valley near Española (Anschuetz per. comm. 1999) and at Pecos National Monument (Gunnerson and Gunnerson 1970). Schaasfma (1977, 1992) suggests a possible Navajo affiliation for Piedra Lumbre sites in the Abiquiu area, although Carrillo (1992) considers that some of these sites are associated with local Tewa peoples.

MEXICAN PERIOD: AD 1821 to AD 1846

Mexico declared its independence from Spain in 1821, which brought about a more lenient land grant policy and expansion of the trade network (Levine et al. 1985). Trade along the Santa Fe Trail between Missouri and Santa Fe began soon after independence and dominated events in New Mexico for the next quarter-century (Connor and Skaggs 1977). This introduced some comparatively inexpensive Euro-American goods to New Mexico, which is reflected in the increase of manufactured items found on sites from this period (Moore 1993).

U.S. TERRITORIAL: AD 1846 to AD 1912

New Mexico remained a part of Mexico until war broke out with the United States. Troops led by Colonel Stephen W. Kearny raised the American flag at Santa Fe and took possession of New Mexico for the United States on 18 August 1846. Grazing and seasonal utilization of the plateau occurred by non-Indians during the early historic periods, with the first homesteads being established on the Pajarito Plateau during the 1880s (Scurlock 1981:138). New Mexico was provided with a territorial government in 1850, and it remained a territory until it was granted statehood in 1912.

STATEHOOD TO WORLD WAR II PERIOD: AD 1912 to AD 1945

The early 1900s in New Mexico saw a continuation of traditional farming, cattle grazing, timbering, and cultural practices. Seasonal homesteading continued on the plateau, though mostly as a supplement to established year-round residences. Hispanic and Anglo Homestead

Era sites are characterized by wooden cabin and corral structures, rock or concrete cisterns, and a scattering of debris associated with household and farming/grazing activities. In discussing the homestead occupation of current LANL lands in this report, it is noted that nearly all of the evidence for homesteading dates to the period of 1912–1945, likely reflecting response to the Enlarged Homestead Act of 1909 and the Grazing Homestead Act of 1916 (Scurlock 1981). Greater railroad and automobile use allowed for an increase in commerce and tourism, and by the 1940s, New Mexicans began to leave the village rural life for jobs in the larger cities, such as Albuquerque, or for jobs outside the state (Simmons 1993:182).

In 1942, Franklin D. Roosevelt gave the approval to develop the world's first atomic bomb. Because of its isolated location, Los Alamos, New Mexico, was selected as the site of the bomb's design and construction. This project came to be known as Project Y, a subset of the Manhattan Project. The creation of a modern town in Los Alamos influenced surrounding communities in northern New Mexico. Lands owned by the Los Alamos Ranch School and mostly Hispanic homesteaders were appropriated for use by the Manhattan Project in 1942, thus effectively ending the Homestead Era on the Pajarito Plateau (LANL 1997).

CHAPTER 4
PAST INVESTIGATIONS

BRADLEY J. VIERRA

Over 100 years of archaeological research has been conducted on the Pajarito Plateau. This chapter provides a brief review of this fieldwork as it pertains to the land conveyance and transfer (LCT) area.

HEWETT AND WILSON (1900–1917)

It was Adolph Bandelier who first described the ancient ruins on the Pajarito Plateau, visiting Otowi and Tsirege in 1885 (Lange et al. 1975:58). However, it was Edgar Lee Hewett who initially investigated these sites. He described and drew site sketches of at least five sites at Los Alamos National Laboratory (LANL) (Hewett 1904, 1905, 1906, 1908): Otowi, Tsirege, a small pueblo located three miles west of Tsirege, the Pulsed High-Energy Radiographic Machine Emitting X-Rays (PHERMEX) site (LA 4665), and Nake'muu. Each was assigned a site number consisting of 8, 15, 16, 17, and 18, respectively. Hewett later conducted excavations at Otowi and Tsirege from ca. 1900 to 1904 (Hewett 1938). This work focused on the middens at Otowi and the midden and pueblo at Tsirege and was done with the help of workers from San Ildefonso Pueblo.

Lucy Wilson also conducted excavations at Otowi from 1915 to 1917. Her work focused on the four northern roomblocks, with less in the southwestern roomblock (Wilson 1916a, 1916b, 1917, 1918a, 1918b). Figure 4.1 illustrates the Hewett and Wilson maps of Otowi pueblo. Both Hispanic and Pueblo workers assisted her with these excavations. The latter included workers from San Ildefonso Pueblo: Santiago, Agapito, Altilano, Facunda, and Crescencio Martinez. In addition, Pueblo women also helped at the field camp.

The current disposition of most of the Hewett collections is unknown. Nonetheless, he does mention that pottery recovered from the burials at Otowi is at the National Museum and the Museum of New Mexico (Hewett 1938:132). Wilson also states that "the very considerable result of his [Hewett] two weeks excavation is now installed in the Hall of the Southwest in the National Museum, Washington" (Wilson 1918b:291). Research into the current location of these collections reveals that the human remains recovered during Hewett's excavations are curated at the Smithsonian Institution. There are 91 accession numbers for human remains from Otowi and 65 accession numbers for pottery vessels from Otowi. In addition, a few items are also curated at the Laboratory of Anthropology, Museum of New Mexico (LOA/MNM).

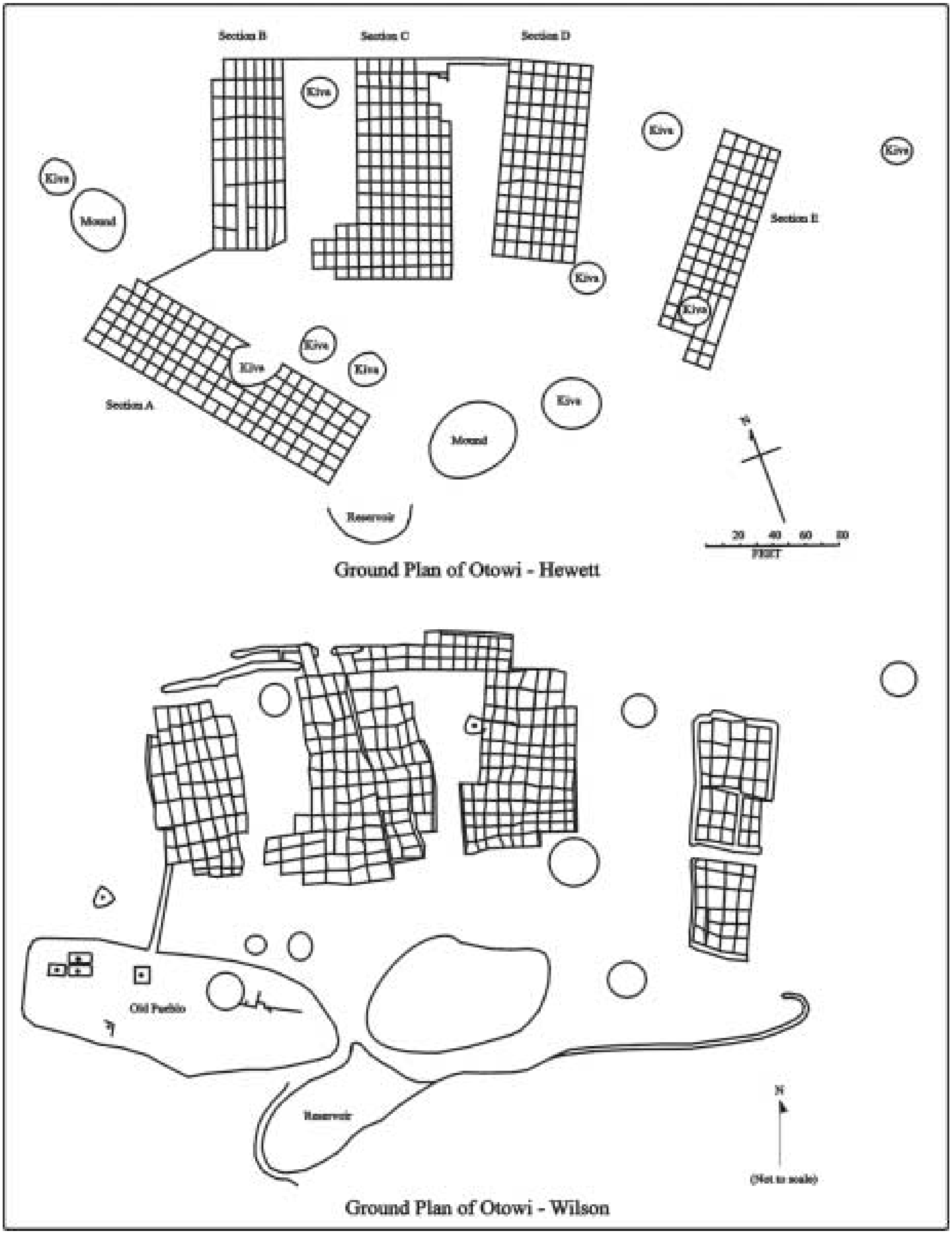


Figure 4.1. The Hewett and Wilson maps of Otowi Pueblo.

In respect to Wilson's collections, Hewett states that

> the collection from Dr. Wilson's excavations went to the Commercial Museum of Philadelphia. With especial gratitude I acknowledge the recent gift of this valuable collection to our institution [Museum of New Mexico] in Santa Fe (Hewett 1938:130).

Steen also reports that the artifacts recovered from Wilson's excavations "are in the Museum of New Mexico" (Steen 1977:5). There are approximately 900 accession numbers for items from Wilson's Otowi excavations at the Museum of Indian Arts and Culture, Museum of New Mexico. In addition, Wilson's site photographs are curated at the Museum of New Mexico archives. An original copy of a J. Percy Adams' map of Wilson's work at Otowi is located at the Archeological Research Management System (ARMS), New Mexico Historic Preservation Division. This map is similar to the one published by Wilson (1916a), but has specific rooms that are outlined and marked with an "x."

H. P. MERA (1920s–1930s)

H. P. Mera conducted a series of surveys in the northern Rio Grande during the 1920s and 1930s. In the early 1930s his work focused on defining the area of biscuitware production, including visits to some of the larger pueblo sites on the Pajarito Plateau (Mera 1932, 1934). Tsirege (LA 170), Navawi (LA 257), Tsankawi (LA 211), and Otowi (Potsuwi'i; LA 169) were all visited, described, and had ceramic collections taken by Mera. Based on the relative ceramic chronologies, he suggested the initial occupation of these sites had occurred during the 14th century. Tsirege, Tsankawi, and Otowi continued to be occupied during the 15th century, with only Tsirege and Tsankawi remaining by the 16th century. The Laboratory of Anthropology (LA) was created in 1930, and it was Mera who assigned the first LA numbers to these sites. Mera visited LA 29, Little Otowi (LA 32), and Otowi (LA 169) in Technical Area (TA) 74. The surface collections from these sites are curated at the LOA/MNM.

BANDELIER NATIONAL MONUMENT: OTOWI SECTION (1935–1962)

Jim Fulton conducted the first archaeological survey in the area of LANL. This work was done on the Ramon Vigil Grant in 1935. Steen states that a "1935 survey was made by a forester, a map was made, and then the field book was lost, so the total result is a map of about 200 site locations" (Steen 1977:5). A copy of the Fulton map is curated at the ARMS, New Mexico Historic Preservation Division. A review of this map indicates that Fulton's survey only went as far north as Mortandad Canyon. Therefore, the White Rock Tract is the only part of the LCT area included within his survey. A single site (#105) was located southeast of Tsirege; however, there is no information on what the site is, and the scale of the map is too large to determine whether it is actually inside or outside the project area.

Robert Lister conducted stabilization work at Otowi and some of the nearby cavates in 1939 (Lister 1939a, 1939b, 1939c, 1939d, 1940a, 1940b). This involved removing debris along the outside sections of the walls from two of the large roomblocks. Approximately 250 ft of wall was exposed along the west- and/or south-facing façades. The walls were remortared and rechinked. In some cases, the initial floor of the rooms was below the modern surface. In this case backfilled materials were removed and a hole excavated through the wall to allow for interior drainage. Before and after photographs were taken of all the walls. Artifacts were collected during the project, including sherds, projectile points, clay pipes, axes, and grooved abraders (i.e., arrow shaft straighteners). Artifacts recovered during this project are curated at the Western Archaeological and Conservation Center, National Park Service (WAC/NPS).

Salvage excavations were conducted by J. W. Hendron of two sites located on the mesa north of Los Alamos Canyon. The sites were situated in the construction right-of-way for the road to Los Alamos. Potsuwi'i I is a one-room fieldhouse, and Potsuwi'i II is a ten-room pueblo. A review of the records at ARMS indicates that neither site was given an LA number. A report was never written for the first site, however, one was completed for Potsuwi'i II (Hendron 1945). The site consists of a linear, two-room-deep roomblock. Several of the east-facing rooms contain hearths, indicating that the front rooms were probably habitation rooms and the back rooms were used for storage. The walls were constructed of unshaped blocks with adobe mortar and underlain with foundations of river cobbles and adobe. Very little artifactual material was recovered from inside of the rooms; however, habitation Room 3 did appear to be burned and contained numerous burned corncob fragments. An earlier pit structure was situated below the room foundations at the southern end of the roomblock. The structure was partly filled with refuse after it had been abandoned. This room was obviously not associated with the main occupation at the site. Approximately 3000 sherds, 350 chipped stone artifacts, five metates, 10 manos, and other various artifacts were recovered from these excavations. The ceramics primarily consist of Santa Fe Black-on-white reflecting a Coalition period occupation. Artifacts recovered from the excavation of Potsuwi'i II are curated at WAC/NPS.

John Turney conducted a survey of the Otowi section of Bandelier National Monument in 1955 (Turney 1955). The Otowi section included portions of Barrancas, Bayo, Pueblo, Otowi, Los Alamos, Sandia, and Mortandad Canyons. He visited and made surface collections of diagnostic sherds from 55 sites: LA 42, LA 169, LA 211, LA 338, LA 394, and LA 2760–LA 2999. Several sites appear to have subsequently been given new LA numbers: 2761–2764 as 8709–8712, 2968 as 8734, and 2985–2988 as 8735–8738. Two of these sites are included within the LCT area: Otowi (LA 169) and LA 394, which is a Coalition site with several mounds. Turney analyzed a total of 13,875 sherds. Table 4.1 presents the results of this analysis for the total project sites LA 169 and LA 394. As can be seen, about 40% of the sherds were identified as culinary wares, 20% as Santa Fe Black-on-white, 20% as Biscuit B, 6% as Biscuit A, 5% as Wiyo, 2% as Sankawi Black-on-cream, and 7% for other types. Most of the Santa Fe Black-on-white was present on the small linear Early Coalition period sites, Wiyo Black-on-white on the Late Coalition plaza pueblos, and the biscuitwares on the Classic period pueblo sites. For example, the majority of the ceramics from LA 394 are Santa Fe Black-on-white with some Wiyo Black-on-white; whereas, Biscuit B dominates the ceramics from LA 169. Artifacts collected during the survey are curated at WAC/NPS.

Table 4.1. Turney Survey Ceramic Analysis Data*

Ceramic Type	Otowi (LA 169)	LA 394	Total Project
Culinary wares	41.4	54.5	38.0
Santa Fe Black-on-white	4.5	33.3	20.7
Basket impression	0.0	0.0	0.1
Wiyo Black-on-white (plateau variant)	1.3	6.8	5.2
Wiyo Black-on-white	2.4	5.4	4.7
Biscuit A	7.7	0.0	6.3
Biscuit B	36.5	0.0	20.8
Potsuwi'i Incised	1.2	0.0	0.5
Sankawi Black-on-cream	3.0	0.0	2.0
Kwahe'e Black-on-white	0.1	0.0	0.1
Jemez Black-on-white	0.0	0.0	0.1
Little Colorado Redwares	0.0	0.0	0.1
Mesa Verde Black-on-white	0.0	0.0	0.1
Galisteo Black-on-white	0.0	0.0	0.1
Poge Black-on-white	0.1	0.0	0.1
Galisteo Glaze	0.0	0.0	0.1
Kapo Black	0.0	0.0	0.2
Rio Grande Glaze	1.0	0.0	0.7
Possible Glaze	0.6	0.0	0.4
Unidentified	0.3	0.0	0.3

* The information is provided by column percentages as given by Turney (1955).

During the 1960s, the Otowi section, including the area around Otowi Pueblo, and Mortandad Canyon was transferred from National Park Service to Los Alamos Scientific Laboratory (LASL) control.

FREDERICK WORMAN (1950–1971)

Frederick Worman was the archaeologist at the LASL from 1950 to 1971. His work focused on salvage archaeological surveys and excavations for proposed construction projects. Worman did excavate two Coalition sites within the project area. LA 4710 is a double-rowed pueblo with eight rooms located at TA-21 (Figure 4.2). No site report was written; however, there is a brief description, a site sketch map, and photographs provided by Steen (1977:54–56). The walls consisted of tuff blocks with adobe mortar.

Most of the rooms along the eastern side of the pueblo contained collared hearths, presumably reflecting a domestic function; whereas, the back rooms at the site were presumably used for storage.

LA 4729 was located on a bench along the southern side of Los Alamos Canyon. It consisted of a double row of ten rooms (Figure 4.2). Worman died before a site report was written; however, Steen provides a brief description, site sketch map, and photographs (Worman and Steen

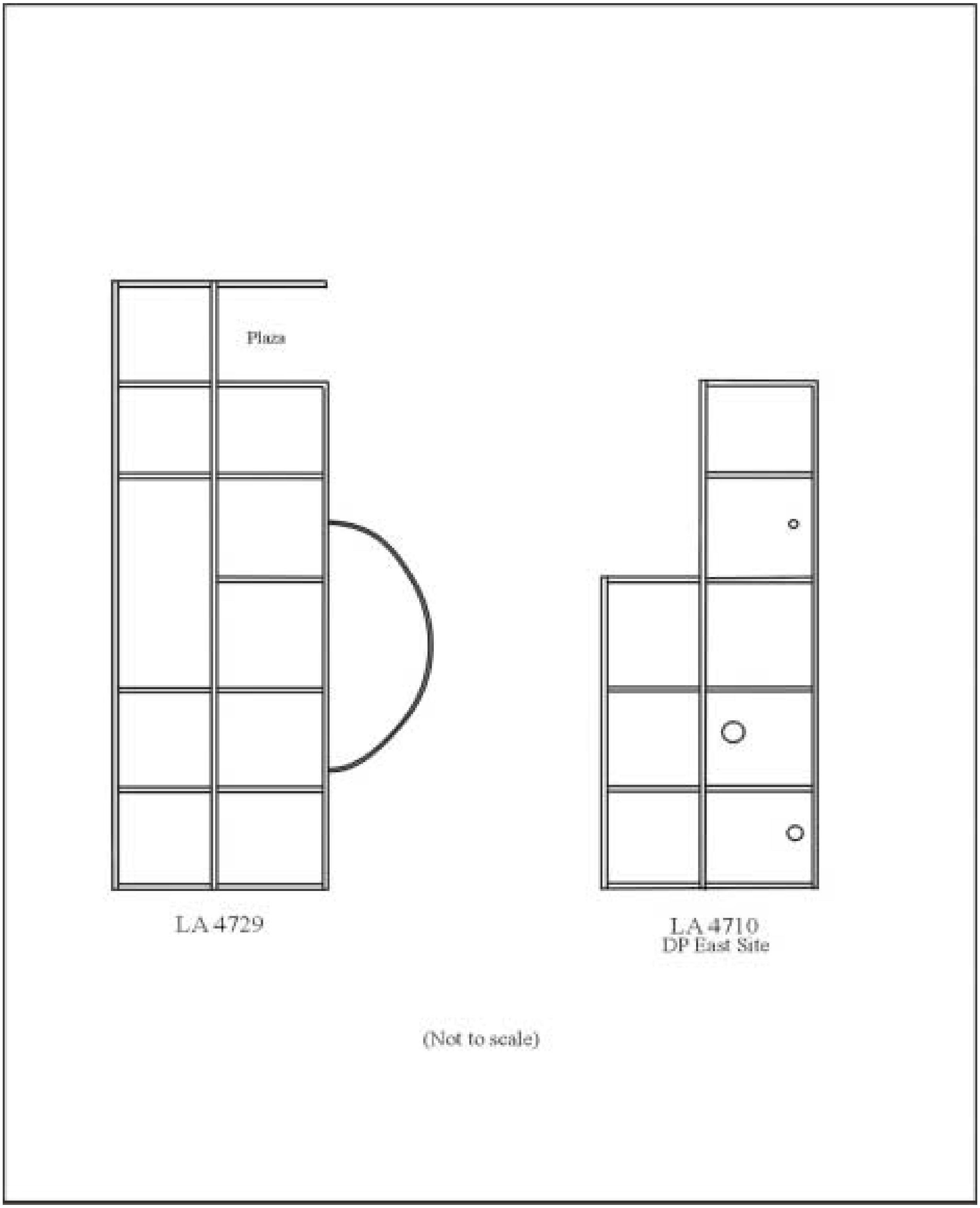


Figure 4.2. Drawing of the two sites surveyed by Frederick Worman that are in the LCT area.

1978:2–9). No hearths are noted on the map, but photographs reveal that plaster was still adhering to the walls in several rooms. LA 4729 was destroyed by a gravel borrow pit. Artifacts recovered from the excavations of LA 4710 and LA 4729 are curated at the LOA/MNM. A human skull fragment recovered from LA 4710 is curated at the Maxwell Museum of Anthropology, University of New Mexico.

CHARLIE STEEN (1973–1981)

Charlie Steen was the LASL archaeologist from 1973 to 1981. He conducted a three-year survey from 1973 to 1975 (Steen 1977). As stated by Hansen (1977) the project had three main objectives: 1) to evaluate and summarize the previous survey and excavation work done by Worman, 2) to survey LASL lands in anticipation of future construction projects, and 3) to recommend sites for inclusion to the National Register of Historic Places. The survey was conducted

> to locate and identify ruins that might be destroyed or damaged by future construction, the search was concentrated on the mesa tops. No particular effort was made to locate groups of cavate rooms (Steen 1977:3).

After the initial surveys, Steen's work focused on specific construction locations. He lists 37 new sites that were recorded since 1977 (Steen 1982); however, most of these were identified during the reconnaissance of the area burned by the La Mesa fire.

Within the LCT area Steen originally recorded at least 17 archaeological sites: LA 12587A–D, LA 12605, LA 14870, LA 15116, LA 15117, LA 16798, LA 3500, LA 35001 A–F, and LA 35002. These sites are located within the White Rock, White Rock Y, Rendija Canyon, and TA-74 land tracts.

PAJARITO PLATEAU ARCHEOLOGICAL PROJECT (1977–1985)

James Hill of the University of California, Los Angeles (UCLA) directed the Pajarito Plateau Research Project (PARP). This project was the first systematic archaeological survey conducted on the plateau (Hill and Trierweiler 1986). It was organized into three phases from 1977 to 1985. A small portion of the Phase I sample survey did include open access areas on LASL lands near Otowi Pueblo and White Rock, and the Phase II survey included various sample quadrats across LASL. PARP recorded a total of 251 sites at LASL during this time period. This consists of 185 sites that were originally recorded by PARP, and an additional 66 sites that were re-recorded Mera, Worman, or Steen sites. PARP used LA numbers ranging from 21268 to 21686 and 29721 to 29797. Approximately 200,000 sherds and 60,000 lithic artifacts were collected from 246 sites. These artifacts are curated at a UCLA facility (Walsh 1999 pers. comm.). Thirteen of these sites were recorded by PARP within the LCT area: LA 21439, LA 21511, LA 21584, LA 21585, LA 21591, LA 21592, LA 21593, LA 21595, LA 21596A–C, LA 21636, LA 21637, LA 21638, and LA 21639. In addition, they revisited previously recorded sites like Otowi (LA 169) and Little Otowi (LA 32).

DAVID SNOW (1983–1985)

David Snow was a contracting archaeologist to LANL from 1982 to 1985. Most of this work consisted of small clearance surveys within proposed construction areas. None of his work was conducted within the LCT area.

BEVERLY LARSON (1986–1997)

Beverly Larson replaced David Snow as contracting archaeologist to LANL from 1986 to 1997. During the 1980s and early 1990s most of this work also consisted of small surveys within proposed construction zones. The first large-scale survey project conducted by the Cultural Resources Management Team was for the Environmental Restoration (ER) Project from 1991 to 1994. Members of the survey teams included Tim Binzen, Ellen McGehee, Steve Hoagland, Mike Hannaford, Steve Lakatos, and Kari Manz. A total of 59 sites were recorded in seven of the LCT tracts as part of the ER Project. This includes Operable Units 1049 and 1106. Table 4.2 lists the site numbers by tract.

Table 4.2. Sites Recorded within the LCT during the ER Project

Tract	LA Numbers
TA-21	86544, 110122, 110141
DP Road	86545
Airport	86533–86535
White Rock	86636, 86637
Rendija Canyon	70025, 70026, 86553, 86604–86607
White Rock Y	86634, 110113, 110115
TA-74	86528–86532, 86542, 86543, 110121, 110126–110136, 110138, 11040, 117883, 127644–127665

Jim Jorgensen conducted a cavate survey at LANL during the 1980s. He was a LANL employee who volunteered to do this project. Approximately 40 cavate sites were recorded, including sketch maps, photographs, and site forms. Several of these sites are located in Los Alamos Canyon: LA 15117, LA 16798, LA 21638, LA 21639, LA 127636, and LA 127637.

Two archaeological surveys were conducted by the Museum of New Mexico as part of a road construction project along State Road 4 and the White Rock Y in 1987 (Moore and Levine 1987; Wiseman 1987). One of the sites recorded by Moore and Levine (1987) is situated within the LCT area. LA 65007 consists of a Late Archaic lithic scatter. Testing revealed the presence of subsurface artifacts in five of the seven test pits. Most of the artifacts were limited to the surface and upper 40 cm (16 in.) of soil, but one test pit did yield artifacts to a depth of 90 cm (36 in.) (Moore 1993).

Wiseman (1987) identified 18 archaeological sites within the LCT area during his survey of the White Rock Y: LA 61033 to LA 61050. Fifteen of these sites are lithic and sherd scatters, with a single rubble mound, a rock art site, and a lithic scatter. The sites include components dating from Middle to Late Archaic, Coalition, and Classic periods. Test excavations were conducted at 11 sites, including the nine lithic and ceramic scatters, the rock art site, and the lithic scatter. The latter site was determined to also include ceramics. The rock art site was photographed, and tracings were made of the petroglyphs. Subsurface artifacts were identified at all but two of the tested artifact scatters; however, these items were primarily limited to the upper 10 cm of sediment. Buried pithouses were identified in two separate areas at the east end of site LA 61041. These pithouses were subsequently given new site numbers (LA 65420 and LA 65421). They are associated with Santa Fe Black-on-white ceramics, and therefore appear to date to the Coalition and not the earlier Developmental period.

An archaeological survey was conducted for the proposed Bason Land Exchange in Rendija Canyon in 1992 (Hill 1992). Thirty archaeological sites were recorded within the LCT area: LA 85402 to LA 85870. Most of these sites consist of fieldhouses, with three rock features, a lithic and ceramic scatter, a lithic scatter, a wagon trail, a possible tipi ring, and a homestead. The fieldhouses date to the Coalition and Classic periods, and the artifact scatters to the Coalition and Middle Archaic periods. Twenty-six of the 30 sites were subsequently tested, and an additional six sites were also located and tested (LA 99391 to LA 99397; Peterson and Nightengale 1993). Sixteen of these sites were considered eligible consisting of 12 fieldhouses, two lithic scatters, and two tipi ring sites.

LANL SURVEY DATA

As of 1997, a total of approximately 16,000 acres had been 100% surveyed and an additional 5500 acres unsystematically surveyed at LANL. The former figure represents about 57% of the land area at LANL. A total of 1595 sites have been recorded, for a site density of about 0.1 sites per acre or 24.8 sites per km^2. This compares with the PARP figure of 21.8 sites per km^2.

Table 4.3 presents a contingency table of survey team by site type. These survey teams consist of Steen, PARP, and LANL. The figures for Steen and LANL include sites that they originally recorded; whereas, the PARP figure includes sites that were both originally recorded and revisited by PARP. This was done because their survey represents specific sample quadrats. As can be seen, there is a significant difference in the distribution of site types by survey team (chi-sq = 282.9, df = 12, p = <0.001). Adjusted residuals were therefore calculated to determine which of the contingency table cells were contributing to the significant chi-square value. Adjusted residuals greater than 1.96 or –1.96 are significant at the 0.05 level. There were significantly more small pueblos and plaza pueblos recorded by Steen, as compared to more artifact scatters and plaza pueblos identified by PARP and more artifact scatters, cavates, prehistoric other, and historic sites recorded by LANL. The results reflect the differing project objectives, site definitions, and survey techniques used by each group. Steen conducted these surveys alone and used a meandering survey technique that emphasized the identification of large rubble mounds. In contrast, PARP teams recorded a variety of prehistoric artifact scatters and pueblo habitation sites, whereas, LANL teams identified a range of prehistoric and historic sites, including smaller sites like trails and water-control features.

Table 4.3. Survey Team by Site Type

Site Type	Steen	PARP	LANL	Total
Artifact scatter	14* -8.0	73 5.7	161 2.7	248
One- to three-room fieldhouse	102 0.9	57 -1.0	208 0.0	367
Pueblo roomblock (linear)	141 10.8	53 1.1	77 -10.4	271
Plaza pueblo (L-shaped, U-shaped, and enclosed)	29 5.0	19 3.8	4 -7.3	52
Cavate	33 -2.9	18 -3.0	138 4.9	189
Prehistoric other	25 -4.1	21 -2.2	136 5.3	182
Historic sites	35 -0.5	10 -3.5	99 3.1	144
TOTAL	379	251	823	1453

Chi-square = 282.9, df = 12, p = <0.001

*Upper number is cell frequency and lower number is adjusted residual value. Significant positive adjusted residual values are highlighted in bold. This table includes sites that were originally recorded and revisited by PARP.

CHAPTER 5
CULTURAL RESOURCE DESCRIPTIONS

STEVEN R. HOAGLAND AND BRADLEY J. VIERRA

This chapter describes cultural resource sites by land conveyance and transfer tract.

AIRPORT TRACT

LA 86533

LA 86533 (S-11) is a large lithic scatter situated on Los Alamos "Town Site Mesa." It abuts against the south side of Highway 502 in an area sparsely vegetated with piñon and juniper trees at an elevation of 2149 m (7050 ft).

The lithic scatter is sparsely distributed over a 50 m north-south by 400 m east-west area. Most of the artifacts represent the by-products of obsidian core reduction and tool production/maintenance, with a few items being made of Cerro Pedernal chert. A Late Archaic corner-notched obsidian projectile point was observed. In addition, two isolated Santa Fe Black-on-white sherds are present. The site has been partially disturbed by the adjacent road, with evidence of erosion along the southern (downslope) side of the site. Based on the presence of the diagnostic projectile point, the site dates to the Late Archaic period. However, a small portion of this scatter may actually be associated with LA 86534 located on the opposite side of the road.

LA 86534

LA 86534 (S-11) is a possible roomblock located to the immediate north of Highway 502 on Los Alamos "Town Site Mesa." It is situated at an elevation of 2149 m (7050 ft) in an area sparsely vegetated with piñon and juniper trees.

The site is characterized by several alignments of shaped and unshaped tuff blocks that cover a roughly 18 m north-south by 16 m east-west area. The alignments are situated amongst several trees that partially obscure surface visibility. A possible midden area is located southwest of the possible roomblock. It consists of an east-west-oriented mound or rise situated adjacent to the road. Although there is a sparse artifact scatter in this area, it is unclear as to whether this rise reflects buried cultural deposits or simply disturbed road fill.

The associated artifact scatter covers an area measuring approximately 50 m north-south by 44 m east-west. The majority of the ceramics consist of Santa Fe Black-on-white with fewer indented corrugated, smeared-indented corrugated, St. John's Black-on-red, and Wiyo Black-on-white. The lithic artifacts primarily consist of obsidian and chert debitage. An obsidian projectile point tip was observed. One mano fragment was found in the midden area and one possible polishing stone was also noted. Based on the diagnostic ceramics, the site appears to date to the Coalition period.

LA 135290

LA 135290 is a small roomblock that is situated on the Los Alamos “Town Site Mesa” a short distance north of State Road 502. The area is sparsely vegetated by piñon and juniper trees at an elevation of 2164 m (7100 ft).

The roomblock consists of a north-south-oriented mound that is 15 by 12 m in area and about 30 cm high. The size of the mound, as well as several apparent tuff block wall alignments, suggests that the roomblock contains from six to ten rooms. The tuff blocks composing the rubble mound average 25 by 20 by 15 cm in size.

The associated surface artifact scatter includes approximately 300 to 400 sherds and 100 pieces of lithic debitage distributed throughout a 40 by 60 m area surrounding the pueblo. The majority of these artifacts are located to the east of the roomblock, possibly reflecting the presence of a midden. In-field analysis was conducted on artifacts from three established dogleashs. One 2.5 m diameter dogleash was located west of the pueblo and two 2 m diameter dogleashs were located east of the pueblo. Analyzed ceramics include 12 decorated sherds and 94 utilityware sherds. The decorated ceramics consist of 11 Santa Fe Black-on-white and a single Wiyo Black-on-white sherd. The utilityware ceramics consist of 19 indented corrugated sherds, 49 smeared-indented corrugated sherds, 22 obliterated sherds, and four nonmicaceous plainware sherds. The lithic debitage consists of a piece of angular debris, three core flakes, and three flake fragments made of Cerro Pedernal chert and a single piece of angular debris and two core flakes made of basalt. Also noted within a dogleash was a basalt metate fragment. Based on the diagnostic ceramics, the site appears to date to the Coalition period.

WHITE ROCK TRACT

LA 12587

LA 12587 (LA 12587C) is a multicomponent site including the remains of a roomblock and a separate lithic scatter. It is situated on a knoll at the southern end of Mesita del Buey, at the confluence of Cañada del Buey and Pajarito Canyon. The area is covered with some piñon and juniper trees at an elevation of 1979 m (6500 ft). The roomblock is located on a small knoll; whereas, the lithic scatter is located downslope and south of the roomblock.
The site contains a fairly sparse and dispersed scatter of tuff rubble. One rough north-south alignment is visible in the southern area of the rubble scatter. The overall distribution of rubble covers an area measuring 20 m north-south by 15 m east-west. However, there is one roughly 7 by 3 m area that could represent a single roomblock and an additional two or more areas with tuff blocks. The latter may represent small roomblocks or, possibly, grid gardens. There are somewhat more artifacts located to the east of the main roomblock, possibly indicating the presence of a midden area. The site area is highly eroded, and a strip running through the south-central portion of the site has been disturbed by a bulldozed power line access road.

The associated artifact scatter, which encompasses the rubble concentration, contains hundreds of artifacts distributed over an area measuring approximately 140 m north-south by 100 m east-west. The artifact distribution suggests that the site is multicomponent with an Archaic and a Coalition period occupation. Remains from the Archaic period occupation primarily compose the southern one-third of the site, while the Coalition period remains are predominantly situated within the northern two-thirds of the site. Infield analysis was conducted on 100% of the artifacts found within two 1 m dogleashes, one 2 m dogleash, and a 5 m by 27 m sample transect unit. The dogleashes were located within the northern Coalition period site area, and the sample transect was located within the Archaic period area of occupation.

The majority of decorated ceramics within the Coalition period occupation area were Santa Fe Black-on-white sherds, with a few Wiyo Black-on-white and a Biscuit A sherd also noted. The utilityware ceramics were dominated by smeared-indented sherds with a few indented corrugated and obliterated sherds also present. The southern Archaic period occupation area included one Santa Fe Black-on-white sherd, one Biscuit A sherd, two Biscuit B sherds, and two smeared-indented utilityware sherds.

Approximately 70% of the lithics observed within the three Coalition area dogleashes were made of Cerro Pedernal chert, with some obsidian, basalt, chert, and quartzite. The debitage from within the dogleashes were primarily core flakes (71%) or angular debris (15%). Other noted chipped stone artifacts included biface flakes, microdebitage, and a core.

In contrast, obsidian comprised over 96% of the chipped stone debitage situated within the south side sample transect. Other noted chipped stone materials were Cerro Pedernal chert, other chert, and basalt. Excluding over 100 pieces of obsidian microdebitage located on an anthill, the chipped stone in this area was fairly evenly split between core flakes (32%), biface flakes (29%), and microdebitage (26%). The remaining debitage were either unidentified flakes (12%) or angular debris (1%). Also noted in the southern portion of the site were a corner-notched, Late Archaic obsidian projectile point base and a rhyolite one-hand mano.

Based on the very high percentage of obsidian debitage and the corner-notched projectile point, the southern portion of the site probably dates to the Late Archaic period. Whereas, the presence of Santa Fe Black-on-white sherds indicates that the northern portion of the site dates to the Coalition period.

LA 86637

LA 86637 is a fieldhouse surrounded by a dispersed ceramic and lithic artifact scatter. The site is located on a small rise above an ephemeral drainage at the mouth of Cañada del Buey. The area is vegetated by piñon-juniper woodland, with the site being situated at an elevation of 1973 m (6475 ft).

The site consists of a fieldhouse that is situated within a much larger lithic and ceramic artifact scatter. Much of this material appears to be part of a background scatter that reflects a long period of use over a 45 by 90 m area. The fieldhouse is a small rubble mound measuring 2.5 by 3.7 m in size that probably represents two rooms. It is constructed of shaped tuff blocks, the largest of which measures about 80 cm in length. The mound is in good condition. An infield analysis was conducted in a 10 m catchment area around the structure (Sample 1). A total of 46 artifacts were recorded. A single Biscuit B and obliterated corrugated sherd with some Cerro Pedernal chert debitage were identified near the fieldhouse.

A dense cluster of lithic and ceramic artifacts is located about 50 m downslope from the fieldhouse. A 10 by 20 m transect that included much of the scatter was analyzed in this location (Sample 3). A total of 55 artifacts were recorded, including a few sherds of Santa Fe Black-on-white, Wiyo Black-on-white, biscuitwares, Sankawi Black-on-cream, Tewa Polychrome, and utilitywares (n = 15). Most of the artifacts in the artifact cluster were Cerro Pedernal chert and obsidian core flakes, with a few other debitage types, two cores, a retouched flake, two projectile points, and a one-hand mano. The projectile points are made of obsidian and appear to be Late Archaic in age. One of these points was collected, consisting of a heavily resharpened stemmed point. Two unmodified quartzite river cobbles and three quartzite one-hand manos were also recorded on the site. Much of this material appears to be part of a background scatter that reflects multiple components.

Based on the single Biscuit B sherd and the presence of shaped masonry blocks, the fieldhouse probably dates to the Classic period. However, the background lithic and ceramic artifact scatter distributed across the site appears to contain components dating from the Late Archaic, Coalition, Classic, and early Historic periods.

LA 127625

LA 127625 (K-170) is a dispersed artifact scatter situated in a low-lying, flat area just east of the mouth of Cañada del Buey. However, artifacts do extend up the talus slope to the north, although not to the top of the mesa. The local vegetation includes juniper, ponderosa pine, prickly pear, sage, and various grasses. The site is located at an elevation of 1951 m (6400 ft).

The site is distributed over a roughly 160 m east-west by 90 m north-south area. An in-field analysis was conducted on approximately 50% of all flagged artifacts (n = 140). Santa Fe Black-on-white amounted to 34% of the total ceramic assemblage; whereas, smeared-indented and indented corrugated sherds accounted for another 36%. Lesser amounts of undefined redwares and Sankawi Black-on-cream were also present along with a very small number of miscellaneous sherds. Lithic materials were mostly comprised of Cerro Pedernal chert with a lesser amount of black translucent and opaque brown Jemez obsidian and Polvadera Peak obsidian. A few flakes of basalt and rhyolite were also present. Most of the chipped stone artifacts were core flakes or pieces of angular debris. One small projectile point fragment was located but it was too small to be identified. A rhyolite milling stone was also recorded. Based on the associated artifact assemblage, this site probably dates to the Coalition period.

LA 127631

LA 127631 (Q-247) is a fieldhouse located on the floodplain at the mouth of Pajarito Canyon. There are some piñon and juniper trees in the area woodland, with the site being situated at an elevation of 1977 m (6494 ft).

The site consists of an eroded one-room fieldhouse. The rock alignments are made from approximately 25 shaped and unshaped tuff blocks that are situated within a 3 by 2.2 m area. The tuff blocks exhibit an average size of 25 by 18 by 10 cm. The site area is eroding slightly downslope along the northern edge of the canyon floodplain.

One Santa Fe Black-on-white ceramic sherd was observed in a drainage located about 2 m northwest of the feature. Otherwise, no other artifacts were identified. Based on the assumed association of the sherd, this site presumably dates to the Coalition period.

LA 128803

LA 128803 (LA 12587A, H-2) is a possible grid garden located at the mouth of Cañada del Buey. The area is vegetated by piñon and juniper trees, with the site being situated at an elevation of 1967 m (6462 ft).

The site consists of a possible grid garden composed of several basalt rock alignments within an area measuring 6 by 3 m. The site is somewhat eroded, although the integrity of the rock alignments appear to be intact.

A review of the site area identified a single chert flake and a quartzite hoe; however, no ceramic artifacts were observed. Based on the observed artifacts and style of construction, this site presumably represents an Ancestral Pueblo site.

LA 128804

LA 128804 (LA 12587B, H-3) is an isolated check dam situated on a shallow slope at the mouth of Cañada del Buey. The area is vegetated by piñon and juniper trees at an elevation of 1980 m (6495 ft).

The check dam is an alignment of 12 large basalt blocks ranging in size from 0.60 to 1.25 m in length. The 7 m long alignment bisects a small northeast-to-south-trending drainage. The site area, including associated artifacts, is in a 10 by 10 m area.

Although a few artifacts are present in the area of the feature, it is unclear as to whether they are associated with the feature. These include some smeared-indented utilityware, Santa Fe Black-on-white, and Wiyo Black-on-white sherds. The date and cultural affiliation of the site is undetermined.

LA 128805

LA 128805 (LA 12587D, H-1) is a one-room fieldhouse located on the floodplain between the mouth of Cañada del Buey and Pajarito Canyon. The site is situated in an area vegetated by piñon and juniper trees at an elevation of 1978 m (6490 ft).

The site consists of a one-room fieldhouse with visible wall alignments. It measures 3.3 by 2.5 m in size. Its masonry consists of tuff blocks ranging from 0.45 to 1.35 m in length and averaging 0.35 m in width. The site area has been impacted by heavy erosion.

Infield artifact analysis documented Santa Fe Black-on-white and smeared-indented corrugated utilityware sherds. The lithic artifacts included mostly basalt (60%), with less obsidian and chert flakes. Artifacts were sparse and scattered in a 15 by 15 m area around the feature. Based on the diagnostic ceramics, the site dates to the Coalition period.

RENDIJA CANYON TRACT

LA 15116

LA 15116 (K-138) is a one-room fieldhouse located on a bench along the south side of Rendija Canyon. The area is covered with ponderosa pine trees, although they were severely burned during the Cerro Grande fire. The site is situated at an elevation of 2116 m (6944 ft).

The feature is primarily constructed of unshaped tuff cobbles stacked against large boulders that form the southwest corner of the structure. It has interior dimensions of 3 by 3.5 m that includes a smaller interior compartment. Small piñon and juniper trees have impacted the southeast corner of the structure. Heavy surface duff obscured surface visibility and no artifacts were observed in the area of the structure. Based on the architecture, the site presumably reflects an Ancestral Pueblo cultural affiliation.

LA 70025

LA 70025 consists of two one-room fieldhouses that are located on a low ridge near the mouth of Cabra Canyon. The site is situated at an elevation of 2122 m (6960 ft) in an area vegetated by ponderosa pine trees with a few juniper and scrub oak trees present. The area was severely burned during the Cerro Grande fire.

The two rubble mounds are approximately 7 m apart and are composed of tuff blocks, three or four of which appear to be roughly shaped. The western structure is slightly upslope and is approximately 2 m^2 in size. Due to the extremely dense pine duff cover, more specific measurements could not be obtained. The second structure is approximately 3 m^2 in size and has masonry stones that have eroded downslope to the south.

The majority of the artifacts at the site were found south and downslope of the eastern structure. They include one worked Santa Fe/Wiyo Black-on-white or Biscuit A bowl sherd, three additional sherds from one vessel (including a rim fragment and two body sherds), and one Cerro Pedernal chert flake. One of the body sherds has a thick and crackled slip and could be a Galisteo Black-on-white or a biscuitware.

Based on the diagnostic ceramics, the site probably dates to the Late Coalition or Early Classic period.

LA 70026

Site LA 70026 (L-54) is a possible historic log enclosure located in the bottom of Cabra Canyon. The site is situated at an elevation of 2118 m (6950 ft) in ponderosa pine forest that was severely burned during the Cerro Grande fire.

The structure was constructed out of a single tier of logs. These log "footings" indicate one complete enclosure and two smaller possible enclosures. A large rock pile is located inside the main enclosure and could be the result of a tree fall. The main enclosure is approximately 5 m north-south by 7 m east-west. The entire site area measures approximately 16 m north-south by 10 m east-west. The Cerro Grande fire burned all the wood elements at the site. All that currently remains is the rock pile.

The site is apparently historic in age, although no artifacts were observed in the area of the feature. Nonetheless, the logs are weathered and deteriorated with evidence of historic lumbering activities (cut stumps) in the area. The logs had been cut with a handsaw and placed across each other. No cut notches, nails, or nail holes were observed. The feature appears to have been built with a minimal amount of effort. LA 70026 is probably an animal pen, although it could also represent a temporary structure associated with the nearby lumbering activities. The site probably dates to the Homestead period.

LA 85402

LA 85402 is a fieldhouse situated on the south side of Rendija Canyon, along the edge of an unnamed drainage. The site lies on a north-facing slope in an area of piñon, juniper, and ponderosa pine trees at an elevation of 2152 m (7060 ft).

The site could not be relocated, with the following site description being taken from the original survey form completed for the Basin Land Exchange Survey by David Hill. The site is comprised of an irregular shaped structure made of unshaped tuff cobbles. It is approximately 2 m in diameter. The northernmost wall stands 35 cm in height with three courses of undisturbed masonry. The artifacts observed at the site consist of two biscuitware sherds located 2.5 m north of the structure. These sherds appear to be from different vessels. Based on the ceramics the site dates to the Classic period.

LA 85403

LA 85403 consists of a fieldhouse situated along the south side of Rendija Canyon in a relatively flat open area at an elevation of 2131 m (6990 ft). The area is sparsely covered with ponderosa pine trees.

This site consists of a single rectangular-shaped masonry room. The room is outlined by several unshaped tuff block alignments that together bound a 5 by 5 m area.

Only two obsidian flakes and one chalcedony flake were observed at the site. Based on the architecture, the site presumably reflects an Ancestral Pueblo cultural affiliation.

LA 85404

LA 85404 consists of a fieldhouse, two rock features, and a diffuse scatter of artifacts. It is located on the south side of Rendija Canyon at an elevation of 2120 m (6954 ft). An intermittent drainage runs to the immediate east and south of the site, cutting through the ponderosa pine forest.

Feature 1 consists of a rectangular outline of unshaped tuff blocks that measures 4.3 by 5 m in size. This feature might represent a fieldhouse. Feature 2 consists of a linear arrangement of unshaped tuff cobbles measuring 2.5 by 13 m. Since this feature is oriented parallel to the slope rather than perpendicular, it is more likely to represent a structure rather than an agricultural terrace. Lastly, Feature 3 is a rectangular fieldhouse comprised of shaped and unshaped tuff blocks that is 4 by 3.5 m in size. There is a 1 by 1 m charcoal stained area located to the immediate south of the rubble; however, it is unclear as to whether this feature is associated with the fieldhouse or is a recent disturbance.

The area is covered with a layer of pine duff that obscures surface visibility. Nonetheless, some obsidian debitage, a chalcedony flake, and three sherds were observed in the area of the features. The ceramics consist of an unpainted biscuitware, a Wiyo Black-on-white, and a Santa Fe Black-on-white sherd. Based on the ceramics, the site dates to the Coalition/Classic period.

LA 85405

LA 85405 is a possible fieldhouse located on a steep east-facing slope of a ridge to the north of Rendija Canyon. It is situated at an elevation of approximately 2134 m (7000 ft) in an area mostly covered with piñon and juniper trees, but with a few ponderosa pine trees.

The site primarily consists of a low mound of cobbles and boulders that measure about 4.5 by 4.5 m in size. There are other rocks scattered down the slope from the densest area of the concentration that presumably reflects eroded wall fall. The surface artifact scatter extends approximately 9 m downslope from the site feature.

As originally recorded a small concentration of the rocks just to the west of the main feature was interpreted as a possible hearth. Test excavations revealed that the feature was nothing more than a surface concentration of rocks.

Three 1 by 1 m test pits (A, B, and C) were excavated at the site. Unit A was located in a rock concentration, or possible hearth, at the west side of the main site feature. It was excavated to a depth of 36 cm with no cultural material being recovered. Units B and C were located within the southwest and northeast corners of the main feature, respectively. Unit B was excavated to a depth of 74 cm with a single biscuitware sherd being recovered. A definite structural wall was exposed in the south face of this excavation unit. Unit C was excavated to a depth of 44 cm with a single Biscuit B sherd and a tertiary flake of red chalcedony being found. Otherwise, no floor was identified within the structure. Eighteen sherds were collected from the surface area of the site. These consist of nine Biscuit B, one Biscuit A, three plainware, and three smeared-indented corrugated sherds. Based on the ceramics, the site dates to the Classic period.

LA 85407

LA 85407 is the Serna Homestead site that is situated on the mesa edge overlooking Rendija Canyon bottom to the south. It is located in an open meadow that is surrounded by piñon and juniper trees at an elevation of 2097 m (6880 ft).

Seven features were identified at the site. Feature 1 is the homestead cabin. The cabin consists of a rectangular-shaped alignment of logs about 5 by 10 m in size. Evidence of the wall foundations is visible, being represented by cobble alignments. Pieces of sheet metal reflect the remnants of roofing material. The original survey report notes that the cabin had been "completely demolished and/or burned" (Peterson and Nightengale 1993:99). The Cerro Grande fire burned much of what remained, with portions of a single log and a few isolated pieces of wood remaining.

Feature 2 is the remains of a stone horno about 3 m in diameter. Feature 3 is an L-shaped alignment of cobbles that measures about 1.5 by 2 m with the angle of the L pointing east. Feature 4 consists of the lower courses of a log structure. The feature is 5 by 5 m in size and probably opened to the north. Most of this feature burned during the Cerro Grande fire, with only two burned logs remaining. Feature 5 is the remains of a large corral defined by an outline of logs about 11 by 12 m in area. Although much of this feature also burned, there are several logs still remaining. Feature 6 is another L-shaped rock alignment. It measures 2 by 2 m in size, with the L pointing towards the southeast. Feature 7 consists of a small rock pile that is 0.6 m in diameter and 15 to 20 cm in height. A few fence posts are present along the periphery of the site. Again, most of these burned during the Cerro Grande fire, but a few are still present.

A sparse artifact scatter covers the site, including lard, sardine, coffee, kerosene, and condensed milk cans. Also present were pieces of galvanized sheet metal, purple glass fragments, a sherd of Kapo Black, and four obsidian flakes. Based on the artifact assemblage, historical documents, and oral history information, the site dates to the Homestead period.
Two 1 by 1 m test pits were excavated at the site. Unit A was placed in the horno. It uncovered portions of the horno, including stones, burned clay, and charcoal. Unit B was located in Feature 6. It was excavated to a depth of 20 cm with no cultural material being recovered.

LA 85408

LA 85408 is a possible fieldhouse located on the east-facing slope of a narrow ridge on the north side of Rendija Canyon. It is situated at an elevation of approximately 2124 m (6970 ft) in an area vegetated by piñon, juniper, and ponderosa pine trees.

The site consists of a mound measuring about 5 m by 6 m in size, and being between 20 cm and 30 cm in height. The feature is oriented north-south, with the majority of artifacts being located downslope to the northeast; however, a few artifacts were also found in the area southeast of the mound. There is a two-track road located 3 m to the south of the site.

A single 1 by 1 m excavation unit was excavated near the west corner of the structure (Unit A). A deteriorated bedrock was uncovered at a depth of 35 cm. Rock alignments and wall foundations exposed in the north and south sides of the unit are one course thick and do not extend to bedrock. Several pieces of chert, chalcedony, and basalt debitage were recovered, as were two ground stone fragments. Two additional ground stone artifacts were observed on the surface of the site, as were about 20 sherds. These include 11 Biscuit A sherds, two biscuitware, a White Mountain redware, and two utilitywares. Based on the diagnostic ceramics, the site dates to the Classic period.

LA 85409

LA 85409 consists of a possible fieldhouse situated on a fairly steep, west-facing slope along the north side of Rendija Canyon. It is about 50 m east of a southerly flowing intermittent drainage at an elevation of approximately 2121 m (6960 ft). The dominant vegetation in the area consists of piñon, juniper, and ponderosa pine trees.

The site consists of a low mound of unshaped cobbles and boulders that is partially covered by trees and a thick layer of duff. Due to these conditions it was very difficult to determine the exact size and configuration of the feature. It appears to be about 6 by 6 m in size and 20 cm in maximum height. Surface artifacts have mostly been found downslope from the feature.

A single 1 by 1 m test pit was excavated near the north wall of the surface structure (Unit A). Four levels were excavated down to bedrock, with no cultural materials being recovered.

Debitage found on the site includes one primary flake of Jemez obsidian, one large secondary flake of white chalcedony, and two angular pieces of chalcedony. Ceramics found on the site include 21 sherds of Biscuit A, eight sherds of Biscuit B, two sherds of an undifferentiated biscuitware, one sherd of Wiyo Black-on-white, one smeared-indented corrugated sherd, and six other utilityware sherds. The diagnostic ceramics indicate that the site dates to the Classic period.

LA 85412

LA 85412 is a possible fieldhouse located at the end of a narrow ridge overlooking a tributary to Rendija Canyon. The ridge is sparsely covered by piñon and juniper trees, being situated at an elevation of 2112 m (6930 ft).

The site can be divided into two proveniences. The main portion of the site consists of a small mound of unshaped cobbles that measures about 3 by 4 m in size. The mound is approximately 20 to 25 cm high, with a shallow depression at its center. The second provenience of the site consists of a concentration of cobbles located southeast and downslope of the main portion. This feature measures 4 by 4 m and possibly represents the remains of a room or some type of structure that was attached to the main portion of the site.

Two 1 by 1 m test units (Units A and B) were excavated within both of these features. Unit A was excavated to a depth of 40 cm. Obsidian and chalcedony artifacts were recovered from Levels 1, 2, and 3. A large cobble metate and a possible stone hoe were recovered from Level 4. A cigarette wrapper was found in Level 2, indicating that the depression in the center of the structure may be the result of pothunting. Unit B was excavated to pumice bedrock at a depth of

40 cm in three levels. The only artifacts recovered from this unit were two sherds of smeared-indented corrugated ware that were located in the first level. Very few artifacts were found at this site, but it presumably reflects an Ancestral Pueblo cultural affiliation.

LA 85413

LA 85413 consists of a possible fieldhouse located at the base of a narrow ridge that projects out onto the north side of Rendija Canyon. The site is situated at an elevation of 2109 m (6920 ft) in an area vegetated mostly by piñon and juniper trees.

The site consists of a small mound (Feature 1) that straddles a short slope with the upper and lower portions of the feature being situated on fairly level ground. The upper portion of Feature 1 measures approximately 3.5 by 4 m and resembles a single-room structure. The lower portion of the feature measures approximately 3 by 3 m. Two other features were recorded at the site. Features 2 and 3 are both short check dams that span a shallow wash. They are situated about 16 m northeast of Feature 1. Feature 2 measures about 1.5 m in length, and Feature 3 is about 2 m in length.

Two 1 by 1 m test pits were excavated into the site. Unit A was placed in the center of the upper portion of Feature 1, and Unit B was placed in the lower portion. Both units were excavated in an attempt to define room walls, floors, or floor features. Unit A was excavated to a depth of 60 cm. No floor or other features were found. Recovered artifacts include 13 pieces of chalcedony debitage, one Jemez obsidian secondary flake, and three Biscuit A sherds. The chalcedony debitage consisted of 11 tertiary flakes, one secondary flake, and one piece of angular debris. Unit B was excavated to a depth of approximately 60 cm. Two burned rocks were found in Level 1 and charcoal was found in Levels 1 and 2. A compact surface representing a possible floor was located at a depth of 39 cm. Recovered artifacts included nine pieces of chalcedony debitage, one obsidian flake, three Biscuit A sherds, and 10 smeared-indented corrugated sherds.
Twelve pieces of chalcedony debitage, a chalcedony core, and 41 ceramics were identified on the surface of the site. The ceramics consist of 23 Biscuit A, three Wiyo Black-on-white, five Black-on-red, four unidentified decorated, one smeared-indented, and five other utilityware sherds. Based on the diagnostic ceramics, the site dates to the Classic period.

LA 85414

LA 85414 is a possible fieldhouse located in an eroded area along the northern side of Rendija Canyon. The site is situated at an elevation 2109 m (6920 ft) in piñon-juniper woodland.

The site consists of a rock concentration that is approximately 4.5 by 4.5 m in size. The eastern edge of the feature has been impacted by erosion and a portion of the feature may well have been washed away. There is a two-track road in close proximity on the southeastern side of the feature.

Two 1 by 1 m test pits were excavated. Unit A, excavated to a depth of 62 cm, was located within the site feature in hope of locating a floor or floor features. Rocks were common throughout Levels 1 to 4; however, no clear alignments or floor surface were encountered.

Recovered artifacts include 11 pieces of chalcedony debitage, two pieces of obsidian debitage, nine smeared-indented corrugated sherds, and two other utilityware sherds. Unit B, excavated to a depth of 20 cm, was placed adjacent to what appeared to be the southwestern corner of the feature. It was placed in this locale in an attempt to locate the corner and define the structure wall. Rocks encountered across the eastern half of the unit did not form a clear alignment. The only artifact recovered was a piece of chalcedony angular debris from Level 1.

Surface lithics identified at the site include a chalcedony and obsidian flake. The lone surface ceramic artifact was a polished plain brown sherd. Given the artifact assemblage and architecture, the site presumably reflects an Ancestral Pueblo cultural affiliation.

LA 85417

LA 85417 consists of several rock features that are located on a low rise that forms a portion of the northern slope of Rendija Canyon. It is situated at approximately 2091 m (6860 ft). The dominant vegetation in the area is juniper, piñon, and ponderosa pine.

The main site feature, Feature 1, is a low rubble mound with concentrations of burned clay visible on the surface. This feature measures approximately 5 by 6 m in size and is between 10 and 15 cm in height. There are five other features on the site. Feature 2 is a rock concentration that measures about 3 by 2 m. Feature 3 is a rock concentration with a possible hearth that measures 2 by 2 m. Feature 4 is another rock concentration that measures 2 by 2.5 m. Features 5 and 6 are both rock alignments (i.e., possible check dams), which measure 4 m and 2 m in length, respectively. The surface artifacts were found to the east and southeast of Feature 1.

Seven test units were excavated in various areas of the site (Units A–G). Two 1 by 1 m test units were placed in Feature 1 (A and B), with a single 1 by 1 m unit being excavated in each of Features 2, 3, and 4 (C–E), a 0.5 by 0.5 m unit being placed within Features 5 and 6 (F and G). In addition, a 0.5 by 0.5 m test unit expanded out along the eastern side of the northeast quadrant of Unit E.

Unit A was excavated to a depth of 41 cm. Pieces of burned clay were found in Levels 1 through 3. Other cultural materials collected include a chalcedony flake and one plainware sherd from Level 2. Sterile clay was encountered over most of the unit to a depth of 30 cm. However, in the northeast quadrant of the unit the clay occurred at about 19 cm and there was a clear edge to this elevated clay layer. Several small pieces of charcoal were recovered from the surface of the elevated clay surface. It is possible that this clay layer is a corner of the floor of a jacal structure and that the layer is elevated due to the accumulation of soil within the structure.

Unit B was excavated to a depth of 20 cm. A dense concentration of burned clay was found on the surface as well as in the first level. Otherwise, no cultural materials were recovered.

Unit C was located in the area of a small rock feature that was interpreted as a hearth during the initial site visit. It was excavated to a depth of 30 cm. Pieces of partially burned wood were found in Level 1, indicating that this feature may be the remains of a hearth. However, the presence of intact burned wood suggests that the hearth may be recent.

Unit D was excavated to a depth of 40 cm. This excavation found no cultural materials. The rock concentration where Unit D was located may well have served as some type of soil control device.

Unit E was excavated to a maximum depth of 40 cm. This unit was placed on a possible hearth. The excavation indicated that the hearth was about 70 cm in diameter. It was outlined with flat rocks set on edge and the bottom of the hearth was lined with small cobbles. The deposits within the hearth consisted of a thin layer of gray ash, with layers of burned gray and red clay beneath. Artifacts recovered from within the unit included three plainware sherds, a sherd of clear glazed earthenware, and numerous small bits of rusted iron (possibly the remains of food cans). There were no artifacts found outside of the hearth. The presence of historic artifacts in the feature may indicate that it is also recent in age.

Unit F was excavated adjacent to the Feature 5 rock alignment that was interpreted as a possible agricultural feature. The unit was excavated to a depth of 40 cm with no cultural materials being recovered.

Unit G was placed adjacent to another rock alignment at Feature 6 that had also been interpreted as an agricultural feature. This unit was excavated to a depth of 35 cm with no cultural materials being recovered.

Six pieces of chalcedony debitage were recovered from the site; one from Unit A and the rest on the surface to the east and southeast of Feature 1. Including four utilityware sherds recovered from Test Units A and E, 57 sherds were collected from the site. With the exception of a single sherd that was tentatively identified as Wiyo Black-on-white, all of the remaining ceramics were utilityware sherds. The Wiyo Black-on-white sherd tentatively indicates a Late Coalition to Early Classic period occupation for this site.

LA 85859

LA 85859 is a small lithic scatter situated on an east-facing ridge along the north side of Rendija Canyon. The site is situated at an elevation of 2100 m (6890 ft) in an area vegetated by piñon, juniper, and ponderosa pine trees. The artifact scatter covers an area of approximately 225 m^2.

Two 1 by 1 m test units were excavated at this site. Unit A was placed at the edge of the artifact scatter and Unit B was placed upslope from the observed scatter. Unit A was excavated to a depth of 60 cm, with obsidian debitage being recovered from all but the first level of the unit. Unit B was excavated to a depth of 30 cm with no cultural materials being recovered. In addition, artifacts were collected from a 1 m wide by 15 m long transect that was laid out across the center of the site. Two Bajada projectile point bases were collected as a grab sample.

A total of 224 pieces of obsidian debitage were recovered from the excavation and 15 pieces were recovered from the sample transect. All of the debitage is the result of secondary or tertiary reduction. This suggests that partially reduced materials (core or preforms/bifaces) were transported to the site and were further reduced in the course of tool manufacture. Twenty of the flakes found on the site exhibit use wear or retouch. The presence of utilized flakes suggests that some type of processing activity occurred at the site; however, no materials were located that would identify what type, or types, of processing might have been conducted. Based on the diagnostic projectile points, the site dates to the Early Archaic period.

LA 85861

LA 85861 consists of a cluster of rocks that could be the remains of a fieldhouse. The site is situated on a gentle slope at an elevation approximately 2103 m (6900 ft). The dominant vegetation at the site is piñon, juniper, and ponderosa pine. The northern half of the site area, as defined by the surface artifacts, has sustained significant impact from water erosion.

Feature 1 is a cluster of rocks that measures 4 by 5 m in size; however, no clear alignments are present. A second feature (Feature 2) is an alignment of boulders that measures about 1.5 m in length. The function of this feature is undetermined.

A single 1 by 1 m test pit was excavated at this site. The unit was placed adjacent to a rock alignment. It was excavated to a depth of 55 cm, with ceramics being recovered from all but the upper excavation level. These include two Biscuit B and several utilityware sherds. Twenty additional sherds were collected from the surface of the site. These include five Wiyo Black-on-white, a Biscuit A, a Biscuit B, and 13 utiltyware sherds. Six lithic artifacts were also collected from the surface, including four obsidian flakes, a basalt flake, and a dark green chert core. Based on the diagnostic ceramics, the site appears to date to the Late Coalition/Early Classic period.

LA 85864

LA 85864 is a possible tipi/wickiup rock ring located on a low ridge between two shallow arroyos that drain towards Rendija Canyon to the south. It is situated at an elevation of 2127 m (6980 ft) in an area dominated by piñon-juniper woodland. Extensive erosion has occurred along the northern edge of the site, and it is estimated that approximately 40 percent of the rock ring has been washed away.

The site consists of a semicircular alignment of large tuff rocks that is approximately 4.5 m in diameter. The rocks are spaced about 0.4 to 0.75 m apart.

A single 1 by 1 m test unit and two shovel tests were excavated at the site. Unit A was placed within the rock ring and was excavated to a depth of 22 cm. The southwest quadrant of a hearth was exposed at a depth of 16 cm. The hearth was represented by a concentration of ash and charcoal with burned clay beneath. It appeared that the hearth was built on the ground surface with no pit or enclosing rock ring. A charcoal sample yielded a date of 130 ± 60 BP (AD 1740/1820 to 1900). Five small, unidentified pieces of burned bone were also recovered from a floated soil sample recovered from the area containing the hearth. No cultural materials were, however, located in the shovel tests.

Two sherds were found near the structure, one located in the arroyo south of the cobble ring and the other located on the ridge. One sherd has a micaceous black paste and the other has a gray paste and tuff temper. A chalcedony core was also observed near the structure. A rhyolitic tuff slab with a ground surface was located 20 m east of the structure.

Based on the architecture, the presence of a micaceous sherd and a radiocarbon date indicating an 18th or 19th century occupation, the site may reflect an Apache cultural affiliation.

LA 85867

LA 85867 consists of two fieldhouses and a rock feature located on a south-facing slope along the north side of Rendija Canyon. They are situated at an elevation of 2114 m (6935 ft) in an area vegetated by piñon-juniper woodland.

Feature 1 is comprised of a low mound of unshaped cobbles and boulders that measures about 4 by 4.5 m in size and is approximately 30 cm in height. This feature is located at the base of the colluvial slope and has sustained impact from a two-track road that crosses the northern edge of the feature. Feature 2 is approximately 3 by 4.5 m in size and is comprised of alignments that appear to be the remains of a single-room structure located on the colluvial slope about 45 m north of Feature 1. Feature 3 is a surface concentration of cobbles and boulders that measures about 0.5 m by 2 m. The function of Feature 3 is not known.

Three 1 by 1 m test units were excavated at the site. Unit A was placed in the center of Feature 1. It was excavated to 72 cm, with a floor being encountered at a depth of 27 cm. The floor consisted of a very hard packed clay surface with several sherds of Pajarito smeared-indented (possible pot drop) and two sherds of Biscuit B. A charcoal sample yielded a date of 430 ± 60 BP (AD 1460/1520 to 1580). Unit B was excavated on the upslope side of Feature 3 to a depth of 21 cm, with no cultural materials being recovered. Unit C was placed in the middle of Feature 2, being excavated to a depth of 30 cm. No floor surface was encountered, nor were any cultural items found in this unit.

A total of four lithic artifacts were recovered from the excavations, consisting of an obsidian flake and three chalcedony flakes. Thirty smeared-indented corrugated and two Biscuit A sherds were recovered from the excavations conducted within Unit A. Most of these sherds were found on the floor of the structure. Given the radiocarbon date and the diagnostic ceramics, the site dates to the Classic period.

LA 85869

LA 85869 is a possible tipi/wickiup ring and a concentration of boulders that is located on top of a hill located north of Rendija Canyon. The site is situated at an elevation of 2124 m (6970 ft) in an area vegetated by piñon-juniper woodland.

Feature 1 is a circular rock ring that is about 5 m in diameter. It is formed by a surface alignment of large cobbles each spaced between 40 and 60 cm apart. The boulder concentration is located in an eroded area situated about 44 m northwest of Feature 1. The boulders form no clear alignments and several appeared to have been recently moved. A recent trash scatter is associated with this cobble concentration.

A 1 by 1 m test unit was excavated into each of the site features. Unit A was placed within the rock ring and adjacent to a small concentration of rocks that was thought to be a hearth. It was excavated to a depth of 11 cm where sterile clay was encountered. The small rock concentration was found not to be a hearth; however, a concentration of burned soil and ash with small flecks of charcoal was exposed along the west edge of the test unit. The burned materials were encountered at a depth of 5 cm and the burned clay extended to a depth of 15 cm; otherwise, there was no clear evidence of an associated pit or depression. Therefore, the excavators suggest that this hearth may have simply been placed directly on the floor of the structure. No other cultural materials were recovered from this test excavation.

The Unit B test excavation was terminated at a depth of 10 cm where sterile clay was encountered. No cultural materials were found and there was no evidence that Feature B was cultural in origin.

The only non-recent artifact found to be associated with the site was an obsidian flake. A tuff metate and a white quartzite mano documented during the initial site recording could not be relocated during the site-testing phase. Based on the site's similarity to LA 85864, it may also reflect an Apache cultural affiliation.

LA 86553

LA 86553 is a wagon road located in Rendija Canyon. There are ponderosa pine and juniper trees in the area of the site, although they have been severely burned by the Cerro Grande fire. The road ranges in elevation from 2085 to 2097 m (6840 to 6880 ft).

This site consists of wagon trail ruts and a historic trash scatter. The wagon trail is approximately 200 m long, 2.5 to 3 m wide, and runs east-west. The trash scatter consists of a few pieces of sheet metal, an enamelware basin, and miscellaneous sanitary seal and condensed milk cans. This site dates to the Homestead period. However, it could not be relocated during the Cerro Grande post-fire assessment project.

LA 86605

LA 86605 (M-49) is a fieldhouse located on a bench to the immediate south of Rendija Creek at an elevation of 2109 m (6920 ft). The area is vegetated by ponderosa pine trees, although they have been severely burned by the Cerro Grande fire.

The site consists of a one- to three-room structure constructed with unshaped and shaped tuff blocks. The 4 by 4 m rubble mound is approximately 0.3 m high. One of the shaped tuff blocks is somewhat longer and wider than the rest (80 by 35 cm).

Approximately 12 to 15 artifacts were observed. They include four Cerro Pedernal chert and one obsidian flake. Diagnostic ceramics include approximately eight glaze polychrome sherds and one glazeware sherd with a buff-colored interior and patches of red slip on the exterior. Based on the ceramics, this site dates to the Classic period.

LA 86606

LA 86606 (B-19) contains rubble from a possible one-room fieldhouse. It is located at the end of a narrow ridge in the western section of Cabra Canyon at an elevation of 2122 m (6960 ft). The surrounding vegetation consists primarily of ponderosa pine with some juniper and scrub oak present. However, the area was severely burned by the Cerro Grande fire.

The masonry is composed of unshaped tuff blocks stacked one to two courses high. The structure measures 3 m north-south by 3.5 m east-west with blocks eroding downslope to the east. No artifacts were observed, however, this may be due to the extremely dense pine duff ground cover. Based on the architecture, the site presumably reflects an Ancestral Pueblo cultural affiliation.

LA 86607

LA 86607 (B-20) consists a two- to four-room fieldhouse located on a ridge that projects out into the center of Cabra Canyon. It is situated at an elevation of 2146 m (7040 ft) in an area vegetated by ponderosa pine and scrub oak. However, this area was severely burned during the Cerro Grande fire.

The structure measures 5 m north-south by 4 m east-west, with unshaped masonry tuff blocks that are stacked one to two courses high. There are two straight alignments and one curved alignment visible, as well as an apparent corner amid the rubble. The area has been impacted by a contemporary hiking trail that runs through the northern portion of the structure. It is also apparent that some structural rock was removed from the trail.

Only two indented corrugated utilityware jar sherds and a single basalt flake were observed at the site. Based on the architecture and artifacts, the site presumably reflects an Ancestral Pueblo cultural affiliation.

LA 87430

LA 87430 is a fieldhouse located along the south side of Rendija Canyon. The site is situated at an elevation of 2111 m (6925 ft) in an area vegetated by ponderosa pine trees.

The site consists of a few rock alignments, with some stones in an upright position. The alignments indicate an approximate 3 by 2 m room; however, additional rubble suggests that more rooms may have existed at one time. There is a small depression just southeast of the room(s) and more rubble scattered to the east. A charcoal stain indicates that there may be a hearth located in a portion of the Pajarito Trail that is located to the west of the site.

The observed artifacts include obsidian flakes and some glazeware and plainware sherds. Based on the ceramics, the site presumably dates to the Classic period.

LA 99396

LA 99396 is a lithic scatter with a few ceramics located on the broad, open, southeast-facing slope of a saddle overlooking Rendija Canyon to the south. The site is situated at an elevation of 2103 m (6900 ft) in an area surrounded by piñon and juniper trees.

The lithic scatter covers an approximately 1080 m^2 area. Testing included 10 shovel tests and a 1 by 23.5 m long artifact collection transect across the center of the site. The majority of 173 lithic artifacts collected from the site consist of obsidian debitage, including 15 flakes recovered from the shovel tests. In addition to this, a possible Bajada basalt point base was collected. Three sherds were observed on the surface, consisting of a Biscuit A, a smeared-indented corrugated, and a utilityware sherd.

All but one of the pieces of debitage are the result of secondary or tertiary reduction suggesting that partially reduced materials were transported to the site where they were further reduced in the course of chipped stone tool manufacture and/or to obtain flakes as expedient tools. Utilized or retouched flakes comprise about 4% of the site debitage.

Based on the obsidian debitage assemblage and the presence of a Bajada point, the site dates to the Early Archaic period.

LA 99397

LA 99397 is a lithic scatter located on the east-facing slope of a narrow ridge on the north side of Rendija Canyon. The site is situated at an elevation of 2131 m (6990 ft) in an area vegetated by piñon and juniper trees.

The site covers an area of about 900 m^2. Fourteen shovel tests were dug at the site, with 10 pieces of debitage being recovered from six of the tests. These were located in the central area of the site with the highest surface artifact densities. These items were recovered from depths of up to about 40 cm. Artifacts were also collected from a 1 by 38 m transect laid out across the center of the site. Except for one metate fragment, all of the lithic artifacts observed were either debitage or chipped stone tools. Obsidian constituted 76% of the lithics with chalcedony forming the remaining 24%. A dusty obsidian similar to Polvadera Peak obsidian was most abundant (75%). The vast majority of the lithic debitage were tertiary flakes. In addition, three formal tools or tool fragments were collected from the site. They consist of a retouched Polvadera Peak obsidian tertiary flake, a crude lanceolate chalcedony biface, and the distal fragment of a Polvadera Peak obsidian biface or projectile point. A fragment of a metate was also observed on the site.

Based on the high percentage of obsidian tertiary flakes and the lack of ceramics at the site, it presumably represents an Archaic period occupation.

LA 127626

LA 127626 (K100) is a single-room fieldhouse located on a bench to the immediate south of Rendija Canyon creek. The site is situated at an elevation of 1787 m (5860 ft) in an area that is forested with ponderosa pine. However, the area was severely burned during the Cerro Grande fire.

The site consists of a single-room fieldhouse that measures about 3 by 3 m in size. The walls consist of isolated and disarticulated unshaped tuff blocks that are poorly visible due to a thick cover of pine duff. The area appears eroded.

No artifacts were observed, although this may in part be due to a thick litter pine duff. Based on the architecture, the site presumably reflects an Ancestral Pueblo cultural affiliation.

LA 127627

LA 127627 (K-109) is a single-room fieldhouse located on a bench to the immediate south of Rendija Canyon creek. It is situated at an elevation of 2117 m (6940 ft) in an area that is forested with ponderosa pine. However, the area was severely burned during the Cerro Grande fire.

The site consists of a square-shaped cluster of tuff blocks that measures approximately 3 by 3 m in size. The walls are represented by approximately two standing courses of unshaped tuff blocks. No artifacts were observed at the site, even after the duff was swept away from the area around and within the room. Based on the architecture, the site presumably reflects an Ancestral Pueblo cultural affiliation.

LA 127628

LA 127628 (K-133) is a possible fieldhouse located on a bench to the immediate south of Rendija Canyon creek. The site is situated at an elevation of 2128 m (6976 ft) within the ponderosa pine forest. However, the area was severely burned during the Cerro Grande fire.

The site consists of a 12 m long rock alignment composed of unshaped tuff and rhyolite blocks. These tuff rocks were likely from a fieldhouse that may have been disturbed by heavy equipment used to clear the area of rocks and trees and/or for construction of the fence line.
Only 13 artifacts were observed at the site. The ceramics consist of two Biscuit A, two Biscuit B, and a nonmicaceous plainware sherd. The lithic artifacts consist of core flakes, biface flakes, and a piece of angular debris made of Cerro Pedernal chert, a black translucent obsidian, and Polvadera Peak obsidian. Based on the ceramics present, the site dates to the Classic period.

LA 127629

LA 127629 (K-139) is a one-room fieldhouse located on a bench to the immediate south of Rendija Canyon creek. The site area is heavily vegetated with ponderosa pine and a few junipers at an elevation of 2114 m (6937 ft). However, the area was severely burned during the Cerro Grande fire.

Alignments of the one-room fieldhouse are intact except the east wall. The wall alignments are constructed of unshaped tuff and rhyolite blocks. Additional tuff and rhyolite rubble located to the east and north may have originated from the east wall. The structure measures approximately 2.3 by 3.1 m. The growth of ponderosa pine trees in the area has disturbed the site. Due to the heavy duff cover at the site, no artifacts were observed.

Based on the architecture, the site presumably reflects an Ancestral Pueblo cultural affiliation.

LA 127630

LA 127630 (K-140) is a small masonry structure located on a bench to the immediate south of Rendija Canyon creek. It is situated at an elevation of 2129 m (6980 ft) in an area covered by ponderosa pine forest. However, the area was severely burned during the Cerro Grande fire.

The site consists of a one- to two-room fieldhouse with rubble scattered over a 4 by 4 m area. The structure is probably about 3 by 3 m in size and is constructed of unshaped rhyolitic tuff and basalt blocks. Erosion has displaced some of the wall material downslope to the north and east. Due to the heavy duff at the site no surface artifacts were observed.

Based on the architecture, the site presumably reflects an Ancestral Pueblo cultural affiliation.

LA 127632

LA 127632 (Q-246) is a possible fieldhouse that is situated on the slope of a hill along the south side of Rendija Canyon. The local vegetation is characterized by ponderosa pine forest at an elevation of 2115 m (6949 ft). The area around the site has been heavily used for recreational purposes. Modern trash is abundant. In addition, there is a deeply worn dirt bike trail located downslope and to the north.

The site consists of a small rubble mound covering an area approximately 3 m north-south by 1 m east-west and standing 15 to 20 cm in height. The feature presumably represents a one-room masonry structure. The rubble mound consists of tuff blocks and fill, with the tuff blocks measuring about 20 by 15 by 10 cm in size. A separate 5 by 7 m scatter of building stones is situated downslope to the north and northeast of the main feature.

A single unidentifiable black-on-white sherd was located in the area of the rubble mound. Otherwise, an isolated biscuitware sherd located about 20 m north of the fieldhouse was the only other artifact observed at the site. The surface is, however, covered with a dense litter of pine duff. Due to the lack of clearly associated diagnostic artifacts, no specific temporal designation can be given to the site. Based on the architecture and ceramics, the site presumably reflects an Ancestral Pueblo cultural affiliation.

LA 127633

LA 127633 (Q195) is located on a north-to-south-trending ridge along the northern edge of Rendija Canyon. The site is situated within a ponderosa pine forest at an elevation of 2105 m (6900 ft). The area has been severely burned by the Cerro Grande fire.

The site consists of a rock feature that could possibly represent the remains of a fieldhouse. The feature is constructed of upright rhyolite slabs interspersed with some unshaped tuff rubble. There is heavy lichen growth on the slabs. The northern (upslope) and western sides of the feature are still intact; whereas, the southern and eastern sides have eroded downslope. The rubble covers a 2 by 1.2 m area, with the central uprights being present within a 1 by 1.2 m area.

No artifacts were observed at this site, however, heavy pine duff obscures the surface visibility. Based on the architecture, the site presumably reflects an Ancestral Pueblo cultural affiliation.

LA 127634

LA 127634 (Q-196) is located on a low north-to-south-trending ridge finger that slopes gently to the southeast along the north side of Rendija Canyon. The site is situated in ponderosa pine forest with a scattering of juniper at an elevation of 2115 m (6940 ft). The area has been severely burned by the Cerro Grande fire.

The site consists of a two- to three-room structure with associated rubble and artifacts. The structure primarily contains unshaped tuff rocks, although there are a few rectangular-shaped tuff and rhyolite blocks. There is rubble around the structure that is likely wall fall. The structure is approximately 2.8 m east-west by 2.8 m north-south. Based on the height of the rubble mound, there is potential for 20 to 30 cm of intact subsurface deposits.

Associated artifacts consist of lithic debitage and ceramic sherds. One hundred percent of the flagged artifacts were analyzed infield. Most of the debitage is Cerro Pedernal chert, with two pieces of black translucent obsidian and one rhyolite flake. Sherds are all biscuitwares, including three Biscuit B and two unidentified biscuit sherds. Based on the ceramics, the site dates to the Classic period.

LA 127635

LA 127635 is located on a low north-to-south-trending ridge along the north side of Rendija Canyon at an elevation of 2120 m (6950 ft). The local vegetation is primarily ponderosa pine, although there are a few junipers in the vicinity. The area was severely burned during the Cerro Grande fire.

The site consists of a one-room fieldhouse. The structure is approximately 2.5 by 3.5 m in area and is constructed of unshaped tuff blocks. There is very little rubble remaining, however, the foundation is intact. Based on a pin flag probe, there may be up to 20 cm of subsurface deposits present within the fieldhouse.

Only three sherds were identified at the site. These consist of a single Biscuit A and two nonmicaceous plainware sherds. Based on the ceramics, the site dates to the Classic period.

LA 135291

LA 135291 is a possible fieldhouse located on a bench to the immediate south of Rendija Canyon creek. The site was identified during the Cerro Grande post-fire assessment project. The surface vegetation consists of a partially open ponderosa pine forest that was severely burned during the Cerro Grande fire. The site is situated at an elevation of 2108 m (6915 ft).

The site consists of a large cluster of rhyolite cobbles covering an overall 10 by 10 m area. However, most of the rocks are centered in a roughly rectangular-shaped 3 by 4 m area that could reflect a one-room fieldhouse. At least one possible rock alignment is visible. Two burned junipers are located directly within the feature. The roots have presumably disturbed the internal portion of the feature, although they did not burn.

The feature is surrounded by a light scatter of artifacts that include a Wiyo Black-on-white sherd, two Biscuit A sherds, two plainware jar sherds, a Cerro Pedernal chert core flake, and a quartzite cobble fragment. Based on the ceramics, the site appears to date to the Classic period.

LA 135292

LA 135292 is a possible fieldhouse located on a bench to the immediate south of Rendija Canyon creek. The site was identified during the Cerro Grande post-fire assessment project. The area of the site is partially open with isolated ponderosa pine trees, being situated at an elevation of 2080 m (6824 ft).

The site consists of a small circular cluster of about 35 rhyolite cobbles within a 2 m diameter area. There are no obvious rock alignments. Most of the cobbles lie directly on the ground, although several are stacked 2 to 3 cobbles high. The area was severely burned during the Cerro Grande fire, with two burned bushes being located within the rock cluster.

There is a sparse artifact scatter surrounding the feature that includes a Wiyo Black-on-white sherd, a Biscuit B sherd, two undetermined whiteware bowl sherds, three plainware jar sherds, two smeared-indented jar sherds, an obsidian core flake, and a Cerro Pedernal chert core flake. Based on the ceramics, the site appears to date to the Classic period.

LA 135294

LA 135294 is a possible set of fieldhouses located along the crest of the gentle east-trending ridge overlooking Guaje Canyon at the northern edge of the Rendija Canyon tract. The site elevation is approximately 2140 m (7020 ft). The vegetation is primarily piñon pine, with some juniper and cholla cactus. Duff and understory is relatively sparse, and the site area was not impacted by the Cerro Grande fire.

The site contains two possible structural features. The western (upslope) feature consists of a group of 2 to 3 masonry rooms covering an area of about 4 by 8 m, with the long axis being north-south. Several small and moderate-sized piñon pine trees are situated in and around the rooms. The masonry consists of large blocks of unshaped tuff. The second feature is a 2 by 3 m cluster of smaller unshaped blocks of tuff situated about 20 m east (downslope) from the better-defined rooms.

The only artifacts observed in the vicinity of either feature were a few pieces of obsidian debitage. Based on the architecture, the site presumably reflects an Ancestral Pueblo cultural affiliation

LA 135293

LA 135293 is a possible fieldhouse located at a flat bench on a gently sloping northeast-trending ridge. The vegetation around the site is primarily ponderosa pine, with some piñon, juniper, and scrub oak within the site vicinity. The site elevation is approximately 2130 m (6990 ft).

The site consists of a small cluster of unshaped tuff rubble appearing to represent the remains of a single rectangular structure that is approximately 3 to 4 m in diameter. The structure was severely damaged by a tree that burned in the middle of the structure, with a portion of the burned stump still being in place. The burn around the structure was moderate, with the duff having been completely removed.

A single sherd of smeared-indented corrugated ware was found in the area of the rubble. Based on the architecture and the single ceramic artifact, the site presumably reflects an Ancestral Pueblo cultural affiliation.

CHAPTER 6
DATA RECOVERY PLAN: RESEARCH CONTEXTS

BRADLEY J. VIERRA

INTRODUCTION

Approximately 10,000 years of human occupation are represented on the Pajarito Plateau. This includes the initial use of the area by Clovis hunter-gatherers and, more recently, the nuclear research conducted by the Manhattan Project. During this long history, the plateau has witnessed various periods of sporadic and intense occupation. Most notable of these are the Coalition and Classic periods (ca. AD 1200–1600), during which many of the archaeological sites on the plateau were constructed, occupied, and later abandoned. Nonetheless, the region was also visited on a seasonal basis by Archaic foragers, and groups of Navajos and Apaches. But it was not until the turn of the 20th century that the plateau would again witness a return to more permanent residences with Homestead cabins and the founding of Los Alamos National Laboratory (LANL).

Although the plateau has witnessed almost 100 years of archaeological research, very little of this work has been published in synthetic reports. Most notable of these is the work of Hewett and Wilson at the large Classic period sites of Otowi and Tsirege (Hewett 1906, 1938; Wilson 1916a, b, 1918a, b). Not until the 1950s to 1970s would there be a resurgence in the excavation of sites on the plateau by Worman, Steen, and the Los Alamos Archaeological Society; however, little of this work has been fully published (Fretwell 1954, 1959; Maxon 1969; Poore 1981; Steen 1974, 1977, 1982; Worman and Steen 1978; Worman 1967; Young 1954). More recently, three major survey projects have been conducted on the plateau. The Pajarito Archaeological Research Project (PARP) (Hill and Trierweiler 1986; Hill et al. 1996), the Bandelier Archaeological Survey (BAS) (Powers and Orcutt 1999a, b), and the Land Conveyance and Transfer (LCT) Project (Hoagland et al. 2000). In the latter two cases, detailed reports presenting the results of these surveys were completed. Reports were also done for small-scale excavations conducted by Washington State University in conjunction with the BAS Project (Kohler 1989, 1990; Kohler and Linse 1993; Kohler and Root 1992). However, only a series of theses and dissertations and a single summary article were ever written for the PARP. All of this underscores the general lack of data currently available on the archaeology of the Pajarito Plateau.

A total of 39 archaeological sites will be excavated as part of the Data Recovery Program for the LCT Project. A series of research contexts have already been proposed in a draft Cultural Resource Management Plan for Los Alamos National Laboratory (Vierra 2002a). These contexts consist of chronometrics, geoarchaeology, paleoenvironment, settlement patterns, subsistence and seasonality, and technology and cultural interaction. Several people have contributed to this plan, including Vierra, Harmon, Schmidt, Nisengard, and Reneau. These research domains provide the framework for identifying specific research questions that can be used to help determine the potential eligibility of sites for inclusion to the National Register of Historic Places. Here, they provide a research design to guide the excavation and analysis of data obtained from the sites located within the LCT Project area. This chapter presents a review of each research context and a series of detailed research questions.

CHRONOMETRICS

The study of evolutionary change is a critical part of archaeological research. How people coped with the changing cultural and natural landscape is an important research issue. Yet, to study culture change we need a chronological framework within which to place this process. Therefore, chronometrics are a critical underpinning to archaeological research.

Table 3.1 (p. 3-1) illustrates the general culture historical chronology that has been developed for the northern Rio Grande. This represents over 10,000 years of human occupation in the region. A variety of relative and absolute dating methods has been used to date archaeological sites in the area. Relative dating is concerned with ordering objects into a temporal sequence from earlier to later. In contrast, absolute dating assigns these events to specific calendar dates.

Ephemeral surface lithic scatters characterize the Archaic period. Geomorphic context, projectile point typologies, obsidian hydration, and radiocarbon dating are all common techniques used to temporally place these sites. The Ceramic period is represented by the presence of habitation structures, fieldhouses, and artifact scatters. Ceramic seriation and tree-ring, radiocarbon, archaeomagnetic, obsidian hydration, and luminescence dating are techniques often used to date these sites. Lastly, ethnohistorical records, relative artifact dating, and tree-ring, radiocarbon, and luminescence dating can be used to date sites from the Historic period.

Relative Dating

Stratigraphy and Superposition

Ever since Nels Nelson first used the stratigraphic method in the Southwest, it has been a mainstay for ordering archeological sequences. Whether these sediments are the result of cultural or natural processes, the layered effect of multiple overlying units provides a relative dating technique for the materials found within these layers. Stratigraphy can be defined as “the study of the spatial and temporal relationships between sediments and soils” (Waters 1992:60); or, as the study of “different layers and levels of occupation on an archaeological site and their relation to each other, and the determination of the archaeological sequence or order in which they were laid down” (Joukowsky 1990). The law of superposition provides the elementary underpinnings for stratigraphic studies, stating that “in any succession of strata not severely deformed, the oldest stratum lies at the bottom, with successively younger ones above” (Stein 2000:19).

Projectile Points

Projectile points are a common item used to relatively date surface artifact scatters. They are very important for dating preceramic sites that otherwise contain few temporally diagnostic artifacts. However, little work has been done in the region towards developing a standardized point typology with associated date ranges. Nonetheless, there have been a series of projects over the years that have described point types and, in some cases, attempted to place them within some defined date range.

Point types are defined as a group of specimens that are similar because they possess a demonstrable cluster of attributes or definable characteristics (Binford 1963:194). This is often based on a polythetic set of morphological and metrical attributes. Nonetheless, to date there have been no attempts to develop a series of statistically defined types as in other areas of the American West (e.g., see Berry 1982; Holmer 1978; Thomas 1981). Seriation refers to the chronological ordering of specific artifact types. Projectile points are sensitive to long-term changes in hunting strategies and tactics and can therefore be used to relatively date archeological contexts.

There have been several descriptive studies done during the last 70 years. The earliest studies include those at Jemez Cave (Alexander and Reiter 1935) and Renaud's (1942, 1945) work in the upper Rio Grande Valley area. It was, however, Irwin-Williams (1973) who originally defined a projectile point sequence for the region in respect to the culture-historical framework referred to as the Oshara Tradition. She defined a five phase sequence for the Archaic based on stratigraphic excavations conducted in the Arroyo Cuervo region near Albuquerque: Jay (5500–4800 BC), Bajada (4800–3200 BC), San Jose (3200–1800 BC), Armijo (1800–800 BC), and En Medio (800 BC–AD 400). Illustrations of these idealized point types are provided in Figure 6.1; however, Irwin-Williams never provided any explicit type definitions. Rather, only a few point illustrations by phase have been published.

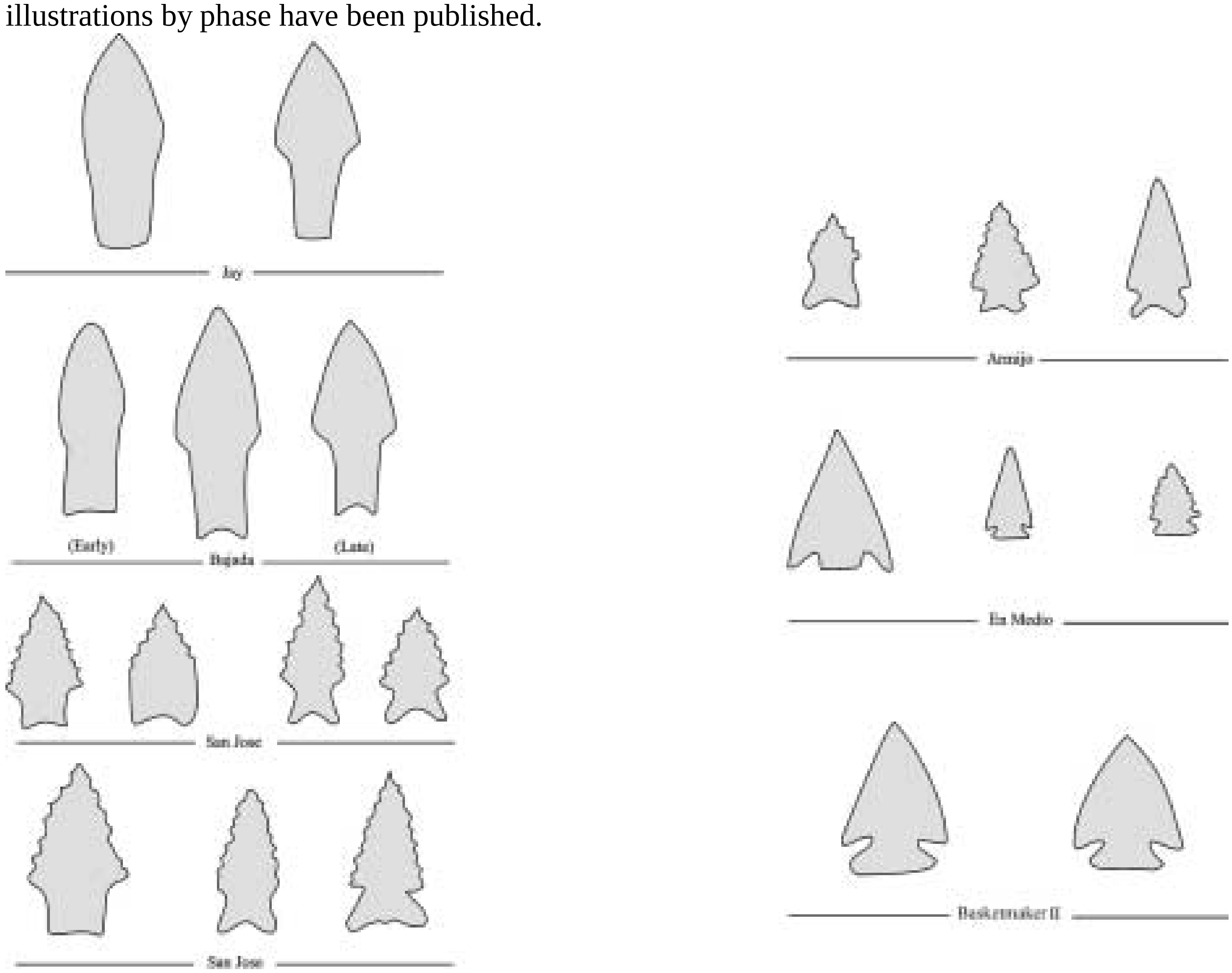


Figure 6.1. Oshara Tradition projectile point types.

Other more recent studies have focused on differentiating point types, but with little or no associated chronometric data. For example, Thoms (1977) produced a projectile point typology for the northern Rio Grande. Test excavations were conducted along Redondo Creek near Redondo Peak as part of the Baca Geothermal Project (Baker and Heinsch 1981). No specific sample size is provided, but it was noted that the majority of the identifiable points consisted of large side-notched forms with high notches, or large/small corner-notched points. Forty-three sites were excavated within the Abiquiu Reservoir flood pool during the 1980s with a total of 669 projectile points being recovered. In the 1990s, archeological testing and data recovery programs were conducted as part of the Ojo Powerline Extension Project in the area of Polvadera and Cañones Mesa. One hundred and nineteen projectile points were recovered during the testing phase and 296 points from the data recovery phase (Brown et al. 1993; Turnbow 1997). Brown et al. (1993:386–387; also see Turnbow 1997:165–166) developed a set of flow charts with the specific criteria used to distinguish large vs small points types within these two classes. Once these point types were identified, chronometric data obtained from the excavations and the cross dating of similar morphological types were used to identify a projectile point sequence for the study area. This sequence is graphically illustrated in Figure 6.2 (Turnbow 1997:222).

Ceramic Seriation and Cross-Dating

In the American Southwest ceramic dating has been accomplished by one or more of four methods: seriation, stratigraphy, cross-dating, and/or calibration with other temporal markers. As previously noted, seriation refers to the chronological ordering of specific artifact types. Blinman (2000) provides a recent summary of ceramic dating in the American Southwest, including both its history and the state-of-the-art methods. One of the most useful references for ceramic identification and dating on the Pajarito Plateau is the *Ceramic Manual for the Bandelier Archeological Survey* by Peter McKenna and Judith Miles (1991). All the local ceramic types are described in terms of construction methods, paste, temper, rims, dates, etc. Also, Lang (1982), Snow (1982), and Vint (1999) provide type descriptions for northern Rio Grande ceramics. Tables 6.1 and 6.2 present the ceramic chronology for the Pajarito Plateau.

Table 6.1. Ceramic Types by Period for the Northern Pajarito Plateau (after Larson n.d.)

Period	Ceramic Types
Early Coalition	Kwahe'e B/w, Early Santa Fe B/w, Wingate B/r and Polychrome, St. Johns B/r and Polychrome, Rio Grande Corrugated, Smeared-indented
Middle Coalition	Middle Santa Fe B/w, St. Johns B/r and Polychrome, Smeared-indented
Late Coalition	Late Santa Fe B/w, Wiyo B/w, Galisteo B/w, Smeared-indented, Obliterated, Micaceous. Necks of culinary jars are often filleted or clapboarded.
Early Classic	Wiyo B/w, Biscuit A, Biscuit B, Obliterated, Micaceous
Middle Classic	Biscuit B, Obliterated, Micaceous, Potsuwi'i Incised
Late Classic	Biscuit C, Tsankawi B/c, Obliterated, Micaceous, Potsuwi'i Incised
Historic	Kapo Black, matte-painted polychrome, Athabaskan wares, Tewa polychrome

Alfred V. Kidder (1915) was the first to attempt a description of the ceramics on the Pajarito Plateau. He divided sites in the area into two basic types: small ruins and great ruins (i.e., plaza pueblos), with the small ruins being earlier than the great ruins. He then separated the pottery on

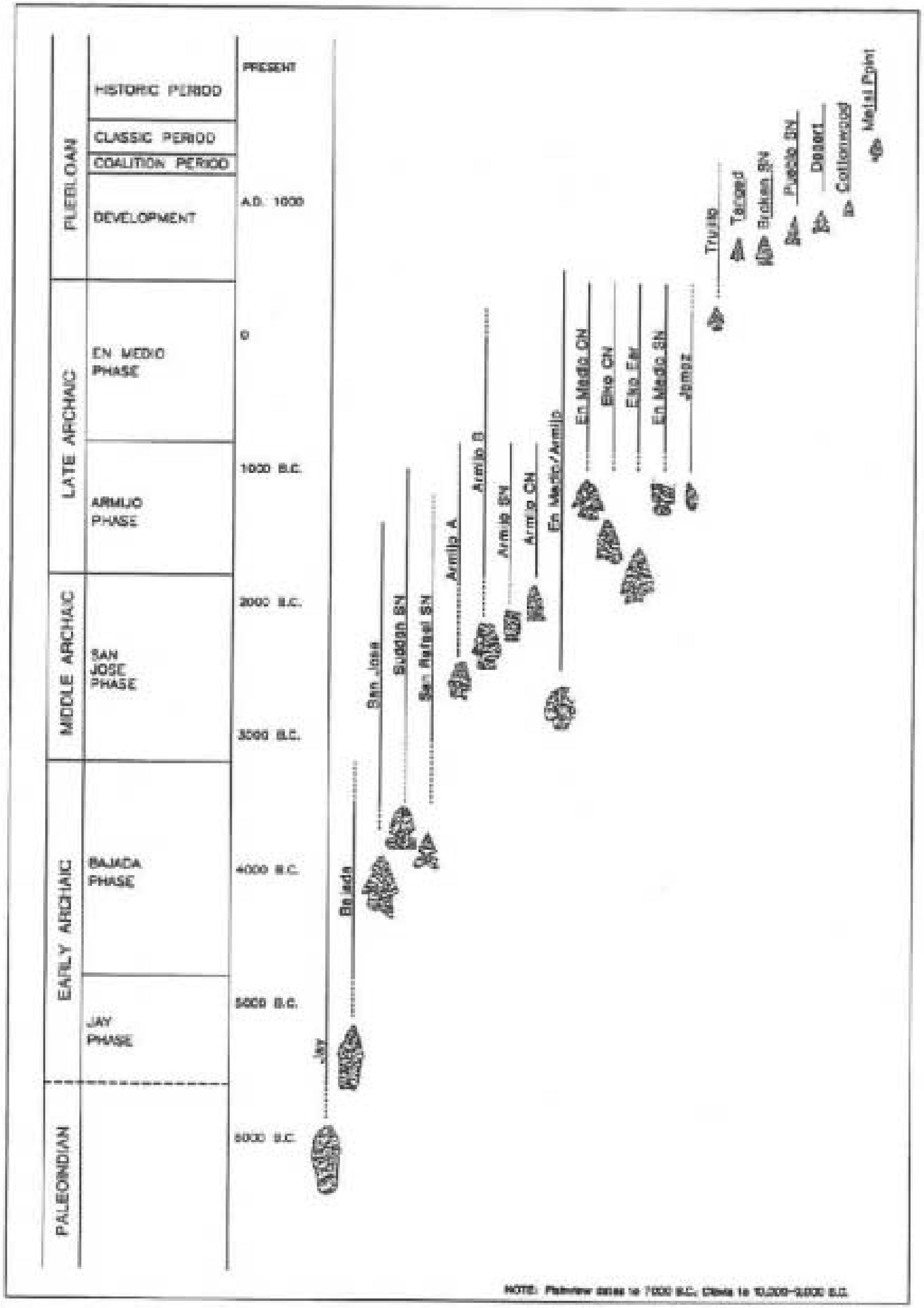


Figure 6.2. Proposed projectile point chronology for Jemez Mountains area (Turnbow 1997).

Table 6.2. Ceramic Wares and Their Dates on the Pajarito Plateau. Types and dates are taken from Breternitz (1966), ESH-20 Cultural Resources Management Team (1999), Harlow (1973), McKenna and Miles (1991), Vint (1999). Common synonyms in brackets.

Ware	Dates (AD)
Utilitywares	
Corrugated wares	
Lino Gray	500 to early 900s
Kana'a Gray	700 to early 1100s
Indented Corrugated (sand temper) [Rio Grande Corrugated]	1150 to 1350
Smeared-indented Corrugated (sand)	1250 to 1400
Corrugated (sand)	1350 to 1450 (tentative)
Smeared Corrugated (sand)	1400 to 1550 (tentative)
Indented Corrugated (mica) [Tesuque Indented]	1350 to 1450 (tentative)
Smeared-indented Corrugated (mica) [Tesuque Smeared-indented, Cundiyo Micaceous Smeared-indented]	1400 to 1500
Sapawi'i Washboard (mica)	1425 to 1600 (tentative)
Obliterated Corrugated*	?
Incised Corrugated*	?
Clapboard Corrugated*	?
Plain Wares	
Los Lunas Smudged	1150 to 1300 (tentative)
Potsuwi'i Incised	1450 to 1550
Kapo Black	1650 to present (abundant 1700 to 1760)
Utilitywares	
Corrugated wares	
Posuge Red	1625 to 1920 (abundant 1650 to 1760)
Plain Gray (sand)	?
Striated Plain Gray (sand)	?
Micaceous Plain [Tesuque Plain]	?
Micaceous Slipped*	?
Decorated Wares	
Black-on-white types	
Kwahe'e Black-on-white	1050 to 1250
Socorro Black-on-white	1075 to 1250
Santa Fe Black-on-white	1175 to 1350/early 1400s
Wiyo Black-on-white	1300 to 1400
Galisteo Black-on-white	1300 to 1400
Jemez Black-on-white	1300 to 1750
Abiquiu Black-on-gray [Biscuit A]	1375 to 1425/1450
Bandelier Black-on-gray [Biscuit B]	1425/1450 to 1475/1550
Cayamunge Black-on-tan [Biscuit C]	1475 to 1600
Sankawi'i Black-on-cream	1525 to 1650
White Mountain Red Ware	
Puerco Black-on-red	1075 to 1200

Table 6.2 (cont.)

Ware	Dates (AD)
Wingate Black-on-red	1100 to 1200
Wingate Polychrome	1125 to 1200
St. Johns Black-on-red	1175 to 1300
St. Johns Polychrome	1175 to 1300
Heshotauthla Polychrome	1300 to 1375
Rio Grande Glaze Ware	
Glaze A series	
Agua Fria Glaze-on-red	1315 to 1425
San Clemente Polychrome	1315 to 1425
Cieneguilla Glaze-on-yellow	1325 to 1425
Cieneguilla Polychrome	1325 to 1425
Glaze B series	
Largo Polychrome	1400 to 1450
Largo Glaze-on-red	1400 to 1450
Largo Glaze-on-yellow	1400 to 1450
Glaze C series	
Espinoso Polychrome	1425 to 1490
Decorated Wares	
Rio Grande Glaze Ware	
Glaze D series	
San Lazaro Polychrome	1490 to 1515
Glaze E series	
Puaray Polychrome	1515 to 1650
Escondido Polychrome	1515+
Pecos Polychrome	1515 to 1700
Glaze F series	
Koytiti Polychrome	1625 to 1700
Koytiti Glaze-on-red	1625 to 1700
Koytiti Glaze-on-yellow	1625 to 1700
Historic Matte Paint Wares	
Tewa Polychrome	1650 to 1750
Ogapoge Polychrome	1720 to 1760
Puname Polychrome	1700 to 1760
San Pablo Polychrome	1740 to 1800
Trios Polychrome	1800 to 1850

*Types from ESH-20 Cultural Resources Management Team (1999)

the small sites into three wares: black-and-white, redware (i.e., Red Mountain redwares), and corrugated wares. Pottery from the great ruins were divided into four wares: redware (i.e., glazeware), biscuitware, incised ware (i.e, Potsuwi'i Incised), and blackware (i.e., utilityware). These descriptions and chronological relationships were later refined during his excavations at Pecos Pueblo (Kidder and Amsden 1931; Kidder and Shepard 1936).

During the 1930s, Henry P. Mera (1932, 1933, 1934, 1935, 1939, 1940) conducted a series of non-systematic surveys in the northern Rio Grande that involved collecting ceramic type specimens from various sites. In doing so, he was able to describe the temporal and spatial distribution of ceramic types across the area. Mera defined the Tewa series and expanded the descriptions of utilityware, biscuitware, and glazeware. In addition to these ceramic descriptions he made excellent use of the few tree-ring dates, cross-dating, and historic records to assign absolute dates to these ceramic types. More recently, Frank Harlow (1973) refined some of the biscuitware descriptions, including the definition of Biscuit C (Cuyamungue Black-on-tan), suggesting that the type was produced during the 1500s, ending the Biscuit A, B, and C series. Also see Gauthier (1982a and b) for a discussion of biscuitwares, Warren (1979a, b) and Snow (1982, 1989) for more recent descriptions of the glazeware series and Harlow (1973) and Snow (1982) for descriptions of the historic matte-paint wares.

It was not until the 1970s and 1980s that large-scale systematic survey projects were conducted on the Pajarito Plateau. Both the PARP and the BAS conducted ceramic seriation studies. For example, surface ceramics were used to assign dates to PARP sites by de Barros (1980, 1981a, 1981b) using a micro-seriation technique he developed and earlier glazeware studies (Kidder and Shepard 1936; Shepard 1942, 1965; Warren 1973, 1977a, 1979a, b). De Barros (1981a) found that the most time-sensitive variables in his seriation were rim thickness, mean hatching line width, percentage of direct flat rims, and everted rims increased through time. In contrast, the percentage of painted design elements with hatching and the percentage of Rio Grande Corrugated present decreased through time. Hagstrum's (1985) comparisons of Santa Fe/Wiyo Black-on-white vs Biscuit B bowls indicated that fewer design elements were used through time. More recently, Ruscavage-Barz's (1999) study of Santa Fe Black-on-white revealed relative stylistic homogeneity for this ceramic type over the Pajarito Plateau. She found only minor differences in design elements between Coalition period roomblocks and plaza pueblos. The exclusive use of hatched triangles and steps decreases over time; whereas, the presence of solid elements, slips, and polishing increases. The latter are more characteristic of Wiyo Black-on-white. Overall, her results are similar to those reported by de Barros.

A single large-scale seriation project was conduced by Orcutt (1999) on the Pajarito Plateau for the BAS. Orcutt began by attempting to determine if there was a rise and fall in the frequency of a given ceramic type over time and if types occurred at expected dates. This was done by compiling a list of dated proveniences from the Pajarito Plateau and the Cochiti area and a list of the ceramic assemblages from those proveniences. Each ceramic type was plotted as a line graph, the dependent variables being the date, the independent variable being the percentage of ware assemblage that an individual type made up and individual points on the graph being proveniences. The temporal span for most types was as expected, although Biscuit A did run a little late. For a second check on whether types occur as expected though time she seriated a sample of site collections from the Bandelier survey using multidimensional scaling (after Drennan 1976; Matson and Lipe 1977). Only decorated sherds were used in the seriation, with glazeware and whiteware types being seriated separately. The whiteware seriation worked fairly well, placing Kwahe'e Black-on-white at one end and Biscuit B or Sankawi Black-on-cream at the other. However, Wiyo Black-on-white dominated assemblages tended to fall a little outside the temporal progression. Having determined that the assemblages were temporally diagnostic, Orcutt used cluster analysis on the seriation assemblages to group similar assemblages together based on percentages of different types. The assemblages from dated sites were then added to the clusters. Separate analyses were run for whiteware/matte painted wares vs glazewares, with 11 clusters being defined. Once this was done, a "fingerprint" for each period was created by averaging the frequency of each ceramic type for all the proveniences that constituted a given period. The final step was to define dates for each period:

> "For some periods there were no dated excavated proveniences, and for others there were proveniences with widely varying dates. Taking the most reliable of the dates and following 'conventional wisdom' on the date ranges for the ceramic types, each period was given a date qualified by a plus and minus factor. The plus and minus factor is a subjective, conservative evaluation of the potential weakness of the date" (Orcutt 1999:108).

The whiteware/matte painted and glazeware sequences were then merged into one chronology (Table 6.2). Finally, she used multiple regression analysis (after Blinman 1989; Kohler and Blinman 1987) to assign all BAS sites with five or more utilityware sherds and five or more decorated sherds to one of the 12 periods.

Winifred Creamer et al. (2000) recently examined biscuitware sherds excavated from the middens of a number of large Protohistoric pueblos in the northern Rio Grande. She found an inverse relationship between sherds decorated on the interior (i.e., Biscuit A) and sherds decorated on both the interior and exterior (i.e., Biscuit B and C). In addition, she identified an increase in the mean thickness of the first exterior painted line through time (i.e., Biscuit B to Biscuit C). These findings provide some support for the biscuitware sequence.

Absolute Dating

Radiocarbon

Radiocarbon dating is the most prevalent chronometric dating technique used in the American Southwest. The dry conditions of the region act to preserve organic remains that can be dated by this method. However, this technique has low precision, with single standard deviations often including overall periods of 100 years. Summaries of the radiocarbon dating process are presented in Michels (1973) and Taylor (1987, 2000).

Dean (1978) was one of the first archeologists to stress the importance of explicitly defining a methodology for using and interpreting chronometric dating techniques. Smiley (1985:38–45), on the other hand, discusses a number of sources that could produce errors in the radiocarbon dating process: 1) field sampling error, 2) built-in age, 3) cross-section effect, 4) Libby half-life error, 5) contamination, 6) calibration error, 7) counting error, 8) lab bias, and 9) isotopic fractionation. Material quality refers to the expected degree of disparity between the dated event and the target event (Smiley 1985:68). He provides a list of radiocarbon datable materials that he considers to have highest to lowest material quality (Smiley 1985:71–72). This scheme can be used in evaluating the dating potential of possible samples:

1. Annual subsistence materials, for example, cultigens or charred wild seeds;
2. Samples from structural logs retaining their outer rings;
3. Sticks, twigs, or small branches;
4. Large cross-sectional pieces from beams or fuel that lacks outside rings;
5. Scattered charcoal from undisturbed contexts, such as hearth fill;

6. Scattered charcoal from excavation strata or levels;
7. Unprovenienced charcoal samples.

There are only three radiocarbon dates for sites excavated at LANL, Peterson and Nightengale's (1993). Otherwise, no samples were submitted from any of Worman and Steen's excavations.

Dendrochronology

Dendrochronology, or tree-ring dating, is a common technique used to date architectural elements in Ceramic and Historic period habitation sites. The technique was developed by A. E. Douglass in the early 1900s, although the basic assumptions underlying the method are still the same: 1) that tree rings are an indirect measure of the annual food supply, 2) that the food supply primarily depends on the amount of annual moisture, and 3) that the width of the rings is therefore a measure of this precipitation (Robinson 1976). These changing ring patterns provide both a means of dating the tree and insights into the past climatic history of the area (i.e., Rose et al. 1981). Although the Southwestern tree-ring chronology dates back to about 2300 BP, the chronology for the Jemez Mountains area only dates back to ca. AD 600.

Smiley et al. (1953) conducted the first systematic tree-ring study in the northern Rio Grande. However, a review of wood samples on file at the University of Arizona Tree-Ring Laboratory in 1991 revealed that only 14 sites on the Pajarito Plateau have been dated by this method (Robinson and Cameron 1992; also see Kohler 1990; Kohler and Root 1992). Table 6.3 presents the information for these Coalition and Classic period sites. One hundred and seventy-one samples were submitted for tree-ring dating by Kohler for Burnt Mesa Pueblo; however, only 13 dates could be determined, of which three were actual cutting dates. Most of the samples were ponderosa pine, including two of the three cutting dates. The other cutting date was derived from piñon pine. This example may underscore the possible difficulties in obtaining cutting dates for samples on the plateau. Again, no tree-ring samples were ever submitted by Worman and Steen.

Table 6.3. Dendrochronological Dates for Prehistoric Sites on the Pajarito Plateau (Robinson and Cameron 1992)

LA Number	Site Name	Number of Dates	Early Cutting Date (AD)	Late Cutting Date (AD)
LA 8681	Fulton #190	20	---	1218
LA 4997	Saltbush Pueblo	3	---	1241
LA 60372	Burnt Mesa	13	1250	1317
LA 545	Water Canyon	14	1302	1447
LA 16097	fieldhouse	2	1412	---
LA 211	Tsankawi	2	---	1439
LA 78	Frijolito	12	1426	1460
LA 217	Rainbow House	18	1451	1458
LA 169	Otowi	4	---	1491
LA 50972	Cavate pueblo	1	1494	---
LA 82	Tyuonyi	55	1386	1521
LA 77722	Large Kiva	15	1522	1525
LA 47	Puye	41	1543	1577
LA 70	Tsirege	31	1559	1581

Although tree-ring dating is the most accurate chronometric dating technique used in the American Southwest, not all tree species provide accurate dates. For example, species like piñon, ponderosa pine, Douglas fir, Englemann spruce, and white fir are all drought-resistant species that are often used for tree-ring dating. However, juniper is a less reliable species and cottonwood is an unreliable species because it resides in well-watered settings. Inherent problems in interpreting dates can include the loss of outside rings either to deterioration or human modification, the reuse of older building materials, the stockpiling of building materials, and the use of old dead wood for fuel (e.g., Ahlstrom 1985; Dean 1969). Detailed discussions of the history of tree-ring research and the methods involved in this technique can be found in Robinson (1976), Stokes and Smiley (1968), Ahlstrom (1985) and Dean (1997).

Samples can be submitted to the Laboratory of Tree-Ring Research at the University of Arizona. The resultant analysis form contains the following information: provenience, lab number, species, inside ring (date and symbol), and outside ring (date and symbol). The symbols describe the condition of the sample and rank the usefulness of the date. Table 6.4 provides the definitions of the symbols used.

Table 6.4. Explanation of Symbols used with Tree-Ring Dates (Ahlstrom 1985; Dean 1969; Hufnagle 1995)

Ring	Symbol	Definition
Inside ring date	p	The pith ring is present. The date is when the tree began its growth.
Inside ring date	np	The date is “near the pith.” When the center is eroded or not present, this symbol indicates that the first annual ring in the specimen is no more than ten years from the beginning of growth.
Inside ring date	Fp	The date is “far from the pith.” When the center is eroded or not present, this symbol indicates that the first annual ring in the specimen is 10 or more years removed from the beginning of growth. Thus, this date should not be used. It is the inside date equivalent to a “vv” outer date. Blank- no pith is present.
Inside ring date	±	Used in combination with one of the above symbols, this indicates that there is an irregularity in the structure of the rings near the pith. The date is based on a count back from the earliest dated ring. Thus, the inside date given may be off a few years.
Outside ring date	comp	The last ring is complete. The tree died or was killed after it had completed growth for that year.
Outside ring date	inc	The last ring is incomplete. The tree died or was killed during the growing season.
Outside ring date	B	Bark is present.
Outside ring date	G	Beetle galleries are present on the surface of the specimen.
Outside ring date	L	A characteristic surface patination and smoothness that develops on the outer surface of beams stripped of bark.
Outside ring date	c	The outermost ring is continuous around the circumference of a full section.
Outside ring date	r	The outermost ring is continuous around the available circumference of a partial section.
Outside ring date	v	In the absence of direct evidence of a true outside of a partial section, a subjective judgment is made that the date is a cutting date.
Outside ring date	vv	There is no way of estimating how far the last ring is from the true outside.

Table 6.4 (cont.)

Ring	Symbol	Definition
---	+	This symbol is used with one of the above. One to three rings may be missing near the end of the ring series whose presence or absence cannot be determined because the ring series doe not extend far enough to provide an adequate check. Thus, the tree cutting date is likely between one and three years (and never more than five years) later than indicated.
---	++	This symbol is used with one of the above. A ring count is necessary due to the fact that beyond a certain point the ring series could not be dated. It typically refers to the fact that the outer rings are so compressed that they cannot be cross-dated. As a result, the rings are simply counted with the assumption that each ring represents a year's growth. Thus, missing rings cannot be accounted for and the true date may be later than the date given. Moreover, the "++" symbol suggests that the tree was under stress near the end of its life and that it possibly died before it was actually cut down.

Obsidian Hydration

Obsidian raw materials are readily available in the Jemez Mountains. Primary sources are present in the areas of the Valle Grande, Rabbit Mountain/Obsidian Ridge, and Polvadera Peak. Therefore, researchers have been very interested in the potential of obsidian hydration dating for temporally placing archeological sites. Indeed, it was obsidian from the Jemez Mountains that was used by Friedman and Smith (1960; Friedman et al. 1965) when this technique was originally proposed. More recently, there has been some debate about the reliability of obsidian hydration dating (Anovitz et al. 1999; Beck and Jones 2000; Ridings 1996; Stevenson et al.1996). Recent studies have therefore focused their attention on refining this dating method (Anovitz et al. 1999; Jones et al. 1997; Mazer et al. 1992; Stevenson et al. 1996, 1998).

As previously noted in the Culture History chapter, the archaeological record of the Pajarito Plateau is characterized by a possible hiatus during the Developmental period. If so, obsidian hydration dating could be an important technique for distinguishing earlier Archaic period sites from later Coalition/Classic period artifact scatters. Several studies have been attempted in the region, but contradictory results were often obtained. A series of surface obsidian artifact scatters was excavated in the Redondo Creek Valley as part of the Baca Geothermal Project (Baker and Winter 1981). Glen Russell (1981a) conducted an obsidian hydration study of 235 flakes and bifaces from 19 sites. The largest obsidian hydration study ever attempted in the northern Rio Grande was conducted by Chambers Consultants and Planners for the Abiquiu Reservoir Project (Lord and Cella 1986), with 496 obsidian samples being analyzed from 43 sites. Mariah Associates also evaluated obsidian hydration dating techniques during the Ojo Line Extension Project testing (Acklen 1993) and data recovery programs (Acklen 1997). Excavations were conducted on Polvadera and Cañones Mesas. A total of 168 obsidian hydration dates were obtained during the testing phase. Figure 6.3 compares the projectile point obsidian hydration dates with associated point cross-date ranges from Acklen (1993:435). As can be seen, the Early and Middle Archaic point types appear to date much later than their cross-dates; whereas, the Late Archaic types span a period that includes earlier and later dates than their associated range. Arrow points date to the Ceramic period, as do some of the Archaic dart points. Most of the undetermined dart points date to the Middle and Late Archaic periods. The large side-notched

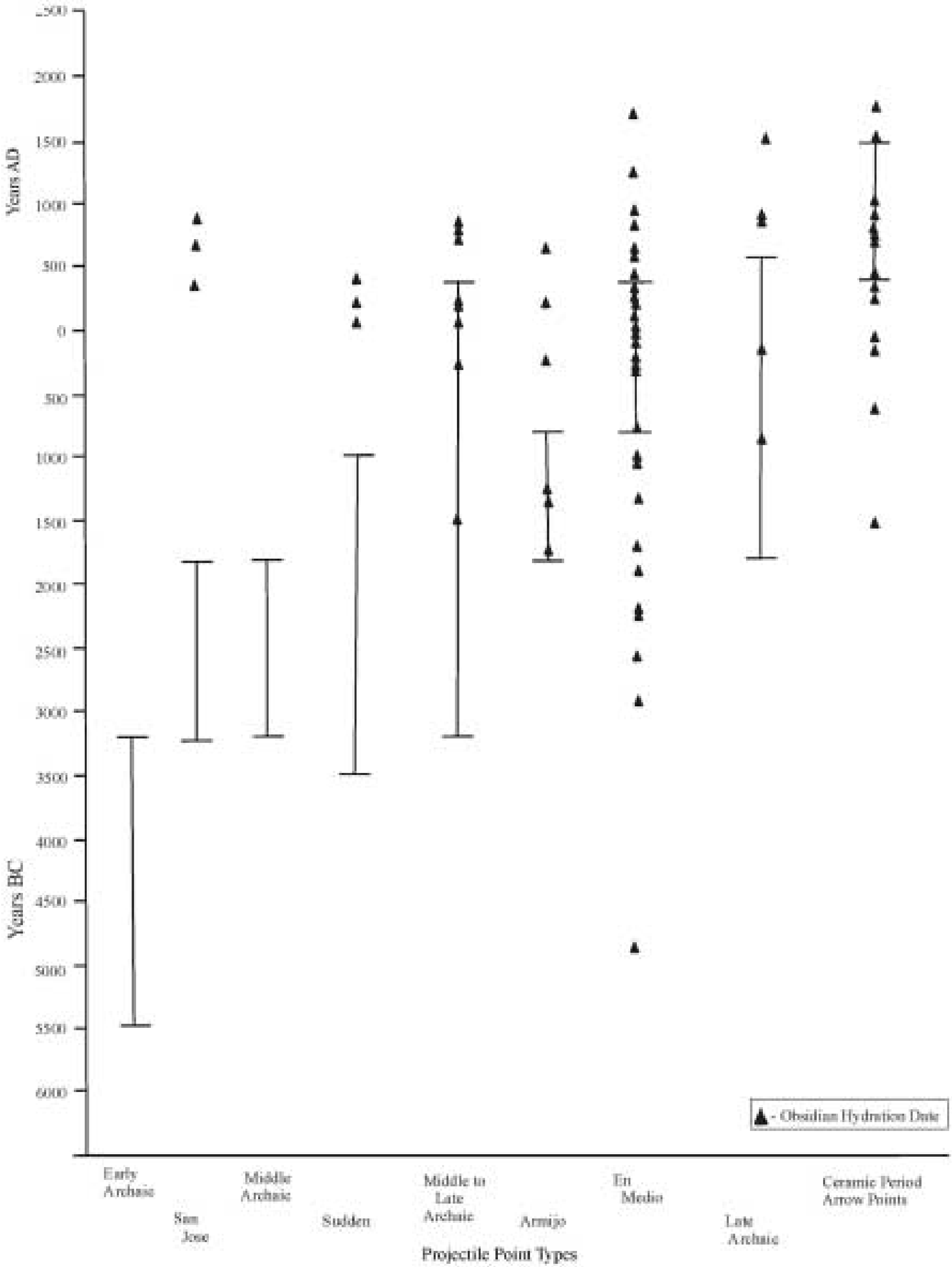


Figure 6.3. Comparison of obsidian hydration dated projectile points with defined chronologies for Ojo Line Extension Project.

dart type (e.g., Sudden) appears to date to the Late Archaic and Ceramic period, rather than the Middle Archaic. This pattern contrasts with that observed on the Baca Geothermal Project, where the hydration rinds on these large side-notched points were thicker than those observed on the large corner-notched points (e.g., Basketmaker II). It is, however, noteworthy that the patterning observed by comparing obsidian dated projectile points with their associated date ranges is similar for both the Abiquiu and Ojo Extension Line Projects. That is, Middle Archaic dates seem to date much later than expected (e.g., to the first millennium AD). As suggested by Acklen (1993:438), this may represent the environmental effects of the arid Altithermal period and long-term exposure to sun, weather, and forest fires. Otherwise, the Late Holocene dates for the Late Archaic and Ceramic periods are more in line with our expectations; however, some of these darts may represent spear points that were used during the later period as suggested by Bertram et al. (1989:347) (also see Vierra 1997a for a similar argument).

Archaeomagnetic

The archaeomagnetic dating method is based on two phenomena. First, that fired soils containing iron oxide minerals retain a magnetism parallel to the direction and proportional to the intensity of the magnetic field in which they cool, and second that the direction and intensity of the earth's magnetic field has changed through time (Wolfman 1984:364). In the American Southwest, a general curve has been calibrated using radiocarbon and tree-ring dates. The result has been the development of a curve tracing the movement of the geomagnetic pole from circa AD 600 to 1500. However, this geomagnetic field is not uniform over areas larger than about 1000 km^2. Therefore, regional refinements need to be made to this calibrated curve. Wolfman (Wolfman 1984:365) states that errors of ±15 to ±60 years at a 95 percent confidence level are possible when 8 to 10 individual samples are taken per feature (e.g., assuming a tree-ring calibrated curve). He also suggests a general error of ±25 years for the technique (Wolfman 1994:35). Given a calibrated curve, this technique can be as accurate, if not more accurate, than radiocarbon dating. Recent research has also defined that portion of the curve for northwestern New Mexico from ca. 300 BC to 75 BC (Blinman, pers. comm. 2000). See Wolfman (1984), Eighmy and Sternberg (1990), and Eighmy (1980, 2000) for detailed discussions of the archaeomagnetic dating technique and field collection methods.

There are several inherent problems with the archaeomagnetic dating technique. First, as stated above, regional refinements are needed to accurately calibrate the curve. Second, the feature needs to be burned to a temperature that resets the magnetic orientation of the sediment. Third, the feature cannot have been disturbed since firing. Fourth, exposure to magnetic fields (e.g., lightning) could affect samples. Fifth, local magnetic anomalies could affect compass readings during field collection and thereby create an error in the calculations. Of the 12 samples taken by Wolfman (1994) on the Pajarito Plateau, only half could be accurately dated. One sample taken from a hearth within a pit structure was not sufficiently burned. Therefore, the results obtained from the samples were actually associated with the paleomagnetic orientation of the tuff bedrock within which the hearth had been cut and not the cultural use of the feature. Indeed, Wolfman warns of the possibility of local distortions due to the presence of heavily magnetized rocks in the area. This is how he explained why two sets of samples from the same hearth yielded accurate, but different results. That is, one was affected by "magnetic material (possibly a small rock) buried in the ground below this sample" (Wolfman 1994: 225). Another sample appears not to correspond with associated tree-ring dates. In this case, he suggests that the calibrated curve may need some slight revising. That is, if the curve was moved slightly west during this time period, the 95 percent confidence oval would have crossed the curve at this point. Other samples yielded poor results due to cultural and/or natural disturbance. His study would seem to indicate that features cut directly into the tuff bedrock may produce less reliable results than those that are clay-lined or dug directly into the soil. These inaccuracies might also be due to local magnetic distortion affecting the compass readings during sample collection.

Luminescence

Luminescence dating measures the last heating event for an artifact exposed to a temperature of 450 °C. This method therefore has the potential to directly date the manufacturing event for ceramic or heat-treated lithic artifacts (Feathers 2000:152). It is the direct dating of artifacts that is the major advantage of this technique over radiocarbon or tree-ring dating. For example, radiocarbon dates are prone to inaccuracies involving old wood, cross-section effect, and correction and calibration factors. In addition, questions of artifact association with the dated sample can also be an issue. Tree rings date the construction event, but not necessarily the manufacturing event, and may also be prone to inaccuracies in artifact association. The luminescence technique can therefore be used for dating surface artifact scatters in the absence of other datable materials. However, it is unclear as to how artifacts burned by forest fires might affect the reliability of this dating technique. See Aitken (1985, 1989) and Feathers (1997, 2000) for detailed discussions of luminescence dating.

Until recently, there has been little use of the luminescence technique for dating archeological sites in the Southwest. However, one study indicated that this technique was more accurate than radiocarbon dating. Dykeman (Dykeman 2000; Dykeman et al. 2002) compared tree-ring dates with both radiocarbon and luminescence dates for protohistoric Navajo sites. He found that the luminescence dates were within a 40-year range of the tree-ring dates. In contrast, the radiocarbon dates provided a 90 to 120 year range that was earlier than the tree-ring dates.

There have only been two studies involving the use of luminescence dating in the region. Eighteen burned rock samples were submitted from sites excavated for the Abiquiu Reservoir project (Lord 1986). They yielded dates from <35,000 BP to AD 1820. The ancient dates appear to reflect residual geologic luminescence. Radiocarbon dates were obtained from only one of these sites. Four of these dates do correspond to the AD 1700 luminescence date.

Ramenofsky and Feathers (2001) used the luminescence technique to date surface collected ceramics from historic sites in the lower Chama Valley. They were specifically interested in determining the age of abandonment for these sites. Therefore, luminescence dating provided a more accurate method than tree rings. However, only nine sherds were submitted for analysis: Biscuit B (*n* = 2), Sankawi Black-on-cream (*n* = 3), Potsui'i Incised (*n* = 1), Kapo Black (*n* = 1), and Casitas Red-on-brown (*n* = 2). Their analysis determined that most of the dates fit the expected ceramic time ranges, although a Biscuit B and Sankawi Black-on-cream sherd did exhibit slightly later 16th and 17th century dates, respectively.

Historic Artifacts

There are three primary periods of historic period occupation represented on the plateau. These consist of the early Historic period (ca. 1600 to 1890), the Homestead Era (ca. 1890 to 1942) and the Manhattan Project/Cold War era (1943 to 1963). There is little evidence of occupation on the plateau during the early Historic period. What remains is primarily isolated sherds of historic Pueblo pottery. For example, sherds of Tewa Polychrome and Pohoge Polychrome have been found in the area of Pajarito Canyon near White Rock. Kapo Black and Potsuwi'i Incised ceramics have been observed at Otowi, but this site predates AD 1600 (Vierra 2000). Information on historic Tewa pottery is provided by Harlow (1973), Mera (1939), and McKenna and Miles (1991). Athabaskans might have also been present on the plateau during this time period. Jicarilla pottery types include Ocate and Cimmarron Micaceous; whereas, Navajo types include Dinetah, Navajo, and Pinyon Gray (Baugh and Eddy 1987; Brugge 1982). Perdido Plain is a micaceous ceramic ware that was possibly produced by Faraon Apaches (Gunnerson and Gunnerson 1970, 1971). Brugge's (1982) review of Athabaskan ceramics indicates that their utilitywares share a number of characteristics. They generally show "a preference for moderately large jar forms, usually a dark gray color but with considerable variation, thin walls and limited decorative treatment" (1982:279). Exteriors were sometimes textured and mica was often used as a temper or applied to the vessel. Other items that might be present include glass trade beads or items made of metal (e.g., projectile points) or glass (e.g., retouched pieces). Trade beads are temporally diagnostic (Harris and Harris 1967).

In contrast to the lack of diagnostic artifacts representative of the early Historic period, the Homestead Era is represented by an array of material culture items. Although this is in part due to the arrival of the railroad to New Mexico and the presence of a variety of cheap commodities, it is primarily the result of the arrival of Hispanic and Anglo homesteaders to the plateau during the turn of the 20th century. The variety of materials increased even further during the Manhattan Project era when roads were constructed for automobile traffic. Nonetheless, material items made of ceramic, glass, and metal might all provide chronological information on potential historic site occupation spans. Each will be discussed separately.

Ceramics

A variety of Euro-American ceramic wares were present by the turn of the century. These include common earthenwares, whitewares, and stonewares. These distinctions are based on differences in firing techniques, paste type, and paste color. The whitewares can be separated into refined earthenwares, semiporcelain, and porcelain. Besides the ware types, decorative technique and hallmarks are also good chronological indicators. Differing design techniques include plain white, transfer print, banded ware, spongeware, spatterware, and flow blue. See Barber (1904), Berge (1980), Cote (1987), Gates and Omerod (1982), Majewski and O'Brien (1987), and Price (1979) for discussions of these dating mechanisms. Hallmarks, or maker's marks, are another very good dating technique. They provide information on the manufacturer and dates that the item was produced (Kovel and Kovel 1953).

Glass

Bottle glass is a common item recovered from historic sites. Several aspects of these items are chronologically sensitive. This includes the base shape, color, seams, closures, embossing, and maker's marks (Abbink 1987; Berge 1980; Fontana and Greenleaf 1962; Jones 1971; Kendrick 1963; Lief 1965; Lorain 1968; Newman 1970; Rock 1981a; Toulouse 1971; Ward et al. 1977). Bottle attributes and production dates are provided in Table 6.5 as derived from Gerow (1997:260). Attributes like clear glass or embossing styles, including "No Deposit," "Federal Law Forbids," or "Federal Law Prohibits Sale or Reuse of this Bottle," and applied color labels may help to distinguish the Homestead Era from the Manhattan Project era, since they date to the 1930s and later. The "*Duraglas*" maker's mark post-dates 1940, so it too may be a good temporal indicator of Manhattan Project era sites.

Table 6.5. Bottle Attributes and Dates of Production (from Gerow 1997:260)

Attribute		Date Range
Base		
	Pontil Mark	To 1870s
	Improved Pontil	1840 to 1880
	Push-up or Kick-up	To 1900s
	Rounded end	1860 to 1900s
	Pointed or Torpedo	1860 to 1900s
	Flattened-round	1900 to 1913
	Off-center Seam	1903 to present
	Ring Seam	1903 to present
Color		
	"Black" or Dark Green	1815 to 1885
	Aqua	1840 to 1910
	Purple	1880 to 1917
	Brown	1880 to present
	Amber	1914 to 1930
	Irridized or Opalescent	Pre-1920 or 1930s
	Clear	1930 to present
	Commercial Colors (Red, Blue, Green, Milk Glass)	1930 to present
Closure		
	Sheared Lip	1810 to 1840s
	Applied Lip (crude)	1840 to 1860 +/- 10
	Applied Lip (smooth)	1860 to 1913
	Lightening Stopper	1882 to 1915
	Lightening Fastener	1882 to present
	Crown Cap	1892 to present
	Pry-off Seal	1908 to present
	Continuous Thread	1919 to present
Embossing Style		
	Slug Plate	1850 to 1915
	Lettered Panel	1867 to 1915
	Poisons or Skull	1870 and later
	"The Bottle Never Sold"	1905 to 1920
	"No Deposit" & "Federal Law Fordbids"	1932 to present
	Applied Color Label	1934 to present

Metal

Metal items can be ubiquitous at an historic site. The problem is that they are prone to corrosion and deterioration, leaving the fragmented remains of an artifact. This is especially true for items made of iron and tin. However, some metal artifacts, such as nails, cans, and cartridge cases, are good temporal indicators. By the late 19th century, wire nails had mostly replaced nails cut from flat sheets (Lees 1977). As with bottles, such attributes as seams, closures, size, embossing, and style are good temporal indicators on tin cans (Berge 1980; Fontana and Greenleaf 1962; Rock 1981b; Ward et al. 1977). Can closure method could be used to distinguish early vs later Homestead Era sites. Hole-in-top cans are replaced by sanitary (modern) cans by about 1910. Condensed milk cans might also be used to separate late Homestead from Manhattan Project era sites. Two sizes are known to be made before 1931 (2 1/2 by 2 1/2 and 4 3/8 by 3 in.), while others were manufactured later (3 3/8 by 3 and 4 by 2 15/16 in.) (Biting 1937; Fontana and Greenleaf 1962:75). KC Baking Powder cans are another good temporal indicator. The canister lids were embossed with "KC Baking Powder Same Price as ___ years ago" or "Price for over ___ years." If the number of years indicated on the lid is added to 1890, then the artifact can be dated to within one or two years of its actual manufacturing date. Table 6.6 shows that accurate dates can be obtained from 1913 to 1939 (Vierra 1985a). Metal cartridge cases can also be used for dating, since firearms changed over time (Gillio et al. 1980).

Table 6.6. Dates of KC Baking Powder Can Lids (from Vierra 1985a)

Years	Date of Manufacture	Number of Cans	Feature Number
23	1913	1	6b
30	1920	1	21a
33	1923	3	21a, 22a, 30b
35	1925 to 1927	2	9j
38	1928 to 1929	3	9j
40	1930 to 1932	1	6a
42	1932	2	10b, 12a
45	1935	1	10e
48	1938 to 1939	2	12d, 14a

Chronometric Dating Research Questions

1. **What period do the sites date to, and is there evidence of multiple occupational episodes?**
2. **Do the recovered projectile points resemble types described for the Oshara Tradition? If so, do the associated chronometric dates place them within the time range as defined by Irwin-Williams?**
3. **How do the projectile points compare in morphology and temporal range to the sequence defined by Turnbow (1997)?**
4. **Given the problems with the obsidian hydration dating of Early and Middle Archaic obsidian artifacts, do projectile points from LA 85859 and LA 99396 also follow the pattern of dating to the Late Archaic? Or, were some of these point types actually used (reused) during later times?**
5. **Can obsidian hydration analysis distinguish between Archaic and later Ceramic period occupations (i.e., Coalition and Classic periods)?**

6. **How do the ceramics compare with the type descriptions and date spans as provided by McKenna and Miles (1991)?**
7. **What are the most temporally sensitive attributes for the ceramic types? Can Santa Fe Black-on-white be subdivided into earlier and later varieties?**
8. **How does Santa Fe and Wiyo Black-on-white compare with similar types that were produced in the Rio Grande Valley (e.g., Pindi and Poge Black-on-white), and later biscuitware types from the plateau?**
9. **How do the dated ceramic assemblages compare with Orcutt's seriation sequence?**
10. **Is there a difference in accuracy between archaeomagnetic samples taken from tuff vs clay-lined features or burned soil?**
11. **How do the results of the radiocarbon, dendrochronology, obsidian hydration, and luminescence dating techniques compare with each other? Which are the more accurate techniques?**
12. **Which suite of historic artifacts provide the most accurate dating mechanism for the homestead site?**

GEOARCHEOLOGY

Geomorphic processes, or physical processes acting on the earth's surface, play an integral role in determining the nature of the land surface at any point in time, how the land can be used, and whether archaeological sites will be preserved at the surface, eroded, or buried. Changes in climate, including changes in the amount, intensity, and seasonal distribution of precipitation, have strongly affected geomorphic processes and therefore the stability of the land surface (e.g., Bull 1991). The nature and density of vegetation are also affected by short-term and long-term changes in climate and by the geomorphic processes acting under that climate. In turn, geomorphic processes are affected by vegetation through their influence on surface runoff and erosion, resulting in complex interrelationships. Results of numerous investigations at LANL and in adjacent areas have demonstrated that significant geomorphic changes have occurred in this area over the time period relevant for archeological investigations, resulting in extensive sediment deposition in some areas and erosion in others (e.g., Reneau and McDonald 1996; Reneau et al. 1996). Archaeological sites from any time period may thus be either buried or removed by erosion depending on the landscape position. Geomorphic studies are therefore critical to understanding the depositional context and integrity of a site.

Geoarcheology Research Questions

13. **What is the geomorphic context of the sites?**
14. **Which sites have been affected by sediment deposition or erosion, and how have these processes affected the integrity of the sites?**

PALEOENVIRONMENT

The archaeological record of the American Southwest is characterized by regional and local shifts in land-use practices. Often these are characterized as periods of "boom or bust" and "expansion or abandonment." The Pajarito Plateau exhibits similar long-term changes in demography and land-use. Why populations reposition themselves across the landscape is an important question. Obviously, there are a variety of factors that can affect this behavior including inter-group conflict, local resource depletion, degrading soil cycles, and droughts. Nonetheless, changing climatic factors involving shifts in rainfall can have a significant effect on the nature and distribution of plant and animal communities and on the success of dry-land farming. Accurate reconstructions of regional paleoenvironmental conditions provide a critical source of information for evaluating models concerned with explaining changes in past human behavior, and understanding how people coped with an ever changing social and natural environment (e.g., see Dean 1988, 1996; Dean et al. 1985, 1994).

A variety of techniques have been employed for reconstructing past environments in the Southwest. Most notable of these is the dendroclimatic record that is based on tree-ring measurements (Dean 1996; Dean and Funkhouser 1995; Dean and Robinson 1977; Rose et al. 1981; Touchan and Swetnam 1995). Studies of pollen sequences and pack rat middens have also played an important role in paleoenvironmental reconstruction (Allen 1999; Betancourt and Turner 1988; Betancourt et al. 1983; 1990; Brunner-Jass 1999; Dean 1997; Ensey 1997; Spaulding 1992; Stearns 1981). However, much less research has been conducted on plant phytoliths or the stable carbon isotope analysis of sediments (Boutton 1996; Piperno 1988). Lastly, plant and animal remains recovered from archaeological sites provide some limited information on local settings, and the potential effects of humans on the landscape (Gillespie 1985; Matthews 1990, 1992; Trierweiler 1987, 1990, 1992). Studies of fuel wood use have identified long-term patterns of deforestation and fuel wood depletion (e.g., Kohler and Matthews 1988). The presence of weedy species has also been used as an indication of agricultural activities (Ford 1984). Lastly, issues concerning game depletion or the attraction of particular species to agricultural fields are just two examples of potential cultural effects on the local animal population (Akins 1985; Semé 1984).

As part of the Southwest Paleoclimate Project, Dean and Robinson (1977) developed a series of dendroclimatic chronologies across the region. Archaeological and standing tree data were collected from 25 stations distributed over the American Southwest. Station #18 is located in the Jemez Mountains. Tree-ring data were collected from archaeological samples and standing trees for the period from AD 598 to 1972. However, the report only provides information for the AD 680 to 1969 time period. This dataset is presented as standard deviations above and below a standardized mean for each station in ten-year increments and is graphically illustrated as isopleth maps. In the Jemez Mountains there are nine decades with standard deviations greater than or equal to -2.0 that reflect significantly less than normal annual tree-ring growth. These decades presumably represent the most severe droughts experienced in the area. In descending order these consist of AD 1950s (-4.10), AD 1580s (-3.10), AD 1920s (-2.90), AD 1250s (-2.60), AD 1130s (-2.40), AD 900s (-2.30), AD 1090s (-2.30), AD 1730s (-2.10), and AD 1040s (-2.00). On the other hand, there are seven decades with standard deviations greater or equal to 2.0 reflecting significantly greater than normal annual tree-ring growth. In descending order these consist of AD 1830s (3.10), AD 1610s (2.40), AD 1790s (2.20), AD 1020s (2.20), AD 850s (2.10), AD 1840s (2.10), and AD 1230s (2.00). Figure 6.4 graphically illustrates this 1000-year pattern. Droughts appear to bracket periods of significant cultural behavior. For example, the AD 900s and 1130s droughts bracket the expansion and collapse of the Chacoan system. AD 1130s to 1250s bracket the expansion of populations into upland areas like the Pajarito Plateau. The severe drought of the 1250s on the plateau is a precursor to the Great Drought of the 1270s to 1290s. There are 50 years of above average rainfall on the plateau after the drought. Lastly, the Classic period follows the Great Drought until the final abandonment of the plateau during the 1580s. The figure illustrates that this was also a period of decreased amplitude in precipitation.

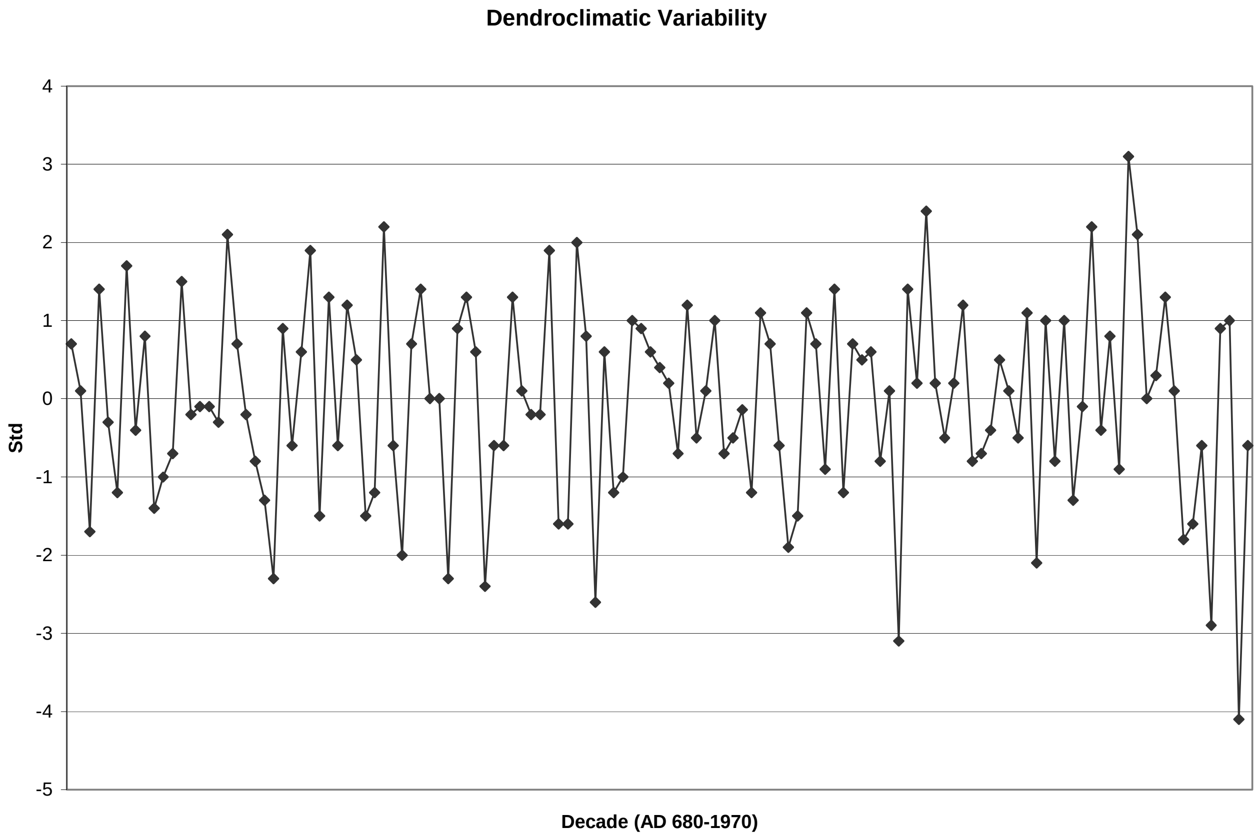


Figure 6.4. Tree-ring climate reconstruction for the AD 680 to 1969 time period. This dataset is presented as standard deviations above and below a standardized mean for each ten-year increment.

Paleoenvironment Research Questions

15. **What evidence do the tree-ring measurements, and the pollen, faunal, and floral remains provide for past environmental conditions at the sites?**
16. **Are there differences between the Early and Late Archaic sites vs the Ancestral Pueblo and Historic periods that could reflect changes in past vegetation communities?**

LAND-USE, COMMUNITY, AND SITE ORGANIZATION

Several recent studies on the Pajarito Plateau have attempted to understand the relationship between environmental stress, agricultural intensification, and the process of site aggregation (Hill et al. 1996; Kohler 1989; Kohler and Linse 1993; Orcutt 1991; Powers and Orcutt 1999;

Walsh 1998). All of these studies have attempted to understand the cultural dynamics of the Coalition and Classic periods on the Pajarito Plateau. Much of this research indicates that there is a succession of settlement types from the Coalition to Classic periods culminating in an aggregated system with a smaller population and a subsistence base more heavily dependent on maize agriculture. On the other hand, little attention has been paid to understanding the seasonal use of the plateau by Archaic populations (Biella 1992; Leach 1981; Moore et al. 1998). This section presents a series of research questions that are concerned with understanding past land-use patterns and site function.

Settlement Distribution Studies

Early studies of settlement distributions in the northern Rio Grande focused on the archaeological implications of population migration during the Coalition and Classic periods. These observations were based on changes in ceramic technology, settlement organization, and settlement distribution. This included the expansion of populations on to the Pajarito Plateau by the 1200s (Ford et al. 1972; Wendorf 1954; Wendorf and Reed 1955). As Steen (1974:83) points out, the settlements of this time period were small, containing "a double row of single story rooms, usually 10 or 12 in all, with the long axis trending north-south." They faced east, with a kiva and midden located in front of the pueblo. Settlements tended to be concentrated on mesa top settings at elevations between 2150 to 2350 m (6600 to 7200 ft). These sites may have been occupied for only short periods of time, probably "no more than a short generation" (Steen 1974:84). Santa Fe Black-on-white pottery was common at these sites. Later, the roomblocks were expanded to include three rows of rooms, and eastward roomblock extensions from the north and south ends of the settlement. This created a central plaza, often with a kiva. Santa Fe and Wiyo Black-on-white were common on these sites. Eventually, large aggregated pueblos were constructed at lower elevations during the 1300 and 1400s. Steen suggests that farming activities moved from primarily mesa tops, to canyon slopes and bottom lands during this period. This is reflected by the presence of check dams across minor drainages. He also suggests that most of the cavate sites were excavated during the Classic period. Biscuitwares are the common ceramic type during this period. By the 1500s, the large pueblos on the plateau were abandoned, with people moving to nearby Rio Grande villages. Sporadic use of these upland areas continued during historic times. This is represented by the presence of historic rock art in Frijoles Canyon (e.g., horses) and the brush walls of a deer trap at Navawi. Steen considers that game pits on the plateau may have been important during this time period (Dean and Robinson 1977; Steen 1974, 1977).

The PARP was the first systematic archaeological survey conducted on the plateau (Hill and Trierweiler 1986). The project was directed by James Hill (University of California, Los Angeles) and was organized into three phases from 1977 to 1985. Surveys were conducted at Los Alamos Scientific Laboratory during the second phase of the project from 1979 to 1980. A total of 251 sites were recorded during this time. One hundred and eighty-five of these sites were originally recorded by PARP, with an additional 66 sites being re-recorded Mera, Worman, or Steen sites. Approximately 200,000 sherds and 60,000 lithic artifacts were collected from 246 of these sites.

Hill et al. (1996), Hill and Trierweiler (1986), and Orcutt (1981, 1993) assume a population-resource-imbalance model involving short-term and long-term environmental degradation, agricultural intensification, and site aggregation. The BAS Project and the Bandelier Excavation Project also focused attention on the long-term process of community aggregation and its social and economic implications (Kohler 1989; Kohler and Linse 1993; Powers and Orcutt 1999a). For example, Kohler (1989), Hill et al. (1996), and Powers and Orcutt (1999b) have proposed an aggregation model that suggests a long-term process of regional population packing, depletion of indigenous flora and fauna, and agricultural intensification that conditions site aggregation. In summary, during the Coalition period sites were initially occupied until agricultural field productivity declined. Mobility and wild food resources were important backups to declining crop returns. With increasing population growth (local and immigration), these backup strategies became less reliable. As such, the population began to aggregate into larger villages located near prime arable land and became more dependent on maize agriculture. Competition increased over the declining availability of arable land and wild resources. New techniques would have been employed to increase agricultural productivity, including the expansion of field sites into new areas. As such, there were several competitive advantages for aggregation: 1) it facilitates the process of reallocating land across generations, 2) it facilitates the process of sharing food, and 3) since aggregates were regularly spaced within defined boundaries, they offer more defendable territories.

Site distribution maps of LANL reveal obvious differences in the patterning of sites over time. The distribution of Archaic sites is presented in Figure 6.5. Although most of these are Late Archaic sites, it is noteworthy that all but one of the Early and Middle Archaic sites are located at higher elevations in the ponderosa pine zone. However, given the sparse distribution of sites, we can combine them with the distribution of all obsidian lithic scatter sites (Figure 6.6). These assemblages are also dominated by the production maintenance of obsidian bifacial tools, but lack diagnostic projectile points. Given the previous data, it is likely that most of these sites represent Late Archaic occupations. Nonetheless, both figures illustrate broad occupation zones: 1) juniper-savanna in the Rio Grande Valley, 2) piñon-juniper at lower elevations on the plateau, 3) piñon-juniper/ponderosa pine at mid-elevations on the plateau, and 4) ponderosa pine/mixed conifer at the higher elevations. Vierra and Foxx (2002) have recently proposed one possible Late Archaic transhumance pattern, involving seasonal movements from the juniper-savanna in early summer to the ponderosa pine/mixed conifer in the mid- to late summer, and then down to the piñon-juniper in the fall. Riverine settings also appear to have been used for winter campsites during the Late Archaic (Lent 1991; Skinner et al. 1980; Stiger 1986). Only a single Archaic site has been excavated on the plateau. LA 70029 is a large surface artifact scatter situated on Mesita del Buey at an elevation of 2120 m (6960 ft) (Biella 1992). Biella suggests that the site represents a reoccupied Late Archaic campsite, however, no features were identified.

A series of surface obsidian artifact scatters was excavated in the Redondo Creek Valley at an elevation of 2500 to 2990 m (8200 to 9800 ft) (Baker and Winter 1981). These sites appear to date to the Middle and Late Archaic periods. As was the case with the Mesita del Buey excavations, no features were identified during this project. In the LCT tracts, there are two Early Archaic sites in the ponderosa pine zone of Rendija Canyon vs a Late Archaic site in the piñon-juniper at White Rock.

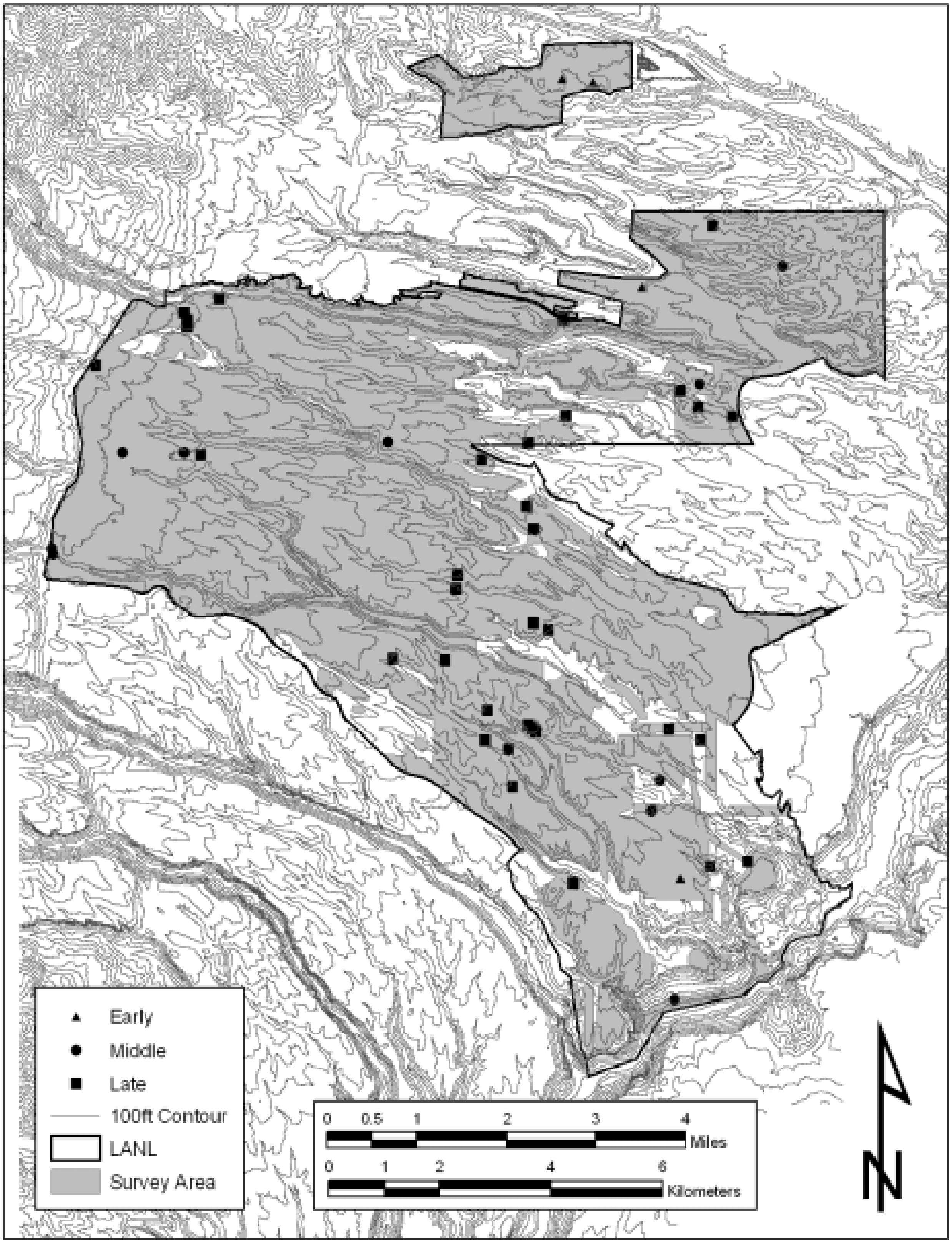


Figure 6.5. Distribution of Archaic sites at Los Alamos National Laboratory.

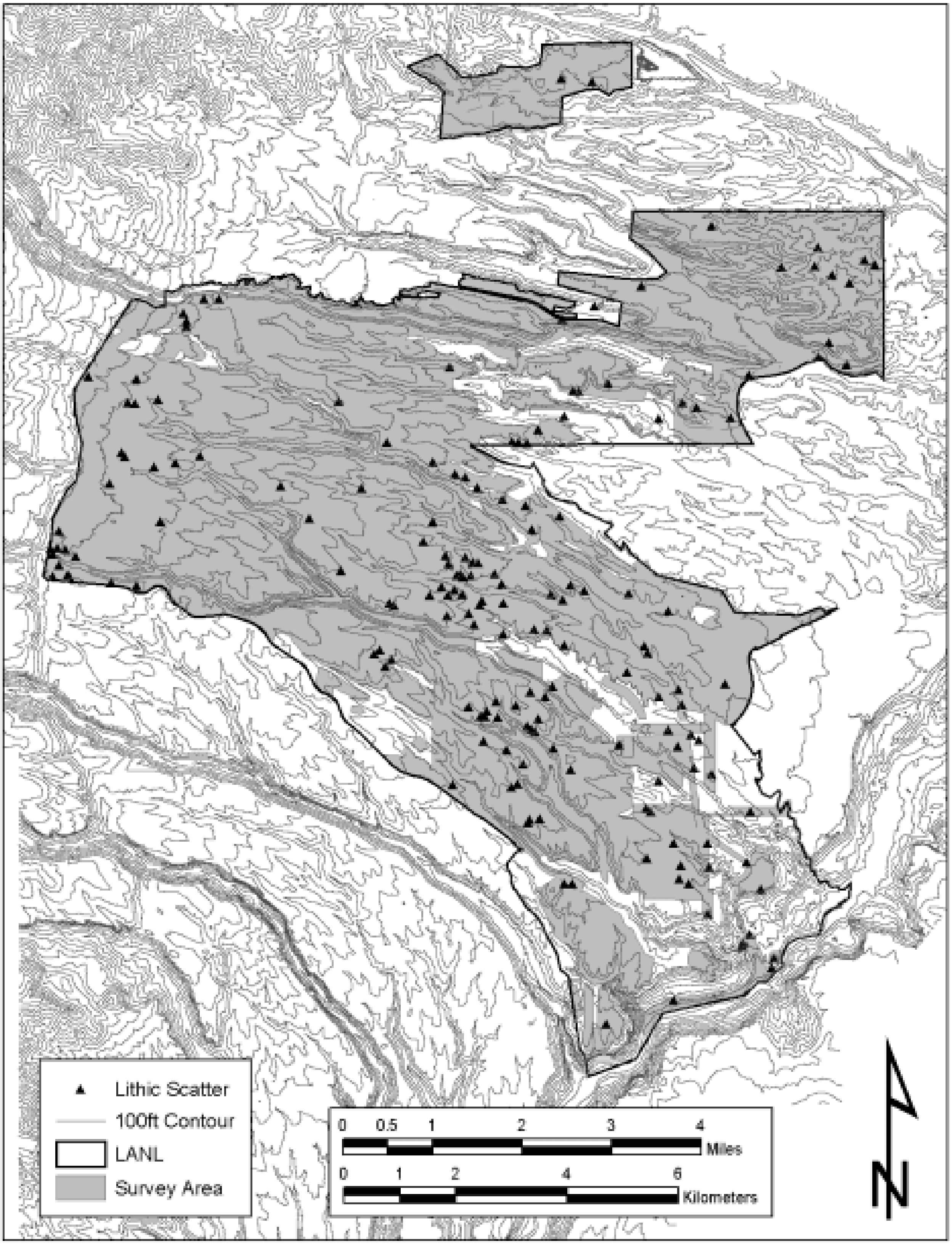


Figure 6.6. Distribution of lithic scatters at Los Alamos National Laboratory.

Figure 6.7 illustrates that Coalition period habitation sites are numerous at LANL, but are confined to the piñon-juniper zone below 2200 m (7260 ft) in elevation**.** In contrast, the number of Classic period habitation sites markedly declines, with the large plaza pueblos being located at lower elevations in the piñon-juniper zone (Figure 6.8). Most of the Coalition period fieldhouses are also located in the piñon-juniper zone, with a few situated at higher elevations in the ponderosa pine (Figure 6.9). This again contrasts with the Classic period fieldhouses that show a marked decrease in the use of the lower elevation piñon-juniper zone and an increase in the use of the ponderosa pine zone (e.g., in Rendija Canyon) (Figure 6.10).

Figure 6.11 illustrates the distribution of Coalition period lithic and ceramic scatter, water control, and garden plot sites. The majority of these sites are restricted to the piñon-juniper zone, with a few lithic and ceramic scatters being located in the ponderosa pine; however, most of the water control features are located in the upper elevations of the piñon-juniper zone. Lastly, Figure 6.12 illustrates the distribution of Classic period lithic and ceramic scatters, with two water control features and a grid garden (LA 21592) being located near Otowi Pueblo. Again, the lithic and ceramic scatters are primarily situated across the piñon-juniper zone. The problem is that most water control features or grid gardens lack diagnostic artifacts, so they often cannot be dated to any specific time period.

Approximately 25 homestead patent claims were made on the plateau in the area of LANL. The location of these patents is provided in Figure 6.13. These patents were mostly made by Hispanic families who resided nearby in the Rio Grande Valley. They include the Archuleta, Duran, Gomez, Gonzales, Lujan, Montoya, Romero, Roybal, Serna, and Vigil families. Only a few Anglo homesteaders were present, including the Anchor Ranch and Grant and Grottenhaler families (McGehee and Larson 1993). Figure 6.14 illustrates the distribution of Homestead Era habitation sites, artifact scatters, fences, and roads at LANL.

Archaic Period Site Structure

Issues concerning hunter-gatherer group size, group structure, site function, and site reuse are best approached using site structure studies. As defined by Binford, site structure is the "spatial distribution of artifacts, features, and fauna on archaeological sites" (1983:144). It is the spatial relationships between facilities and artifact distributions that provide information on internal site organization and activities. This is best illustrated by Binford's (1978, 1983) study of site disposal methods and the identification of drop zones, toss zones, and dumping areas (also see Camilli 1979). Vierra (1985b) suggested the use of site structure studies as a method for diagnosing reoccupied hunter-gatherer campsites. Studying summer Archaic campsites in northwest New Mexico he was able to define a basic campsite module. That is, a basic site organization plan. This plan consists of a hearth area with metate and a separate lithic reduction locus. He suggests that once a basic campsite module is defined, then one can ask the question as to whether multiple modules on a site are contemporaneous or not. That is, do they represent single vs multiple occupation episodes?

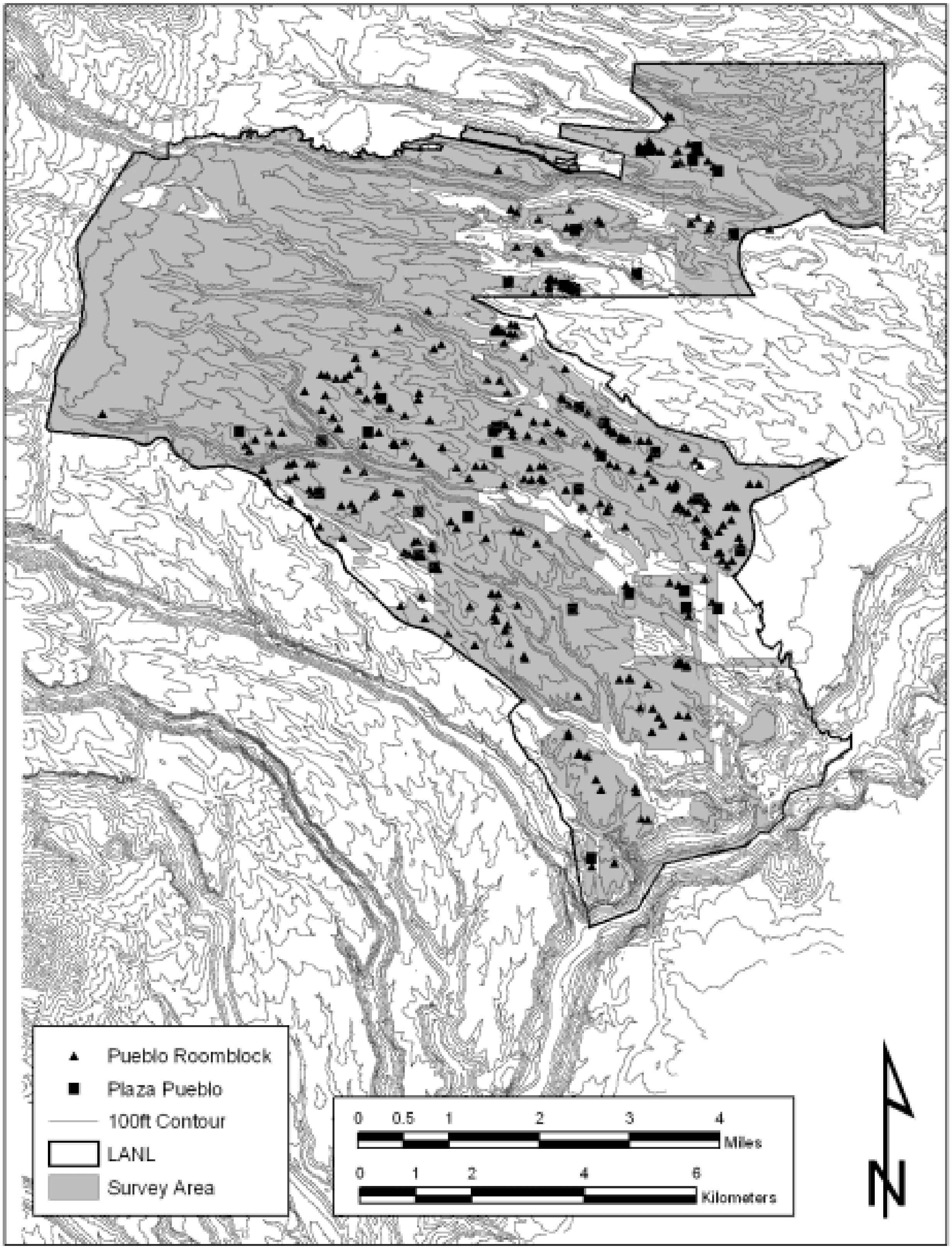


Figure 6.7. Distribution of Coalition period habitation sites at Los Alamos National Laboratory.

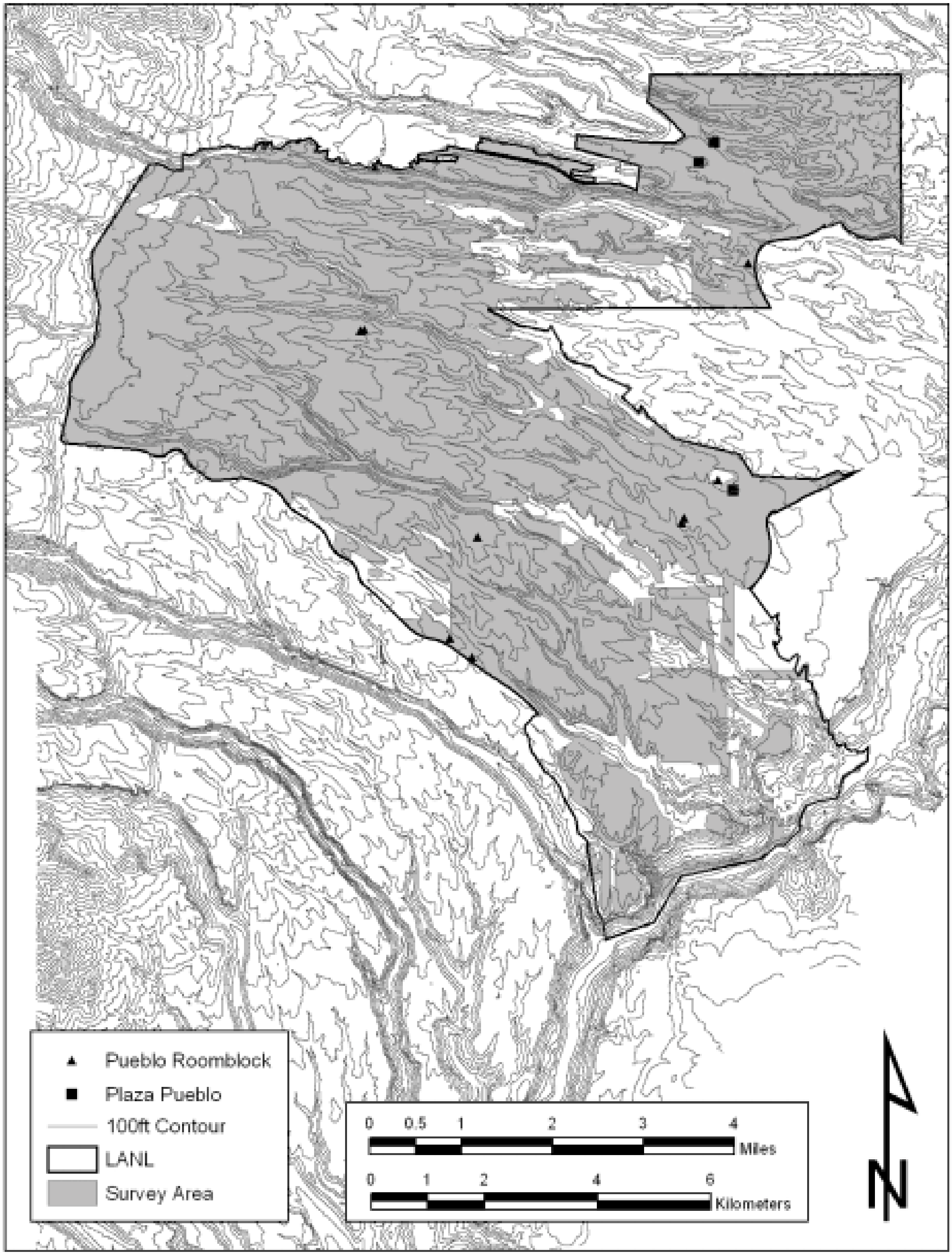


Figure 6.8. Distribution of Classic period habitation sites at Los Alamos National Laboratory.

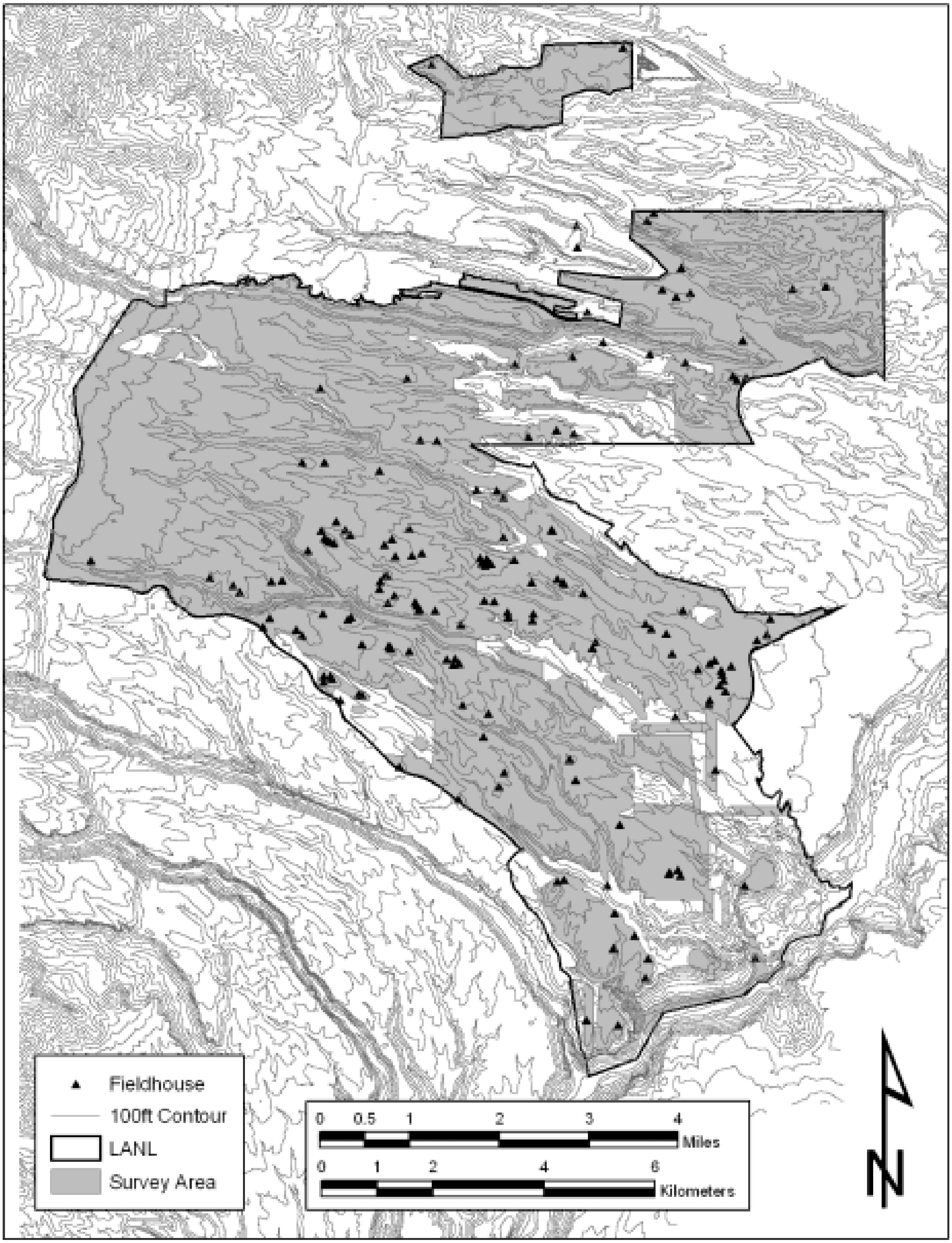


Figure 6.9. Distribution of Coalition period fieldhouses at Los Alamos National Laboratory.

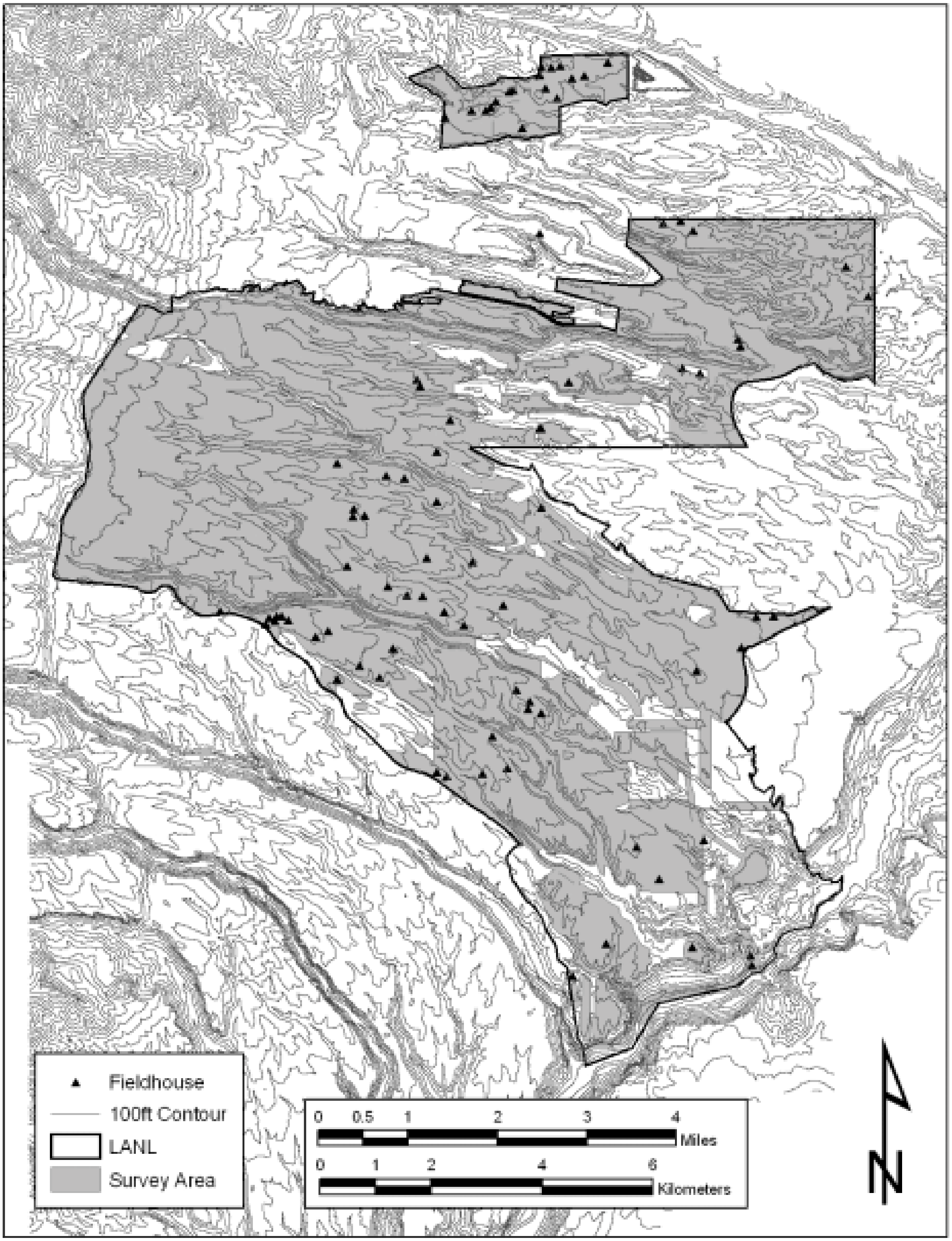


Figure 6.10. Distribution of Classic period fieldhouses at Los Alamos National Laboratory.

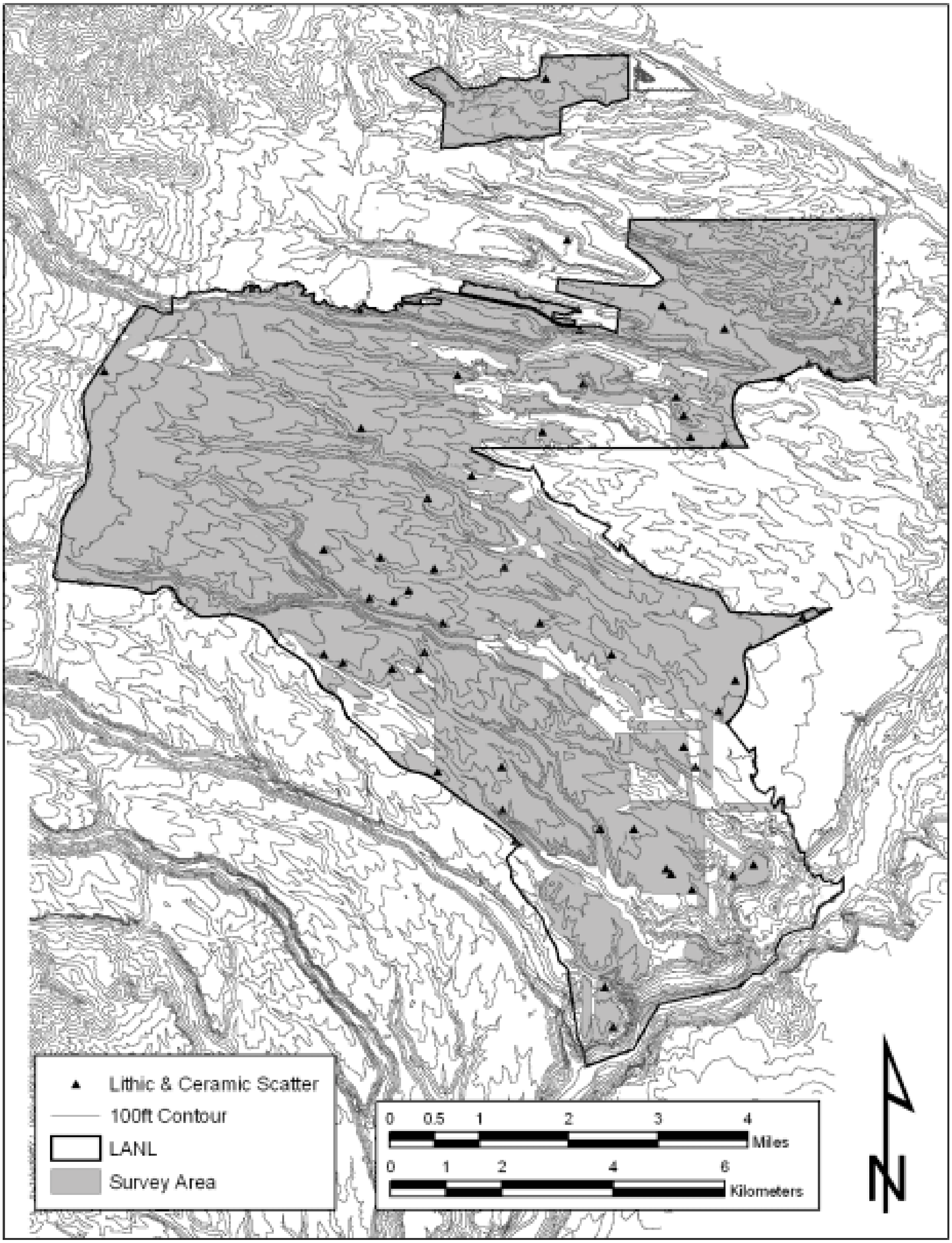


Figure 6.11. Distribution of Coalition period lithic and ceramic scatters at Los Alamos National Laboratory.

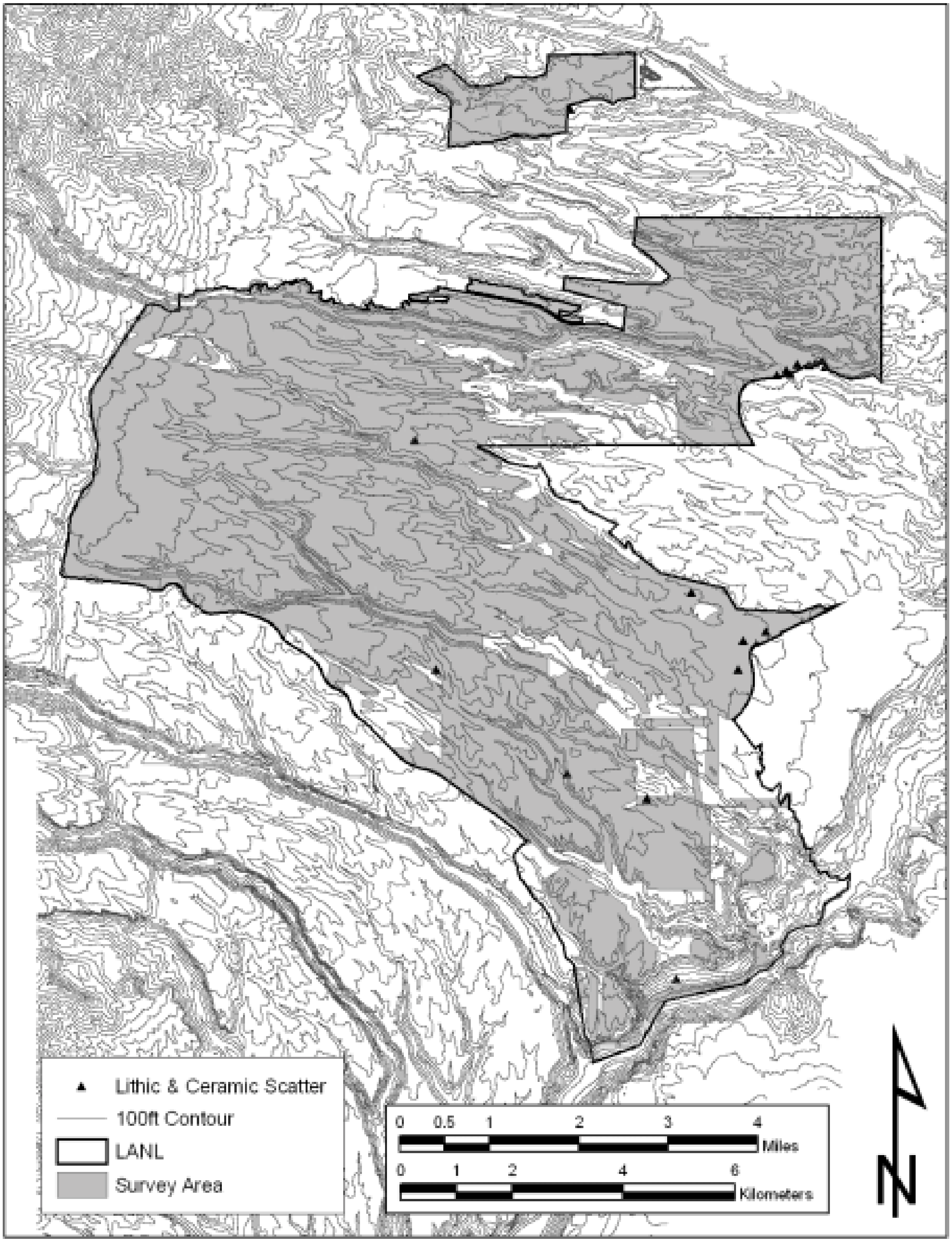


Figure 6.12. Distribution of Classic period lithic and ceramic scatters at Los Alamos National Laboratory.

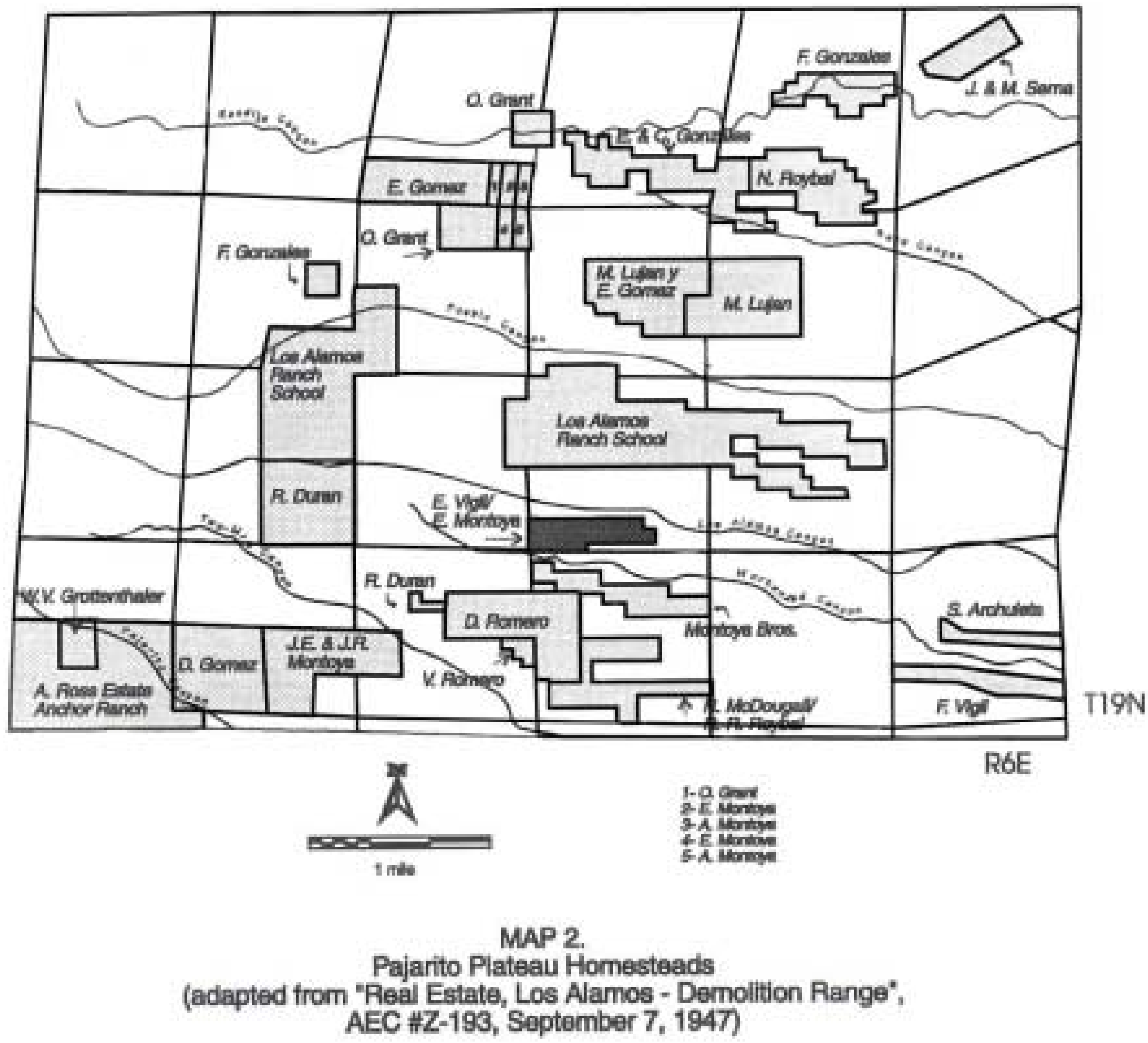


Figure 6.13. Pajarito Plateau homesteads.

Chapman's (1979) detailed study of Archaic sites in the Cochiti Reservoir area identified several distinct intra-site spatial patterns:

1. maximum concentrations of firecracked rock occur adjacent to existing hearths,
2. maximum concentrations of lithic debitage or tool manufacturing debris are distributed to one or either side of the hearth and generally form crescentic arcs extending from the hearth itself toward one side of the hearth,
3. these arcs enclose areas that are relatively free of any debris,
4. larger by-products of tool manufacture (cores and large angular debris) are generally distributed outside the debris-free areas and may well represent toss zones,
5. metates or metate fragments are generally found adjacent to hearths, and
6. manos or mano fragments are sometimes found adjacent to hearths and sometimes found within the toss zones of expended cores and large angular debris.

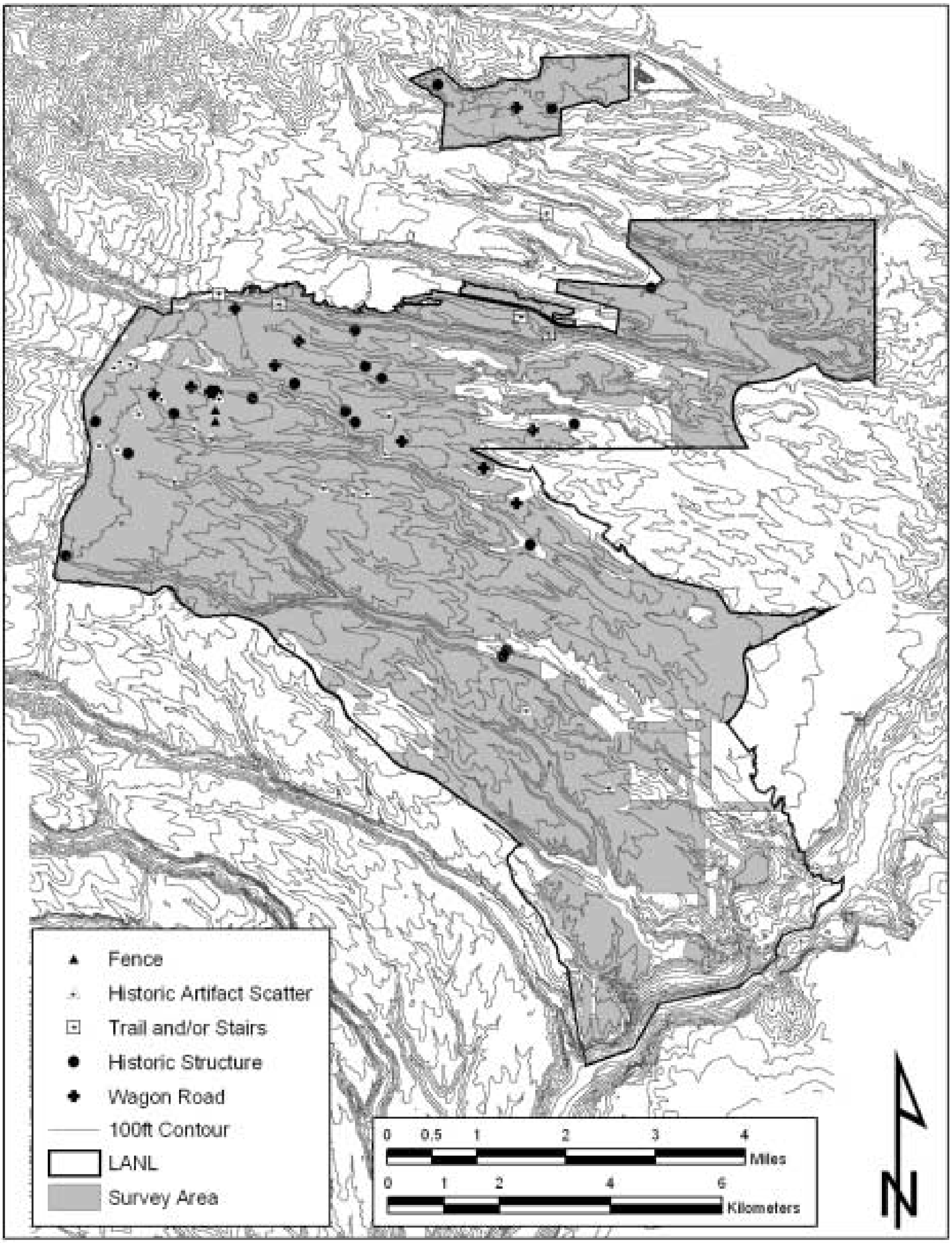


Figure 6.14. Distribution of Homestead Era habitation sites, artifact scatters, fences, and roads at Los Alamos National Laboratory.

Dating was limited for these sites, but Chapman suggests that they primarily represent Late Archaic campsites; however, the lack of botanical and faunal remains precluded his ability to determine what season(s) the sites were occupied (also see Chapman 1980).

Only one Archaic site has been excavated at LANL. LA 70029 is a lithic scatter located on a piñon-juniper covered mesa top between Pajarito Canyon and Cañada del Buey at an elevation of 2120 m (6955 ft). Excavations were conducted at the site by Biella (1992), but no features or spatially distinct activity areas were identified. She suggests that the location was repeatedly used during Late Archaic times as temporary campsites where the production/maintenance of obsidian bifacial tools was an important activity. Several one-hand manos were also recovered. The lack of botanical and faunal remains also precluded her from making any interpretations concerning season(s) of occupation. Nonetheless, presumably hunting and plant processing activities occurred there. Contrary to the Cochiti Reservoir sites, fire-cracked rock is lacking from this and other Archaic sites on the plateau. The lack of features makes the identification of specific site organization plans more difficult, since as both Vierra and Chapman note, these features often act as the focus for site activities.

Lent (1991) excavated a Late Archaic winter habitation near San Ildefonso Pueblo in the Rio Grande Valley. The structure was a shallow circular depression about 1.5 m in diameter. It had an internal hearth, two small pit features, and two post holes. However, two outside activity areas were also defined. They contained hearths, roasting pits, a milling feature, ground stone, and fire-cracked rock. The lithic assemblage represented a mixture of core reduction and bifacial tool production/maintenance activities. Few botanical or faunal remains were recovered, with no cultivated plants being identified.

Coalition Period Community Organization

Although definitions of “community” vary there is a general consensus that a community is a group of people above the level of the family who live close to each other and who interact with one another on some regular basis. Wills and Leonard (1994:xiii) define two types of communities: residential communities that are composed of people living at an individual site and political communities that consist of “individual sites assumed to be linked through intersettlement mechanisms for making social or economic decisions.”

Ruscavage-Barz’s (1999) study in Bandelier National Monument identified as few as one and as many as six separate Coalition period communities. The smallest communities are 0.1 km^2 in area and have two or three sites representing 30 to 40 people. The largest communities are 7.0 to 9.0 km^2, with up to 20 sites and nearly 400 people. She sees this community pattern as indicating a need for people to be close together, in spite of the abundance of available land (1999:172):

> First, community layouts suggest settlements are organized to take advantage of the potential for cooperation with other community members beginning as early as the initial occupation of the study area in Period I. Second, cooperation is not a strategy limited to large groups of people living in aggregated settlements…Cooperation occurs among dispersed settlements, and the community may serve as the organizational framework for this cooperation.

The LCT Coalition period habitation sites were presumably components of larger communities. However, fine-grain ceramic dating of these sites is lacking. Nonetheless, there are four additional Coalition period roomblock sites situated on the mesa top within a 1 km radius of LA 86534. Two of these sites were excavated by Worman in the area of the Los Alamos Airport. The Airport No. 1 and No. 2 sites contain five and nine rooms, respectively. Figure 6.15 is an idealized sketch of the Airport No. 2 site. A large quantity of burned maize was recovered from Room 3 of this site, but reports were never written for either site (Steen 1977:65–66). LA 86536 is the eroded remains of an 8- to 10-room pueblo situated along the edge of the mesa. LA 135290 is a linear rubble mound that contains about 10 to 15 rooms. It is located about 500 m west of LA 86534.

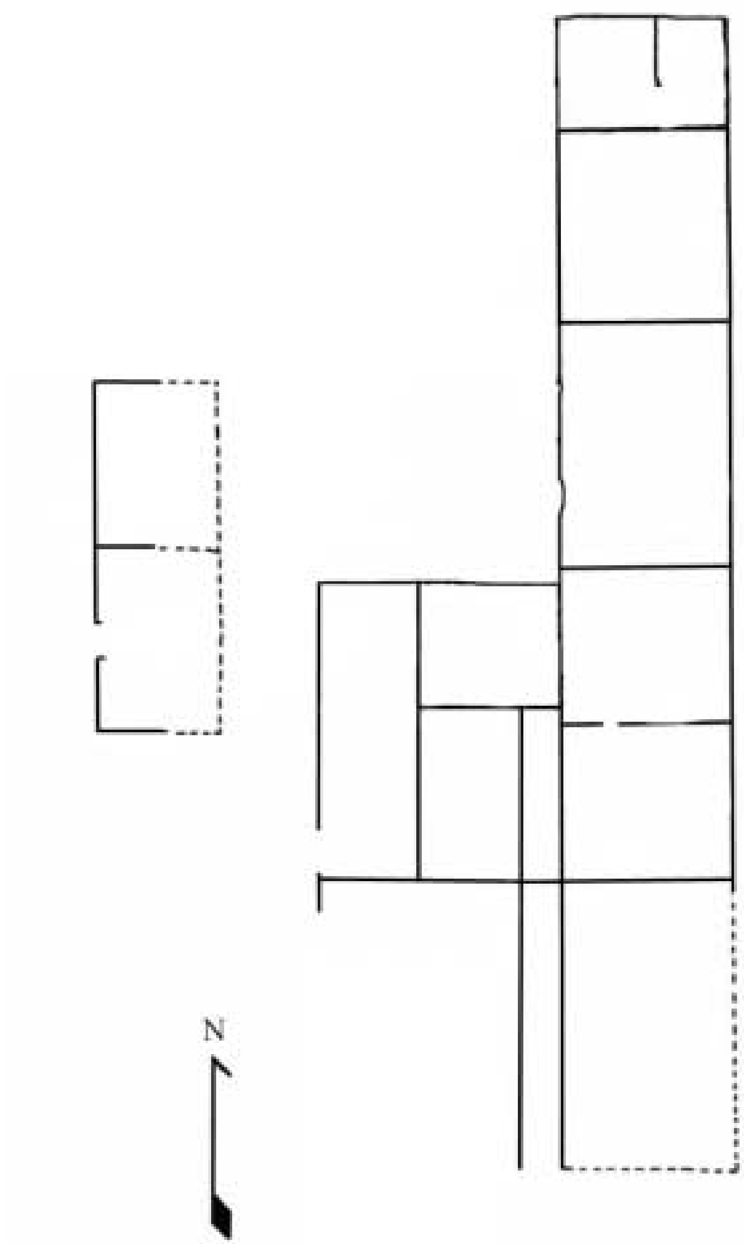


Figure 6.15. Sketch map of Airport No. 2 site.

There are six Coalition period roomblock sites located within a 1 km radius of LA 12587 near White Rock. One of these is located adjacent to LA 12587, with the other five being situated along the western side of Pajarito Canyon. Both sets of sites are located at the mouth of the canyon in an agriculturally fertile area. This is presumably why there are numerous Coalition period sites located on the western and eastern flanks of the canyon. In addition, there was at least one Coalition period roomblock present in nearby White Rock (LA 8681). The site was excavated by the Los Alamos Archeological Society (Fretwell 1954, 1959; Maxon 1969; Young 1954). It contained 22 rooms and a kiva, representing two construction episodes. The original roomblock was linear-shaped, consisting of Rooms 1–4, 11–13, 14, 15, 16, 20, and 21 and the kiva. Later additions to the roomblock consisted of Rooms 5–10 and 17–19; however, the kiva was constructed by remodeling an original room (Figure 6.16). Outer ring tree-ring dates of AD 1167, 1229, 1257, and 1264 are reported for Rooms 9, 4, 3, and 4, respectively. Excavations were also conducted at two Coalition period roomblocks on nearby Mesita del Buey. These consist of a nine-room pueblo with two kivas (LA 4618; Figure 6.17) and a 22-room pueblo with one kiva (LA 4624) (Larson 1989, 1991; Vierra 2002a).

These Coalition period habitation sites represent the general site layout for the period. That is, linear north-south oriented roomblocks, two to three rooms deep with kivas located along the eastern side of the pueblo. The roomblocks contain from about five to 20 rooms. Habitation rooms with hearths are located along the eastern (front) side of the pueblo and storage rooms on the west (rear) side. Communal rooms (i.e., kivas) are generally larger in size and are often D-shaped (Steen 1977, 1982; Worman 1967; Worman and Steen 1978). These overall patterns can also be seen in Figure 6.18. However, all of the previous excavations focused on the roomblocks, with little or no work being done in the outside plaza areas. Exterior kivas were therefore less likely to be identified. Steen (1982) did, however, conduct some limited excavations in exterior areas along the northern, western, and eastern sections of the roomblock at LA 4629. He found a shallow midden layer (2 to 20 cm in depth) along the eastern plaza side of the pueblo. In contrast, no midden material was found along the western side, only wall fall. A firepit was, however, identified at the northern end of the roomblock. Snow (1986) also conducted some limited excavations of a midden at LA 4718. After excavation, it was identified as a 3 by 5 m burned area that was overlain with 10 to 15 cm of charcoal stained soil containing a few artifacts. Otherwise, Steen (1977:11) notes that middens are generally located to the east of the roomblocks and are characterized by mostly “thin” deposits.

Steen (1977, 1982) suggests that these linear Coalition period roomblocks were generally occupied for relatively short periods of time with little evidence of remodeling; however, this does not appear to be the case with LA 8681. Nake’muu is the only site on the plateau for which a detailed construction history has been developed (Nordby et al. 1998). The pueblo is organized around a central plaza; however, a closer inspection of the wall construction sequence indicates that two separate linear roomblocks were initially built. These consist of the Southeast Block (including Rooms 2–12 and 53–54) and the Northwest Block (including Rooms 28 to 45) (Figure 6.19). The roomblocks are oriented northeast-southwest and contain two rows of rooms that are about seven rooms long. The western set of rooms was constructed first, followed by the attachment of the eastern set of rooms. That is, the roomblocks were built as a single unit. The original doorways opened towards the southeast where outside activity areas were located. Later, a series of lateral northern and southern roomblocks was added, enclosing a central plaza. The

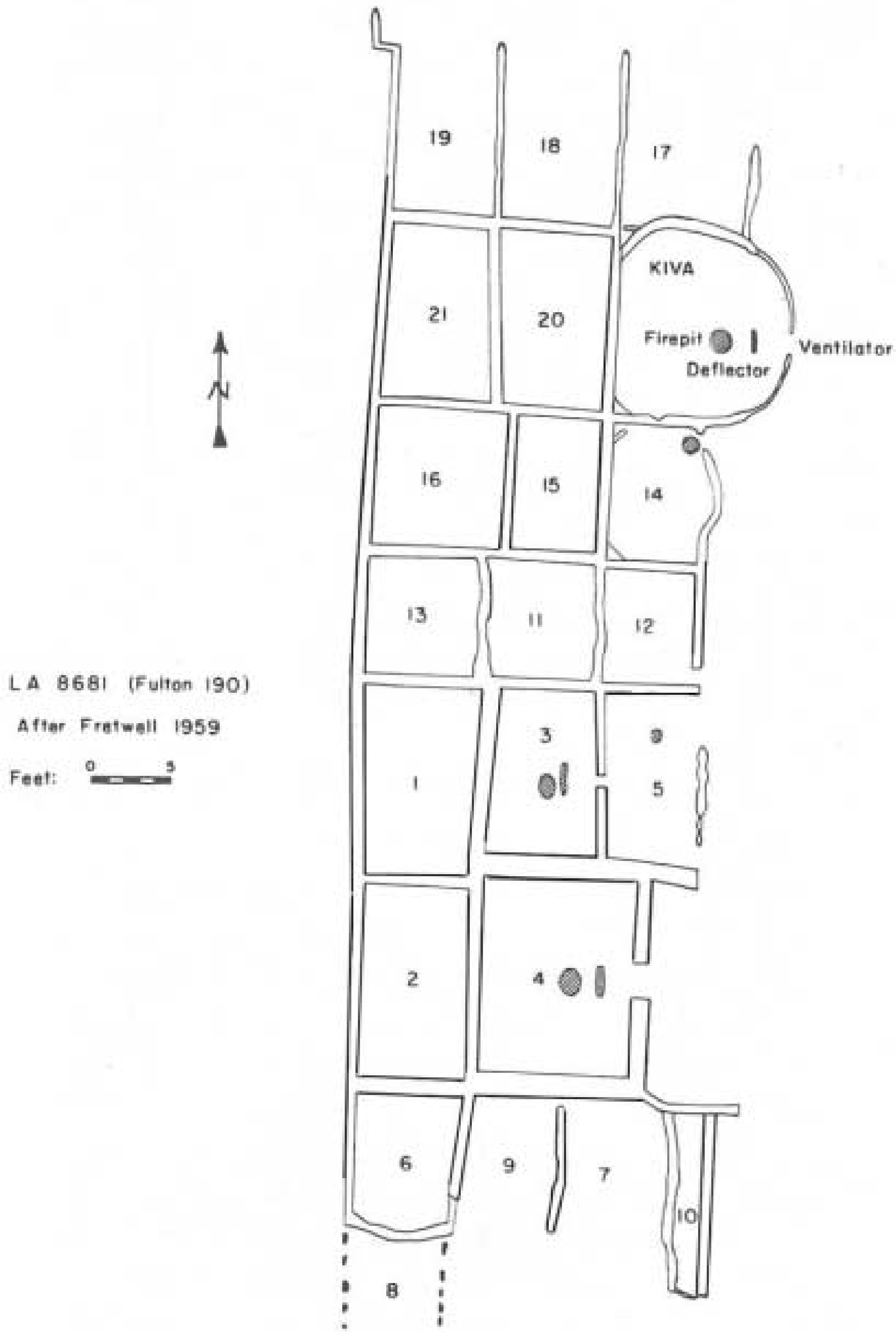


Figure 6.16. Plan map of LA 8681 (White Rock).

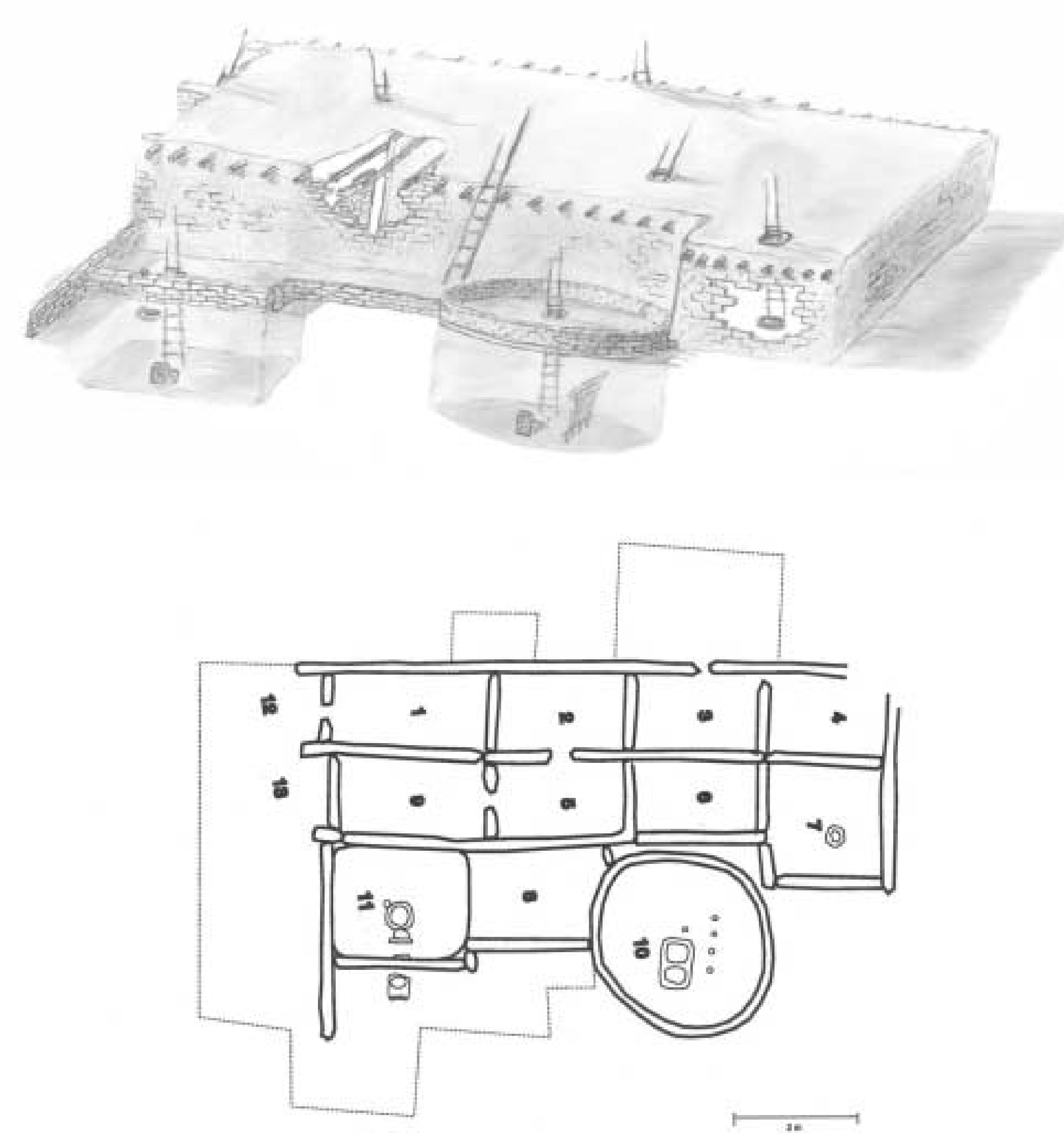
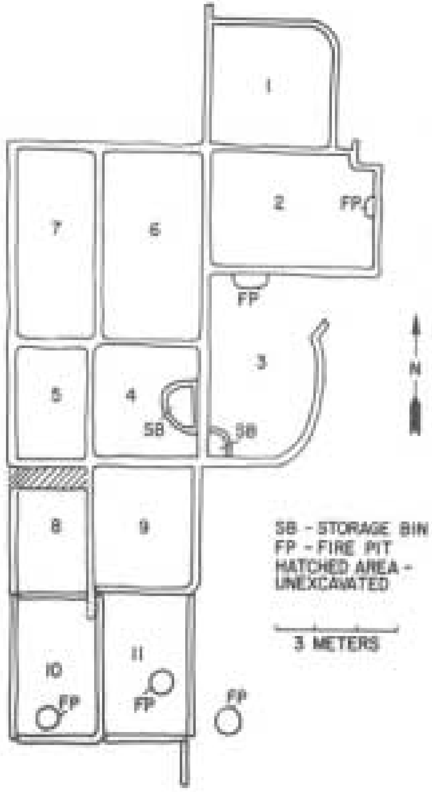
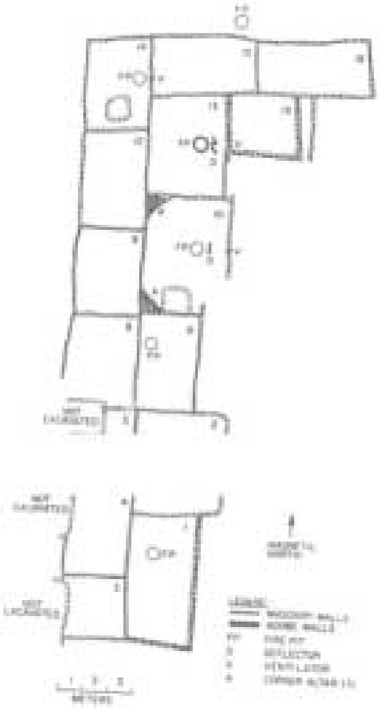


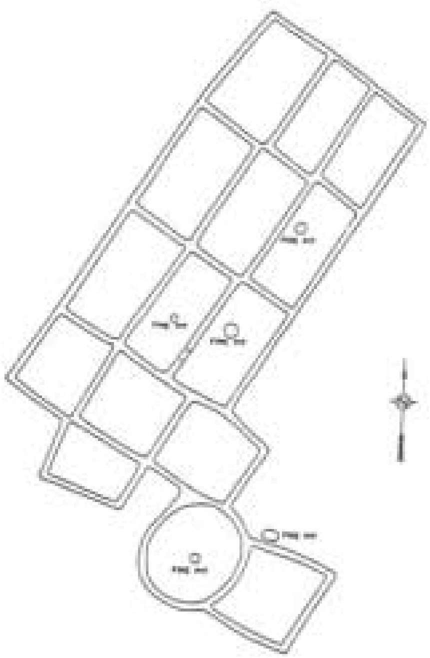
Figure 6.17. Plan map of LA 4618 (Area L).



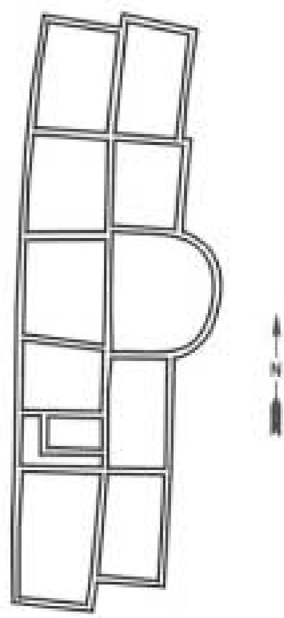
LA 4628



LA 4629



LA 4659



LA 4715

Figure 6.18. Plan maps of Coalition period roomblocks with kivas.

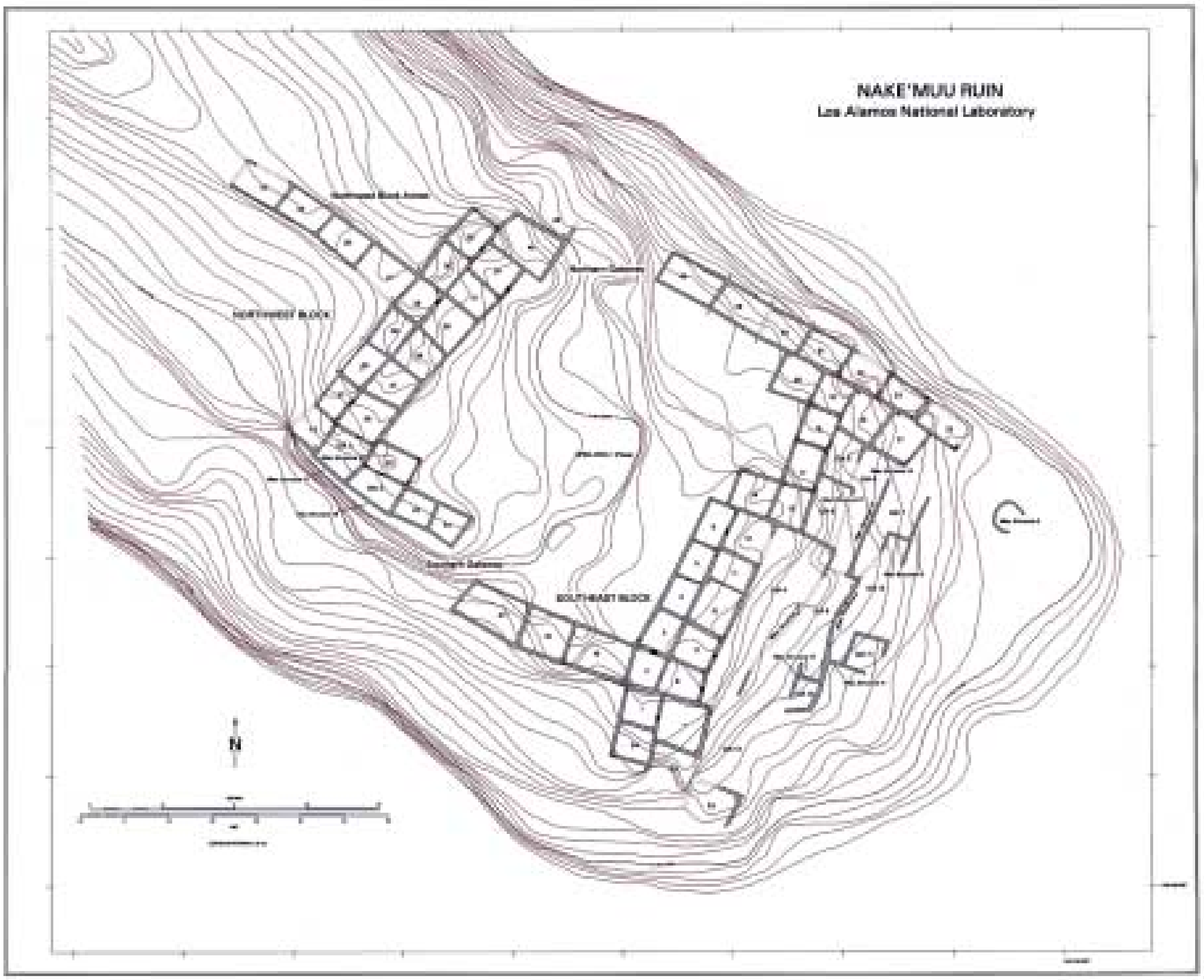


Figure 6.19. Plan map of Nake’muu.

outside doorways were subsequently sealed and the focus of the pueblo became the central plaza area. It is noteworthy that the initial room construction occurred with a predetermined plan with multi-family units. This is what you might expect for colonizing groups. This contrasts with the larger northern Rio Grande pueblo sites of Rowe Ruin, Arroyo Hondo, and Pot Creek Pueblo, which all grew via the accretion of clusters of roomblocks (Cordell 1998; Creamer 1993; Crown 1991; Crown and Kohler 1994). That is, roomblocks were built as single-family units. So, what we see at Nake’muu is that rows of rooms and not blocks of rooms were the basic construction unit.

Steen (1982:37–38) describes several potential changes in wall construction technique through time on the plateau. All walls tend to have a foundation of tuff blocks with adobe mortar. However, earlier sites have adobe walls built upon this foundation. Roughly shaped or unshaped tuff blocks with adobe mortar were subsequently used. Then, during Classic times, more highly shaped (or “cut stone”) blocks were used in wall construction, with the addition of chinking. Nonetheless, all three techniques continued to be used during the same time period, and it was “not uncommon to see all three techniques incorporated in a single structure (Steen 1982: 38).”

Nordby et al. (1998) have suggested that block size may differ by room function or construction period at Nake'muu.

At least three separate room functions have been suggested for Coalition period pueblos: habitation, storage, and communal (Steen 1977, 1982). Habitation rooms tend to be larger, are situated in the front of the roomblock, and contain hearths. In contrast, storage rooms are smaller rooms without hearths that are located at the rear of the roomblocks. Hearths are the most common internal feature, with storage bins being occasionally noted. These fire pits are circular-shaped and adobe-lined with adobe collars. Communal rooms (i.e., kivas) are larger, can be rectangular, circular, or D-shaped, and contain several internal features (i.e., hearth, deflector, ventilator, and corner benches). Nordby et al.'s (1998) study at Nake'muu provides some quantitative support for Steen's observations. A cursory review of Figure 6.20 indicates that room size differs across the site, i.e., small rooms that are from 4 to 7 m^2 in size, medium rooms that contain 7 to 8.5 m^2, and large rooms that are greater than 8.5 m^2 in size. The roomblocks are generally two rooms deep with medium-sized living rooms in the front and smaller storage rooms located at the rear. Large rooms may have been used for communal social activities. For example, several large rooms are located at the entry ways to the central plaza (Rooms 45, 47, and 48).

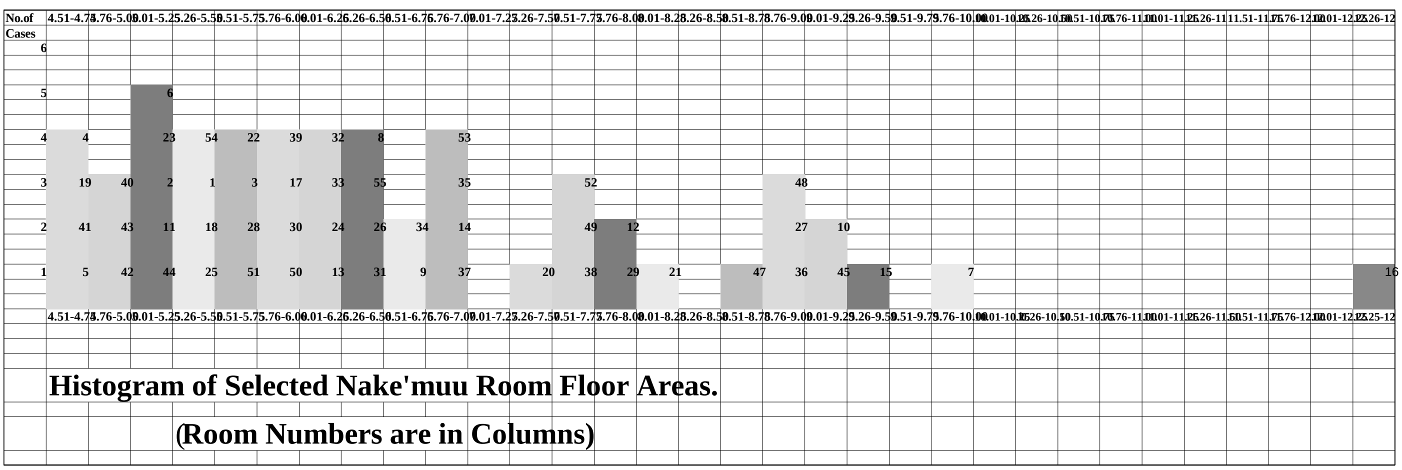


Figure 6.20. Histogram of selected Nake'muu room floor areas. (Room numbers are in columns.)

There is little data available concerning the nature of floor assemblages within roomblocks. The floors themselves tend to be prepared adobe surfaces, although a flagstone floor was identified at R Site No. 1. The room was a rear room, presumably used for storage (Steen 1977). Occasionally, it was noted that a whole vessel or metate were found on the floors of some rooms. For example, a complete corrugated jar was recovered from a storage room at LA 4631, two metates from a "milling room" at LA 4627, and metates from "storage rooms" at LA 4629 (Steen 1982; Worman 1967). Otherwise, sherd tables might list items recovered from floor contexts (e.g., LA 4632 and LA 4729; Worman 1967, 1978).

Coalition and Classic Period Fieldhouses

Fieldhouses are one- to three-room structures that were located near agricultural fields and were seasonally occupied while tending these fields. Due to the short-term nature of the occupation, little artifactual material is generally present at these sites. As previously noted, most of the Coalition period fieldhouses are located near the habitation sites in the piñon-juniper zone. This contrasts with the Classic period, during which there is a marked increase in the presence of fieldhouses in the ponderosa pine zone. Previous research on the Pajarito Plateau has indicated that fieldhouses are more common during the Classic period than during the Coalition period (Masse and Vierra 2000; Orcutt 1981; Preucel 1990). However, Preucel argues that the raw number of fieldhouses dramatically jumps between the Early Coalition and the Late Coalition, while Orcutt sees virtually no change in the number of fieldhouses during these two periods. Nonetheless, the basic pattern is always the same, numerically more fieldhouses during the Classic period. Preucel suggests that fieldhouses are a response to the process of site aggregation, mitigating the long distances between residential sites and agricultural fields (see also Kulisheck 1995; Wilcox 1978, but see Kohler 1992; Moore 1978, 1980; Orcutt 1993 for differing interpretations).

Several one- to three-room structures have been excavated at LANL. Three one-room structures, three two-room structures, and a single three-room structure were excavated by Worman during the 1960s (LA 4633, LA 4658, LA 4660, LA 4711, LA 4713, LA 4728, and LA 13286) (Steen 1977; Worman 1967; Worman and Steen 1978). All seven are masonry structures, composed of one to three standing courses that are one stone wide. No floor features are noted and the nature of the floor is only described for LA 13286. It consists of a “hard-packed soil, but not plastered” (Steen 1977:62). A couple sherds were the only artifacts recovered from the floor of LA 4658, dating it to the Coalition period. Otherwise, three sherds recovered from the fill of LA 4633 dates it to the Coalition period, and a sherd from the fill and outside ground surface at LA 13286 dates it to the Classic period. The fieldhouses at LANL tend to follow the same pattern in masonry architecture as that exhibited at the habitation sites. That is, unshaped or roughly shaped tuff blocks are used during the Coalition period vs large shaped tuff blocks during the Classic period.

During the 1980s, the Los Alamos Archaeological Society excavated a one-room (LA 14814) and a three-room (LA 14815) structure on North Mesa in Los Alamos (Poore 1981). The one-room structure was constructed of “well-shaped” tuff blocks stacked three courses high. There was about 65 cm of fill within the structure, lying on a “hard-packed earth” floor. An area of shallow hearth with a deflector was located near the east wall. A few sherds and lithics were found in the fill and on the floor, including the bottom of a micaceous vessel in the area of the hearth. The presence of biscuitware sherds dates the site to the Classic period. The three-room structure was L-shaped, with a refuse area located about 50 m southeast of the feature. The walls were constructed of shaped tuff blocks three to four courses high. In contrast to all the other sites, the floors in this roomblock were of “packed, smoothed adobe.” Hearths were present in two of the rooms and a possible milling bin in another. One of the hearths is a formal collared hearth that was filled with ash, the other was simply a burned area on the floor found next to a wall. A large number of artifacts were found in the fill and on the floor of the rooms, including most of a Santa Fe Black-on-white bowl. Two burials were also uncovered just outside and to the east of the roomblock. Contrary to the other one- to three-room structures excavated at LANL, LA 14815 apparently represents a small habitation structure that dates to the Coalition period.

Nine fieldhouses in Rendija Canyon were tested by Peterson and Nightengale (1993) in 1992. These sites consist of two Coalition/Classic period, five Classic period, and two Ancestral Pueblo (undetermined) period occupations. Test pits were generally dug adjacent to surface rock alignments in order to define the inside wall and floor area of the structure. The rooms were filled with about 30 to 60 cm of a loose silty loam. Generally no floor surface was identified within the test pits, although the presence of artifacts might be used to denote the possible floor levels. Nonetheless, on one occasion they found a "hard packed surface" and on two occasions they identified a "hard packed clay surface" that represented distinct floors. Nonetheless, no internal features were identified. LA 85417 was the only site that contained evidence of burned daub that could reflect the presence of a jacal structure. Testing failed to identify any clear masonry walls at LA 85861. Overall, only a small amount of artifactual material was generally recovered from these sites. This might include about 5 to 15 pieces of debitage (mostly Cerro Pedernal chert, with some basalt and obsidian), 20 to 40 sherds, a couple pieces of ground stone, and a core. A possible hoe was also identified at LA 85412.

Coalition and Classic Period Agricultural Features

Check dams and garden plots are present at LANL. Steen (1977:34) suggests that these are mostly situated at elevations lower than about 2000 m (6700 ft) and are associated with the Late Coalition (i.e., Wiyo Black-on-white) and Classic time periods. This observation would lend support to the argument that agricultural production was increasing during the process of site aggregation (Hill et al. 1996; Kohler 1989; Powers and Orcutt 1999b). The check dams generally consist of rock alignments situated within drainage channels. Garden plots on the other hand, are square to rectangular-shaped rock alignments with individual units being more than 3 m in length. These can be found both on mesa tops and canyon bottoms. The terraced grid gardens (LA 21592) in Bayo Canyon near Otowi are the most extensive agricultural features identified at LANL (Figure 6.21). Garden plots have also been found in Pajarito Canyon, with the potential for gravel-mulched gardens in the lower part of the canyon near White Rock. Both pumice and scoria derived from the El Cajete and Cerros del Rio formations are exposed in this area. Numerous grinding slicks are also present in this area. Anschuetz (1998, 2001) notes that these slicks are also associated with agricultural features in the Rio del Oso area near Española, and that they may have in part been used to sharpen axes for clearing fields. Possible Classic period irrigation ditches, grid gardens, and fieldhouses are also present in White Rock Canyon (LA 12701). A partially excavated section of one of these ditches determined that it was 2 m wide, about 40 cm deep, and lined with basalt slabs (Steen 1977:34; Gauthier pers. comm. 2001). Besides these limited excavations, no other agricultural features have been excavated at LANL. Steen (1982: 24, 44) also notes that garden plots appear to have been placed around some abandoned Coalition period sites (e.g., LA 4627 and LA 4629). This presumably represents the reuse of these locations during Classic period times.

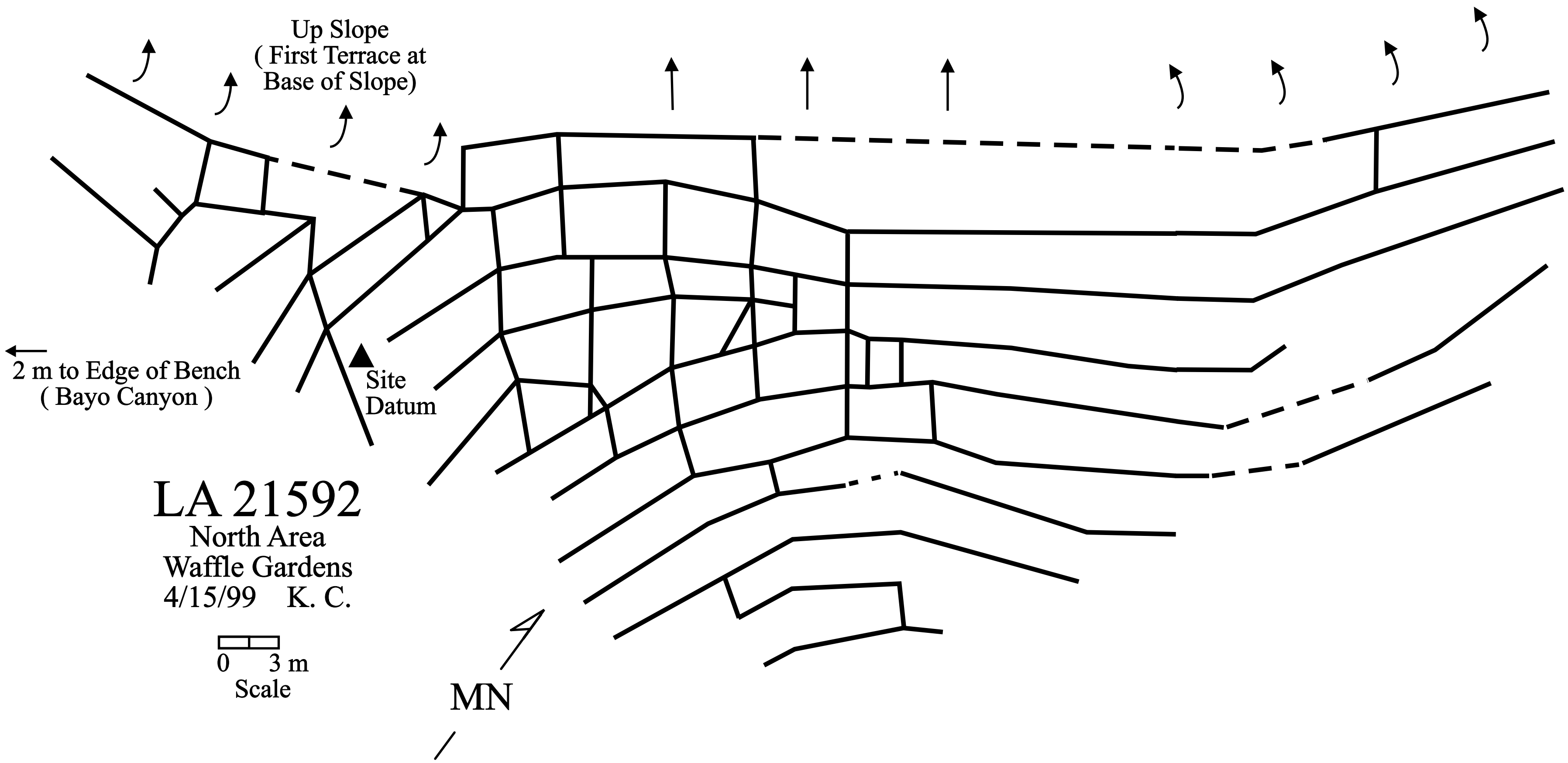


Figure 6.21. Grid gardens (LA 21592) in Bayo Canyon near Otowi Pueblo.

Coalition and Classic Period Artifact Scatters

Lithic and ceramic artifact scatters representing temporary campsites or specialized activity areas are distributed across LANL. However, no artifact scatters have been excavated at LANL. Infield analyses do indicate that lithic and ceramic artifact scatters exhibit similar artifact densities as lithic scatters, 12.3 vs 18.6 artifacts per m^2 (Vierra 2000). This might indicate that the level of occupational intensity for these campsites is similar to that exhibited by Archaic sites. In contrast, garden plots, cavates, and one- to three-room structures exhibit much lower densities of 0.1, 3.2, and 4.5 artifacts per m^2, respectively, and roomblocks and plaza pueblos much higher densities of 61.6 and 62.3 artifacts per m^2, respectively.

Athabaskan Campsites

A variety of people may have seasonally used the plateau during the 17th to 19th century time period. This includes Pueblos, Navajos, Jicarillas, and Utes. Pueblo use of the plateau was mostly relegated to the lower elevations where they grew beans and other crops; however, hunting and gathering activities probably occurred at all elevations. Steen (1977:30) suggests that many of the game pits on the plateau date to this period. On the other hand, Navajo and Jicarilla use of the plateau was presumably limited. The presence of Tewa Polychrome and Cerro del Medio obsidian on 18th century Navajo Pueblito sites indicates contact with the area. Indeed, Navajos conducted raids into the northern Rio Grande Valley during the 17th and 18th centuries (Marshall 1995; Wozniak 1992). In contrast, members of the Ollero band of the Jicarillas wintered in the area of Coyote and Abiquiu during the 19th century (Opler 1971). Lastly, Utes sporadically used the region from the 17th to 19th centuries (Schroeder 1965; Wozniak 1987). In Earls' (1989:250) review of cobble ring sites at Abiquiu Reservoir, she suggests that the most likely candidates for the site occupants were the Jicarilla, Utes, or possibly local Hispanics/Genizaros. Glass beads and micaceous ware pottery dating to the 18th century were found at one of these sites. Therefore, based on the archaeological evidence, a Jicarilla occupation seems most likely for components at this site.

Two rock rings that could possibly represent the remains of a wickiup or tipi were recorded in Rendija Canyon (Peterson and Nightengale 1993). Test excavations at LA 85864 identified the presence of a hearth inside one of the structures that yielded a radiocarbon date of 130 ± 60 BP (Beta-58428). This would reflect a calibrated date for the feature within the 18th or 19th centuries. A single micaceous sherd and possible tuff metate were identified. LA 85869 is another rock ring site that was tested in Rendija Canyon; however, it failed to yield any evidence of a hearth or datable material (Peterson and Nightengale 1993). A quartzite mano and tuff metate were documented.

The archaeological literature emphasizes the poor visibility of Apache campsites and the lack of recognition techniques for identifying them (Gregory 1981:266; Oakes 1996; Schaafsma 1981:299; Sebastian and Larralde 1989:93–94; Vierra 1997b). Vierra (1997b) summarized the current evidence for identifying the archaeological correlates of an Apache occupation. This included information on structures, subsistence, and technology (i.e., ceramic and lithic artifacts).

Ethnohistorical records from the late 18th and 19th centuries indicate that Apaches built two types of residential structures: wickiups and tipis. Wickiups are circular brush shelters sometimes covered with skins; tipis are constructed of upright tent poles with skin covers (Matson and Schroeder 1957:339; Opler 1983:433–435; Sonnichsen 1958:16). Opler (1983:435) notes that the Mescalero tended to use wickiups in upland settings and tipis on the plains.

Several 20th century Western Apache sites with wickiups, exterior activity areas, and ramadas have been studied. The wickiups are circular and approximately 3 to 5 m in diameter. The poles forming the superstructure are placed at regular intervals around the periphery of the structure. Wickiups are conical or dome-shaped and covered with brush, branches, grass, and sometimes skins to tarps along the side exposed to the prevailing winds. A hearth may be built in the center of the structure, depending on the season of occupation. More activities requiring heat or light occur inside during the winter; whereas, exterior space and ramadas are used more often in the spring and summer (Donaldson and Welch 1991; Gerald 1958; Longacre and Ayres 1968; Schaeffer 1958; Tuohy 1960). Several factors can affect campsite organization, including group size, group structure, length of occupation(s), and season(s) of occupation (e.g., Powell 1983; Vierra 1985b). How similar these 20th-century wickiups are to those that might have been used during the 19th century is, however, unknown.

Few Apache sites are described in the archaeological literature and most of them consist of tipi rings. Earls et al.'s (1989) study of rock rings sites at Abiquiu Reservoir is the closest study to the plateau. Test excavations were conducted at three sites with multiple rock rings. Dating on these sites ranges from Early Archaic to 19th century, representing long-term reuse of the area. The rings vary in size, integrity, and artifact assemblages. Nonetheless, the rings generally consist of a single line of stones, circular-shaped, ranging from 3 to 6 m in diameter. In summary, they suggest two possible occupation patterns. The first pattern consists of larger rings that contain no central hearth but do have ground stone items. In addition, they tend to have more artifacts situated within a 10 m radius of the ring. These rock rings are interpreted as warm season, family-based campsites. In contrast, the second pattern consists of smaller rings with central hearths, but no ground stone present within the ring. These are interpreted as possibly representing cold season logistical hunting camps. However, they also note that hearth presence alone should not be used as the sole indicator of seasonal occupation. But rather "a large, reused hearth in a cobble ring is probably an indicator of winter occupation" (Earls et al. 1989:248).

Tipi ring sites have been reported in various areas of eastern and southern New Mexico (Katz and Katz 1985:235–247; Laumbach 1992; Levine and Winter 1987; Mobley 1978, 1983; Ward et al. 1977:390–392). These sites contain from 5 to 47 stone circles, with rock rings measuring from 3 to 8 m in diameter. Preliminary excavations identified poorly defined floors, sometimes with hearths. The rings are generally associated with a sparse surface scatter of artifacts, mostly chipped stone with occasional ceramics. Chronometric dates indicate that some of these sites were occupied during the 17th and 18th centuries.

Material culture items associated with Apache campsites include ceramics, lithics, and metal and glass artifacts. Pottery types include micaceous wares primarily consisting of large grayware jars with thin vessel walls (Brugge 1982). Chipped stone tools include small side-notched triangular projectile points with straight, concave, or notched bases. A variety of metal artifacts are present including knives, arrow points, and tinklers. Glass artifacts might include trade beads and retouched pieces.

Homesteads

Research conducted by Peterson and González-Peterson (1993) indicate that the plateau homesteads (ca. 1900–1943) were dominated by the Hispanic community who lived in the Rio Grande Valley near places such as San Ildefonso, Pojoaque, El Rancho, and Española. The few exceptions to this were the Anchor Ranch, Ashley Pond's holdings within the area of the Los Alamos town site and in Pajarito Canyon, the homestead that became Camp Hamilton in Pueblo Canyon, and several others (McGehee, pers. comm. 2000). Approximately 25 homesteads were located on the plateau in the area of LANL. Detailed discussions of selected Anglo and Hispanic homesteads can also be found in the studies by Foxx et al. (1997), Foxx and Tierney (1999), and McGehee and Larson (1993).

Although the Native American community did not participate in the plateau homestead program, they had continued to use these upland areas for agricultural, gathering, hunting, and religious activities. This was an ongoing land-use strategy that began during the late 1500s when they moved off the plateau. During the homestead occupation, there is every indication of cordial relations between the Hispanic and Native American communities. Several Hispanic families lived at or near San Ildefonso Pueblo and both communities actively exchanged produce and other subsistence items. The relations between the Anglo community and the Hispanic community were likewise generally cordial, although the Anglo community seemed less inclined to utilize the plateau before the Manhattan Project.

Homestead lands were cleared of vegetation before farming, and fence lines were constructed along the boundaries of the claims. Typically, a cabin and associated out buildings would be constructed out of locally available timber. The homesteads were generally occupied on a seasonal basis from April to November for herding livestock (e.g., sheep) and growing cash or tradable crops. Dry farming was the only method for growing crops, due to the lack of available permanent water flow for irrigation. Beans were the primary cash crop, with corn, squash, pumpkins, peas, beets, turnips, and, occasionally, wheat being mostly grown for personal consumption. Informants indicated that the harvests were successful and bountiful every year despite the cold temperatures and lack of irrigation. In addition to these crops, local plants were gathered, including wild strawberries, wild plumes, yucca root, oregano, *quelitas* (wild spinach), *podillo*, *chimajá*, and *yerba buena* (Foxx and Tierney 1999; Peterson and González-Peterson 1993).

The agricultural produce was both for local family consumption as well as a cash crop for buying supplies and items not grown or made by the homestead families. As such, the homesteads were an important component of the local economy. The fact that several of the homesteads, including seasonally occupied homesteads, were maintained and used throughout the duration of the late Territorial and New Mexico Statehood period indicates that homesteading and seasonal agriculture were at least a moderately successful form of subsistence economy.

LA 85407 in Rendija Canyon is the Serna Homestead (Peterson and González-Peterson 1993). The site was originally patented by Andres Martinez in 1922 and then sold to Jose and Fidel Serna; however, the Sernas may have occupied the homestead since 1913. The Serna family maintained the homestead until 1942 when the lands were obtained by the War Department. The tract contains about 685 acres**,** with the homestead being located at the western end of the tract (i.e., overlooking the Rendija Canyon bottom). LA 85407 consists of two structures, a corral, and an horno. Informants state that the homestead was used as a seasonal farm, with the family traveling to the rancho three times during the year: in the spring for planting, the summer to weed and clean the fields, and September or October to harvest the crops. It took an entire day to get to the homestead from their residence in the valley. They stayed about two weeks at a time and brought milk, cows, chickens, and all the supplies and tools they needed. The family had a log cabin on the property that included three rooms and a sunporch. The property claim notes that 40 acres were under cultivation, with beans, corn, and vegetables being planted. There was no water on the claim, so water was obtained from a well located about one-quarter mile south of the farm in Rendija Canyon. Otherwise, rainfall was the primary source of water used to grow the crops since there was no source for irrigation farming.

In contrast to the Serna Homestead, the Romero Homestead appears to have been occupied most or all the time from April to November. An informant stated that the Romero family moved to the homestead in "the first part of spring, usually in late April, and stayed until cold weather set in at about the middle of November" (Foxx and Tierney 1999:15). They brought some chickens and pigs to the rancho in a horse-drawn wagon. Beans were the main crop, with some squash, pumpkins, peas, and corn; whereas, melons, watermelons, and chile were mainly grown in the Rio Grande Valley. A kitchen garden contained peas, pumpkins, sweet corn, and melons, and peach trees were also present on the homestead. Test excavations were conducted at the *Vigil y Montoya* Homestead (McGehee and Larsen 1993). The site contains a cabin, rock enclosure, horno, and a possible privy. Two test pits were excavated in and adjacent to the cabin and one in the horno. A compacted dirt surface and possible remnants of a wooden floor were identified. A variety of domestic artifacts were recovered, including ironstone and historic Pueblo ceramics, a comb, metal can or bucket, and bottle glass. Items associated with the cabin include window glass, insulation, wood remains, and nails. An auger hole placed within the horno exposed burned rock and charcoal-stained soil.

Land-Use, Community, and Site Organization Research Questions

17. **Can site structure studies identify the internal organization of the Archaic campsites? If so, what evidence is there for identifying the occupying group size, structure, and site occupational history?**
18. **Is there any evidence of structures or features on the Archaic campsites?**
19. **How do these Archaic campsites contrast with the Late Archaic winter habitation site excavated near San Ildefonso Pueblo?**
20. **What is the general layout of the Coalition period habitation sites?**
21. **Can habitation vs storage rooms be identified and are there kivas (or communal rooms) present?**
22. **Is there an outside midden area located to the east of the roomblocks?**

23. **Are there exterior activity areas present adjacent to the roomblocks?**
24. **What architectural style was used in the construction of the walls?**
25. **What is the construction history of the roomblock? Is it similar to the plan used at Nake'muu?**
26. **Is there any evidence of remodeling in the roomblocks?**
27. **Do the fieldhouses represent short-term residences, or is there any evidence that they might have been used as long-term habitations?**
28. **How does the architecture at the fieldhouses compare to Coalition and Classic period roomblock sites?**
29. **What construction techniques were used for agricultural features?**
30. **Can site structure studies identify the internal organization of Ceramic period artifact scatters? If so, what evidence is there for identifying the occupying group size, structure, and site occupational history?**
31. **Do LA 85864 and LA 85869 represent Athabaskan campsites?**
32. **Given that the Serna Homestead appears to have been sporadically occupied during the growing season, how does the organization of this site contrast with the Romero Homestead that was occupied continuously during the growing season?**

SUBSISTENCE AND SEASONALITY

The study of subsistence strategies is one of the most important and technically developed fields in archaeology. Subsistence is thought to be one of the most basic of human necessities and is usually taken to mean the quest for food (Kelly 1995; Reitz et al. 1996; Renfrew and Bahn 1996). Archaeologically, subsistence is documented by the waste products of food preparation, both plant and animal. In discussions of subsistence, it is important to distinguish between *meals* (direct evidence of various kinds as to what people ate at a particular time) and *diet* (evidence of various kinds attesting to patterns of consumption over a long period of time).

In general, the sources of information for meals is primarily represented by coprolites, or fossilized feces, that represent direct consumption of a meal (Renfrew and Bahn 1996; Sobolik 1993). For long-term patterns of consumption, or diet, most information on subsistence comes directly from the remains of what was eaten. Zooarchaeology, the study of past human use of animals, and paleoethnobotany, the study of past human use of plants, are the two primary techniques used to collect dietary information (Ford 1979; Grayson 1984; Hastorf and Popper 1988; Pearsall 1978; Reitz and Wing 1999). In addition to the more direct study of coprolites, animal bones, and plant remains, there are other indirect means that can be used to infer prehistoric subsistence strategies. These include tools and artifacts, residues on vessels and tools, chemical residues on plant and animal remains, plant impressions, artistic representations of animals and plants, and historical records.

Because food resources are not continuously available or desirable (e.g., big game in the winter months) at all times and places throughout the year, populations often must move to a site from which the desired resources can be acquired. The estimation of the seasons in which these cultural activities occurred, or seasonality, is thus a matter of considerable importance to archaeologists.

As employed here, the term seasonality means the time of year at, or during which, a particular event is most likely to occur. In this context, time of year can mean two things: absolute calendrical date or sequential dates. In studies of seasonality, the latter usually refers to the estimates of spring, summer, fall, and winter. Unfortunately, these estimations are overly general and highly ambiguous because seasons vary in length and time of occurrence from place to place and year to year. As a result, it is preferable, when possible, to discuss seasonality in more specific terms. Although non-generic estimates provide a more fine-grained framework for discussions of seasonality, it is often difficult to know the absolute time at which a cycle (e.g., flowering plants) in question begins, thereby often necessitating a combination of both methods. Subsistence remains, especially faunal and botanical remains, can help to elucidate assessments of seasonality for particular sites in both a calendrical and sequential manner (Adams and Bohrer 1998; Morales 1998).

Archaic Period

Excavations conducted at open air Archaic sites in the Jemez Mountains areas have failed to recover any substantive floral or faunal remains (e.g., Biella 1992; Baker and Winter 1981). Only the dry shelter of Jemez Cave has yielded a variety of remains that can potentially provide information on Late Archaic subsistence and season of site occupation. Portions of Jemez Cave were excavated in 1934 and 1935 (Alexander 1935; Alexander and Reiter 1935) and 1965 (Ford 1975). Both excavations produced virtually similar assemblages of faunal and floral remains, indicating a probable occupation of the cave during the late spring and summer (Ford 1975). Ford based his interpretations of a late spring/summer occupation on the presence of maize remains. Maize was presumably grown near the Soda Dam where a small pond had formed. The production of yucca textiles also appears to have been an important activity at the site (Ford pers. comm., 2001). Faunal remains identified from initial excavations at Jemez Cave include specimens from the following species: teal, American merganser, hawk, turkey, dusky grouse, sharp-tailed grouse, great-horned owl, red-shafted flicker, yellow-shafted flicker, short-eared owl, sandhill crane, piñon jay, ring-tailed cat, bison, domestic cow, beaver, prairie dog, ground squirrel, porcupine, black bear, mountain lion, jackrabbit, cottontail rabbit, bobcat, skunk, woodrat, mountain sheep, mule deer, muskrat, gray fox, and badger. No counts are given with which to assess relative importance of the species present. In the later excavations, the species identified included a much smaller array of species. Only three species were identified, and include bison, cottontail rabbit, and pronghorn. Forty-six additional specimens were solely identified as mammal remains.

Floral remains identified from the initial excavations at Jemez Cave include specimens from the following species: maize, yucca, reed-grass, grasses, juniper, pumpkins, oak, sagebrush, prickly pear, ocotillo, piñon pine, and cotton. Quantified data are not available, but distributional information is present (Alexander and Reiter 1935:61–64). In the later excavations, the following species were identified: willow (n = 31), pine (n = 11), corn (n = 1), pumpkin (n = 3), juniper (n = 22), reed-grass (n = 115), birch (n = 1), cottonwood (n = 1), ponderosa pine (n = 4), oak (n = 1), and sagebrush (n = 1). Identifications for floral remains were similar between the two seasons of excavation, however, the faunal remains showed a large disparity. No quantitative analyses were conducted.

Coalition Period

Although excavations have occurred at a number of Coalition period sites at LANL, there are very few that have produced subsistence remains. And, of the excavated sites with subsistence remains, very little can be said in comparative terms because of differential recovery methods. Sites that were excavated by Worman have little to no subsistence remains from them because they were not screened and collected (Worman 1967; Worman and Steen 1978). Sites excavated by Steen do in fact have subsistence remains, but these remains were screened and collected with differing methods from site to site, usually using quarter-inch mesh (Steen 1977). As a result, the few sites that do have subsistence remains will likely yield little in the way of interpretive value because of the lack of comparability between sites. Additionally, the following sources may be consulted if more detailed information on Coalition period subsistence strategies on or around the Pajarito Plateau is sought (Acklen 1997; Cordell 1998; Head 1988; Steen 1977; Trierweiler 1987, 1990; Worman 1967; Worman and Steen 1978).

Of the Coalition period sites excavated at LANL, 22 have faunal remains (LA 4618, 4624, 4627, 4628, 4629, 4631, 4632, 4659, 4666, 4710, 4712, 4714, 4715, 4716, 4718, 4722, 4729, 8681, 61041, Airport Ruin #2, Pajarito Cave, and the Community Center Ruins), and 14 have botanical remains (LA 4618, 4624, 4627, 4628, 4659, 4710, 4712, 4718, 4729, 8681, 61041, Airport Ruin #2, Pajarito Cave, and the Community Center Ruins). Little published information is available and, if more information is sought, the collections themselves would have to be examined. Nonetheless, Steen (1977:34) does note that maize and squash remains are "abundant" in these excavations. He also states that cotton was found in a pottery vessel.

The most useful subsistence data recovered from Coalition period sites is that recovered from excavations at Bandelier in the late 1980s and early 1990s (Kohler 1989, 1990; Kohler and Linse 1993; Kohler and Root 1992). Four sites (LA 3852 [Casa del Rito], LA 50972, LA 60372 [Burnt Mesa Pueblo], and LA 60550) were excavated by Kohler and a number of archaeologists from Washington State University. Although samples varied in size from site to site, identified taxa between the sites were similar. These taxa include a preponderance of cottontail, deer, pocket gopher, and turkey, with a relatively lesser amount of mice, woodrat, prairie dog, squirrel, jackrabbit, porcupine, skunk, blue grouse, undetermined canid, coyote, pronghorn, elk, bighorn sheep, bison, and bear. Additionally, large numbers of unidentified mammal and bird remains were present (Kohler 1989, 1990). Despite the sometimes-small samples at three of the four sites (>500), excluding Burnt Mesa Pueblo, the consistent diversity and good condition of the faunal remains make them one of the most promising subsistence assemblages from the Pajarito Plateau. The wide array of species from a number of distinct ecological zones indicates that economic efforts were not focused solely in one area. Instead, grasslands, riparian zones, piñon/juniper zones, oak woodland zones, and coniferous areas were all exploited, creating the diverse faunal assemblages present at these sites.

Likewise, macrobotanical samples from the same four sites produced a large assemblage of identifiable remains. The macrobotanical assemblages from these sites, like the faunal assemblages, were similar from site to site. Assemblages at all sites consisted of seeds, wood, fruits, stems, rind fragments, and various parts of corn plants. Taxa that were present at all four sites include chenopodium, amaranth, unidentified dicots, juniper, piñon, ponderosa pine, cottonwood, and corn. Other identified species include pigweed, saltbush, mountain mahogany, rabbitbush, pincushion cactus, pumpkin, squash, beans, jimson weed, hedgehog cactus, spurge, ash, indeterminate grasses, legumes, wild tobacco, prickly pear, ground cherry, purslane, chokecherry, oak, squawbush, yucca, members of the rose family, and willow. While the largest assemblage came from Burnt Mesa Pueblo, the species listed above were well represented across the other three sites (Kohler 1989, 1990). Most of the macrobotanical remains identified were fragments of charred wood, the diversity of which indicates that a number of different vegetation zones were exploited by the inhabitants of the sites in this area. No macrobotanical samples (pollen or phytoliths) were taken during excavations at the Bandelier sites.

Classic Period

Excavated Classic period sites at LANL also have little in the way of faunal or floral remains. Subsistence remains were not collected at sites that were excavated by Worman. Sites excavated by Steen do have subsistence remains, but they were screened through quarter-inch mesh, thereby not being particularly representative of remains that may have been there originally (Cannon 1999). As a result, the few sites that do have subsistence remains will probably yield little in the way of interpretive value because of the lack of comparability between sites, and the paucity of data in general.

Excavated Classic period sites at LANL are not numerous. Major excavations have occurred primarily at two sites, Otowi (LA 169) and Tsirege (LA 170). Hewett conducted excavations at Otowi and Tsirege ca. 1905 (Hewett 1938; Mathien 1990). This work focused on the middens at Otowi, and the midden and roomblocks at Tsirege. No detailed excavation reports were ever completed, with only limited descriptions of these excavations being presented by Hewett (1904, 1905, 1908, 1938). Lucy Wilson also conducted excavations at Otowi from 1915 to 1917. Her work focused on the four northern roomblocks, with less in the southwestern roomblock where Hewett worked (Mathien 2000; Wilson 1916a, 1916b, 1917, 1918a, 1918b). Although a draft report of her excavations was completed, it was lost in the mail, thereby providing little information on the materials recovered. Based on the inventories at various repositories, however, it appears as though there are subsistence remains present from Tsirege, but not from the excavations at Otowi.

Coalition and Classic Period Agricultural Features

As previously noted, grid gardens and check dams have been identified at LANL. Grid gardens in Bayo Canyon near Otowi (LA 21592) are also terraced, being situated at the base of a talus slope in order to catch the downslope runoff. The grids at this site are generally about 3 by 5 m in size. Research on past agricultural technology has determined that a variety of techniques was used during the Coalition and Classic periods in the northern Rio Grande. This includes gravel-mulched, cobble-bordered grids, check/diversion dams, terraces, ditches, and pits (Anschuetz 1998). However, there is little archaeological data concerning what crops were being grown within these features. Maize and prickly pear pollen have been identified in sufficient quantities to indicate that they may have been cultivated in some Chama Valley agricultural features (Clary 1987; Dean 1989, 1991, 1994, 1997; Holloway 1995; Smith 1997). In addition, pollen samples taken from a gravel-mulched garden located in the Rio del Oso area yielded cotton pollen

(Anschuetz 1998:305; Dean 1991). This pollen evidence indicates that both domesticate and wild plant species were possibly being grown by Ancestral Pueblo groups. Recent studies by Foxx et al. (1997) on plant succession in abandoned Homestead Era fields on the plateau indicate that species common to the genus *Artemisia* (*A. carruthii* and *A. dracunculus*) were often found in these disturbed locations. In addition, over a 10-year period, they observed that forb species were eventually replaced with grass species during the succession process in recently disturbed areas. However, Smith does note the presence of large grass pollen (e.g., Indian ricegrass) in several of the El Rito grid gardens, stating that "native grasses could have been encouraged in the prehistoric fields" (Smith 1997:5). Therefore, the presence of some wild species could be indicative of agricultural activities. That is, either when the fields were being cultivated or after they were abandoned or lay fallow.

Athabaskan Campsites

Only limited test excavations have been conducted at two possible Athabaskan campsites on the plateau. Test pits were placed within the rock rings at LA 85864 and LA 85869. Neither excavation yielded identifiable plant or animal remains. Only some small bits of charcoal and bone fragments were recovered from a hearth within one of the rock rings.

Homestead Sites

Ethnohistorical data indicate that the plateau homesteads were often occupied from April to November for herding livestock (e.g., sheep) and growing cash or tradable crops. Beans were the primary cash crop cultivated on the plateau, but other crops like corn, pumpkins, peas, squash, beets, turnips, and, occasionally, wheat were also grown for personal consumption. A limited amount of herding might have also occurred (Foxx and Tierney 1999; Peterson and González-Peterson 1993).

Excavations were conducted at the Romero Cabin site on Pajarito Mesa at LANL. The mesa is covered with piñon-juniper and the cabin is situated at an elevation of 2255 m (7400 ft). Although no synthetic report has ever completed, a monograph presenting the results of the botanical analysis was done (Foxx and Tierney 1999). The original homestead patent was filed in 1913, however, the standing cabin was actually built during the 1930s. The following plant specimens were identified at the site in decreasing order of frequency: peach pits, acorns, piñon shells, plum pits, cherry pits, squash seeds, watermelon seeds, apricot pits, juniper seeds, sunflower seed shells, a cheno-am seed, and a possible cholla seed. The Romero family grew two types of beans that they sold in local stores: pinto and a small white bean. Testing at the *Vigil y Montoya* Homestead also yielded peach pits (McGehee and Larsen 1993). Other subsistence items identified at this homestead site include sardine cans, coffee can lids, condiment glass, evaporated milk cans, lard buckets, KC Baking Powder cans, an Ortega's chile can, and a Martinelli's apple juice bottle. In addition, the presence of a shotgun shell would presumably reflect hunting activities. Besides the homesteads, a total of 54 different kinds of fruits and vegetables were cultivated at the Los Alamos Ranch School, along with at least 33 species of flowers.

Subsistence and Seasonality Research Questions

33. What subsistence foods were exploited by Archaic peoples on the plateau?
34. During what season(s) of the year were Archaic peoples occupying the plateau?
35. Are there differences in foods and season(s) of occupations between the Early and Late Archaic occupations?
36. Are there differences in foods and season(s) of occupations between Archaic sites in the piñon-juniper vs the ponderosa pine zone?
37. What subsistence foods are represented at the Coalition period habitation sites?
38. Were the Coalition period habitation sites occupied seasonally or throughout the year?
39. What subsistence foods are represented at fieldhouses?
40. What season(s) were fieldhouses occupied?
41. Are there differences in subsistence items and season(s) of occupation between Coalition and Classic period fieldhouses?
42. What crops were grown in the agricultural features (e.g., grid gardens)?
43. What subsistence foods were exploited at the possible Athabaskan campsites?
44. During what season(s) were the possible Athabaskan campsites occupied?
45. What subsistence foods are represented at the Serna Homestead? What relative contribution did hunting, gathering, agricultural produce, herding, and store-bought foods provide for the diet?
46. What evidence for season(s) of occupation is represented at the Serna Homestead?
47. How does the subsistence and seasonality information recovered from the Serna Homestead contrast with that recovered from the Romero and *Vigil y Montoya* Homesteads?
48. How do these data on subsistence and seasonality reflect changes in the long-term use of the plateau from Archaic through Homestead Era times?

TECHNOLOGY, PRODUCTION, AND EXCHANGE

Technology refers to the tools, facilities, and labor needed to ensure an individual's ability to survive and reproduce. We often discuss this in terms of economic organization, i.e., the procurement, production, distribution, and consumption of items. A variation of this perspective is an organizational approach to understanding technological variability that stresses the importance of the interrelationship and interactions between various aspects of society, subsistence, foraging strategies, and technology (Binford 1973, 1977, 1979; Nelson 1991; Torrance 1989). Raw materials, and the tools themselves, can be procured in a variety of ways, including through exchange networks. These networks can act to enhance the flow of information and goods between trading partners. As such, they provide a back-up strategy to local resource shortfalls, either by providing information on the location of available resources or by obtaining resources directly from these trading partners (e.g., Binford 1982; Hegmon 1995). Differing tactics were used by Southwestern foragers vs agriculturalists, and this is in part reflected in their differing lithic and ceramic economies.

Lithic Technology and Exchange

Lithic technology includes both chipped and ground stone artifacts. The by-products of stone tool manufacturing are some of the most ubiquitous remains in the archaeological record. They represent a complicated process involving the acquisition of raw materials, tool production, tool use, and the subsequent discard of expended tools. How people procured these materials and whether they obtained them from local or nonlocal sources are important for understanding organization of past economic systems. Two important concepts need to be defined: procurement strategy and procurement tactic. *Procurement strategy* refers to the specific material types selected for tool production. This information is readily available in the archaeological record as the varying proportions of worked material types present. *Procurement tactic*, on the other hand, refers to the specific methods used to procure them (Vierra 1993a:141). Raw materials can be obtained in three ways. An *embedded* tactic involves the collection of raw materials incidentally to subsistence-related movements (Binford 1977, 1979; Binford and Stone 1985). A *direct* tactic involves making a trip to the source location for the sole purpose of collecting raw materials (Binford 1979; Gould and Saggers 1985; Renfrew 1975:41). A distinction is made here between embedded and direct tactics, although these have often been subsumed as direct procurement tactics (e.g., Ericson 1984:6; McAnany 1988; Meltzer 1989). An *indirect* tactic involves obtaining items from an intermediary. This usually involves some form of trade or exchange relationship (Earle and Ericson 1977; Ericson and Earle 1982; Renfrew 1975, 1977; Stanley et al. 1988).

It has generally been argued that Southwestern hunter-gatherer groups procured lithic raw materials using an embedded procurement tactic (Shackley 1990:63, 1995; Vierra 1985, 1990, 1993b). In this case, tools are replaced with locally available materials during a group's annual rounds. The distribution of these materials may provide information on the procurement range or annual range traversed by hunter-gatherer groups. In contrast, Southwestern agriculturalists obtained lithic raw materials using an embedded, direct, or indirect procurement tactic (Brown 1990, 1992; Cameron 1984, 2001; Findlow and Bolognese 1980, 1982a, 1982b; Harry 1989; Parry 1987; Vierra 1993a, 1997c; Walsh 1998; Young and Harry 1989). A direct procurement tactic involves the bulk acquisition of raw materials, since these items are stored for future use. This might include nodules, large flakes, or prepared cores of nonlocal materials. An indirect procurement tactic involves obtaining items through some form of exchange relationship. This might include nodules, prepared cores, or formal tools made of raw materials that are not locally available. Local materials are defined as any lithic material that is obtainable within a 10 km (6 mile) catchment radius of the site, and nonlocal materials are those from outside this catchment. This is the typical foraging radius covered during daily activities around a habitation site (Binford 1982).

Archaic Period

Research on stone tool technology has emphasized residential mobility as a possible explanation for technological variation (Carr 1994; Ebert 1979; Kuhn 1994; Parry and Kelly 1987; Shott 1986). The effect of lithic material availability on stone tool technology is another possible explanation for technological variation (Andrevsky 1994; Bamforth 1986). Other studies of stone tool technology have emphasized the importance of time constraints, energy efficiency, and risk reduction for explaining technological variation and long-term changes in technology (Jeske 1992; Nelson 1992; Torrence 1983, 1989; Vierra 1995).

Studies of Southwestern Archaic chipped stone technology indicate an emphasis on the production/maintenance of bifacial tools (Chapman 1977; Parry and Kelly 1987; Shackley 1990; Sullivan and Rozen 1985; Vierra 1993a). Beyond projectile point morphology, little has been done to understand differences between Early, Middle, and Late Archaic technology (e.g., Irwin-Williams 1973). Several studies have identified distinctive changes between Middle vs Late Archaic technology. This includes a bifacial core-tool reduction trajectory and a greater emphasis on resharpening to increase tool use-life during the Middle Archaic vs a flake-tool reduction trajectory and less evidence of tool resharpening during the Late Archaic (Torres 2000; Vierra 1999).

Recently, researchers have identified significant differences in stone tool technology when comparing Archaic habitation with campsites (Roth 1998; Vierra 2002b). This pattern also seems to be represented in the northern Rio Grande. Analysis of assemblages from upland campsites in the Jemez Mountains area indicates that Archaic assemblages are dominated by the production/maintenance of bifacial tools (Baker and Winter 1981; Biella 1992). In contrast, the lithic assemblage of a winter habitation site located in the Rio Grande Valley near San Ildefonso reflects a greater emphasis on core reduction activities (Lent 1991).

In general, Archaic sites on the plateau are dominated by the use of nonlocal obsidian (Biella 1992; Vierra 2000). However, only five obsidian samples have been analyzed for source identification from a single Archaic site (LA 70029). These materials were derived from the Cerro Toledo (e.g., Obsidian Ridge) and Cerro del Medio sources located about 16 km (10 miles) as the “crow flies” southwest and west of Los Alamos (Stevenson 1992); however, a “dusty” obsidian (presumably El Rechuelos) was identified on Archaic sites during the LCT survey (Vierra 2000), but comprised only about 1% of the total obsidian assemblage. The El Rechuelos (i.e., Polvadera Peak area) source is located about 24 km (15 miles) as the “crow flies” to the northwest of Los Alamos. These materials are presumed to have been procured with an embedded procurement tactic, with exhausted tools being replaced during a group’s annual movements.

Ceramic Period

In contrast to Southwestern Archaic chipped stone technology, Ceramic period assemblages generally emphasize core reduction activities (Parry and Kelly 1987; Sullivan and Rozen 1985; Vierra 1990, 1993a, and 1993c). With the shift to agricultural-based economies, the conflicting demands of subsistence pursuits, labor, technology, and social activities need to be balanced (Jeske 1992). This process has a *residual effect* on the stone tool technology, when increasing amounts of energy are diverted into other aspects of technology and labor organization. More specifically, there is a de-emphasis on the stone tool technology, per se, and an increased emphasis on corporate labor group structure and that aspect of technology associated with agricultural intensification. This includes milling equipment, ceramics, storage facilities, architecture, and agricultural features.

Vierra's (1985b, 1990) study of Ceramic period site types also indicates important differences in assemblage composition. Lithic and ceramic artifact scatters that presumably represent temporary campsites or specialized activity locales exhibit a mix of tool production and core reduction activities. This contrasts with the habitation sites that emphasize core reduction activities. Indeed, these artifact scatters lie in between Archaic sites and Ceramic period habitation sites in assemblage composition. Analyses conducted during the LCT survey support this observation (Vierra 2000). That is, lithic and ceramic artifact scatters exhibit a mix of biface production and core reduction activities. This contrasts with both the one- to three-room structures and habitation sites that emphasize core reduction. Agricultural sites (e.g., grid gardens) might also contain specialized tools like hoes, axes, mauls, and shovel bits (Anschuetz 1998).

Overall, the Ceramic period assemblages primarily contain a mixture of Cerro Pedernal chert, basalt, rhyolite, and obsidian lithic materials. Basalt and rhyolite are locally available from bedrock exposures. Indeed, most of the cortex on these materials is nodular cortex (i.e., a natural weathered surface) indicating a primary source. In contrast, Cerro Pedernal chert/chalcedony is available from Rio Grande terrace gravels located in the valley (e.g., near Totavi). The presence of mostly waterworn cortex on Cerro Pedernal chert materials indicates that they were indeed obtained from secondary sources. Fourteen obsidian samples were recently submitted for source identification from LA 4624, a Coalition period pueblo located on Mesita del Buey. The results of the x-ray fluorescence analysis of these artifacts indicates that 11 were made of obsidian derived from the Cerro Toledo (e.g., Obsidian Ridge area), two from Cerro del Medio, and one from El Rechuelos (i.e., Polvadera Peak area) sources (Vierra n.d.). Therefore, most of the obsidian on this site was obtained from the most proximate source. A very large obsidian flake was recovered from a Coalition period cavate site (LA 86630) located at the base of Mesita del Buey in Pajarito Canyon (Vierra et al. 2000). The flake was 18.5 cm long and weighed 1274 g. The dorsal surface is covered with nodular cortex, indicating that it represents a large primary flake removed from a boulder. This artifact presumably reflects a direct procurement tactic from either the Cerro Toledo or Cerro del Medio source areas. A similar tactic was employed by Pueblo groups in the Flagstaff area while obtaining obsidian from the Government Mountain source (Vierra 1993a). Evidence for direct procurement is also reflected on the plateau at a basalt quarry site located in Bandelier National Monument (Gauthier, pers. comm. 2002).

Studies of the LCT survey data also identified significant changes in raw material selection between the Coalition and Classic periods. Coalition period habitation sites contain relatively more Cerro Pedernal chert/chalcedony and igneous materials vs Classic period habitations that contain relatively more obsidian (Vierra 2000). This is a pattern similar to that observed by Walsh (1997, 1998) in the area of Mesita del Buey. He suggests that a reliance on local materials during the Coalition period reflects greater community competition and restricted access to resource areas. In contrast, the presence of relatively more nonlocal materials during the Classic period reflects decreased competition and access to larger resource territories (i.e., buffer zones). However, it may also reflect site aggregation and the development of formal trade relationships. The problem is that the exact source of these obsidians has yet to be determined. They may have continued to exploit the Cerro Toledo and Cerro del Medio sources using a direct procurement tactic; however, obsidian from the more distant El Rechuelos source could have been obtained from a formal exchange network. The LCT survey indicated that a "dusty" obsidian (El

Rechuelos?) comprised 8.0% of the Coalition period assemblages vs only 4% of the Classic period assemblages. If this is accurate, then contrary to Walsh's argument, it is during the Coalition period that the more distant obsidian source is being used.

Important changes in ground stone technology were also probably occurring during the Ceramic period. The LCT survey identified the presence of one- and two-hand manos, millingstones, and slab and trough metates at Coalition and Classic period sites. Recent analyses of a Coalition period pueblo on Mesita del Buey (LA 4624) identified the presence of two-hand manos and slab metates (Vierra n.d.). We would expect the ground stone assemblages to reflect current arguments that suggest an increasing emphasis on maize agriculture from Coalition to Classic periods. Ground stone tools can act as an indirect measure of dependence on plant processing and maize agriculture. For example, Hard (1986, 1990) has argued that the total area of the grinding surface area on manos will increase as a function of a growing dependence on maize agriculture and corn processing. For example, manos with a length less than 11 cm presumably reflects an economy 0 to 15% dependent on agriculture, 11 to 15 cm of a 0 to 45% dependence, 15 to 20 cm of a 35% to 75% dependence, and greater than 20 cm of over 65% dependence.

Craft specialization could indicate the presence of formal trade networks. Archaeological evidence for stone tool craft specialists has been identified at the Salmon Ruins site in northwest New Mexico (Shelley 1983) and several Sinagua sites in the Anderson Mesa area of northern Arizona (Brown 1990; LePere 1981). In contrast, Cameron's (1984) study of Pueblo sites in Chaco Canyon did not identify any evidence of craft specialists. There has been no research conducted on this issue in the northern Rio Grande. However, given current aggregation models, it seems doubtful that they would exist during the Coalition period. On the other hand, with the development of formal trade relationships and access to upland source materials (e.g., obsidian), craft specialists may have existed during the Classic period. As previously noted, a fine-grained basalt quarry has been identified on the southern Pajarito Plateau at Bandelier National Monument. Quarries are also present at Cerro Pedernal near Abiquiu (Warren 1974). The presence of rock-cut bedrock quarries presumably reflects the bulk acquisition of raw materials using a direct procurement tactic. This tactic may have been used to obtain a surplus of materials for the production of exchange items (e.g., cores or tools). Surface obsidian quarries are also present in the area of Rabbit Mountain, Cerro del Medio, and Polvadera Peak (Moore 1986; Vierra 1993a; Wolfman 1994). In addition, surface quarries are present on the gravel terraces along the Rio Grande Valley (Moore 1993; Moore and Levine 1987). Creamer (2000:107) has suggested that the presence of obsidian and Cerro Pedernal chert at Classic period Galisteo Basin sites reflects an exchange network with Tewa villages to the north; however, these items might also have been procured from nearby Rio Grande gravel deposits.

Ancestral Pueblo Ceramic Technology and Exchange

Studies on ceramic production and exchange on the Pajarito Plateau began with the work of Kidder's (1915:413–421) initial dissertation research. This includes some preliminary descriptions of paste, temper, and slip. However, it was actually Kidder and Shepard's (1936) study of the ceramics from Pecos Pueblo that provided the first detailed descriptions of the biscuitwares. Later, Mera (1932, 1935) added to the descriptions of painted ware types from the Pajarito District, types that he considered to be ancestral to historic Tewa pottery (also see

Harlow 1973). Not until the work of Shepard (1942, 1965), Warren (1969, 1970, 1976, 1977a, 1979a, 1979b, 1979c), and more recently Habicht-Mauche (1993, 1995) would further advances be made on understanding ceramic production technology in the northern Rio Grande.

The ceramics on the Pajarito Plateau are Ancestral Tewa wares, including Kwahe'e Black-on-white, Santa Fe Black-on-white, Wiyo Black-on-white, Abiquiu Black-on-gray (Biscuit A), Bandelier Black-on-gray (Biscuit B), Cuyamungue Black-on-gray (Biscuit C), and Sankawi Black-on-cream (Mera 1932, 1935; Lang 1982). More recently, they have been referred to as Pajarito Whitewares by Habicht-Mauche (1993:10) (although Kidder [1915] had already in part referred to them as "Pajaritan Pottery"). Table 6.7 presents the information on paste and tempering materials used to define plateau painted and utilitywares as derived from McKenna and Miles (1991). Kwahe'e, Santa Fe, and Wiyo Black-on-white are all generally tempered with tuff and sand; whereas, the biscuitwares and utilitywares are primarily tempered with tuff. The latter includes quartz grains that are derived from the tuff (e.g., ant hill sand). Overall, there are several important changes in painted ware production techniques that are occurring through time. These are represented by changes in the composition of the clays and tempers used, a general increase in vessel wall thickness and paste porosity, and changes in firing techniques. The latter is in part reflected in the "clink" vs the "clunk" sound made when a sherd of Santa Fe Black-on-white vs Wiyo Black-on-white is tapped. As Kidder (1915:419) pointed out, the term "biscuitware" refers to the "light, porous" nature of this pottery, a pottery that is much thicker than its earlier counterparts. Refiring and sherd tensile strength studies could aid in identifying these past ceramic production techniques.

Table 6.7. Pajarito Plateau Painted and Utilityware Type Descriptions (McKenna and Miles 1991)

Type	Paste	Temper	Texture of Core
Kwahe'e B/w	Uniform gray to whitish gray	Quartz sand, igneous rock, tuff, sherds	Generally fine paste
Santa Fe B/w	Blue-gray, ranges from whitish to dark gray	Tuff, fine-coarse sand	Fine, homogeneous
Wiyo B/w	Light brown/tan, some olive green	Tuff, fine sand, and basalt, some sherd	Fine, homogeneous
Biscuit A	Dark gray to white	Tuff, pumice	Fine-medium, homogeneous
Biscuit B	Dark gray to white	Tuff	Fine, homogeneous
Sankawi'i B/c	Pinkish tan to orangish tan	Sand, tuff	Fine to very fine, homogeneous
Indented corrugated	Brownish gray-gray	Tuff, including quartz grains	Medium to very coarse
Smeared-indented corrugated	Brownish gray-gray	Tuff, including quartz grains	Medium to very coarse
Plain gray	Brownish gray-gray	Tuff, including quartz grains	Medium to very coarse

Very little research on ceramic production and exchange has been conducted on the Pajarito Plateau. The above ceramics represent locally produced wares, with only a few nonlocal ceramics being represented on the central plateau at LANL. As Vint (1999) suggests, during the

Coalition period, mobility, hunting and gathering, and local reciprocity all acted to reduce subsistence risk. Ceramics were mainly produced for household use. Nonlocal ceramics are those produced outside of the central plateau. They are rare and include the White Mountain redwares. During the LCT survey, White Mountain redwares only represented about 3% of the Coalition period painted ware ceramics (Vierra 2000). They represent part of an inter-regional Pueblo III exchange network. During the Classic period, formal trade relationships were probably used to buffer annual subsistence short falls. Craft specialists could have produced ceramics for regional exchange. Nonlocal ceramics present in the area include both painted wares and utilitywares. Glazewares from several nonlocal sources (e.g., Albuquerque, Cochiti, and the Galisteo Basin area) are present, in addition to tuff tempered glazewares that might have been obtained from nearby Frijoles Canyon. Utilitywares, including micaceous pottery, were also obtained from pueblos in the Rio Grande Valley. On the other hand, the presence of biscuitwares at Pecos Pueblo and at the Galisteo Basin sites indicates that these ceramics were being exchanged outside the Tewa culture area (Creamer 2000:105; Kidder and Shepard 1936). Glazewares also comprised about 3% of the Classic period painted ware ceramics identified during the LCT survey. In contrast, nonlocal micaceous plainwares represent 25% of the utilitywares present at the Classic period site of Otowi (Vierra 2000). It is therefore the latter ceramic type that represents one of the major Classic period trade wares.

There have been no systematic studies of clay and temper sources conducted on the Pajarito Plateau. Warren (1976, 1977b, 1979d) has described possible sources in the area of White Rock Canyon. Vint (1999:407) also notes some potential sources at Bandelier National Monument. He describes a grayish clay source located near the mouths of Frijoles and Alamo Canyons. There are abundant temper sources including tuff, quartz crystals derived from the tuff in ant hills located on the mesa tops, basalt outcrops, and stream sands. Steen (1982:37) notes the presence of tuff “metates” at excavated Coalition period sites that could have been used for grinding temper. Several sources of clay are also present at LANL. These might include residual clays located at the base of the soil profile on mesa tops, clay sediments situated within erosional gullies cut into the lava flows of the Cerros del Rio volcanic field, and a grayish clay present in a lacustrine facies of the Puye Formation near the mouth of Los Alamos Canyon. Several small samples of clays were collected by archaeologists at LANL and submitted to Eric Blinman for preliminary firing experiments. He suggests that clays obtained from the bottom of the erosional gully and the lacustrine clays resemble those used for Santa Fe Black-on-white pottery. In contrast, a sample taken from the interface of the basalt and overlying pumice formation more closely resembles a Wiyo Black-on-white paste. That is, a paste containing more pumice inclusions (Blinman, pers. comm. 2002).

Vint (1999) conducted a preliminary study of Santa Fe Black-on-white pottery collected from the Bandelier National Monument (n = 170). An Inductively Coupled Plasma Spectroscopy analysis was conducted on the sherds, with a microscope also being used to identify tempering materials. He was able to distinguish two compositional groups. Both contained similar clay compositions, but they were separated by the presence of relatively less tuff and more quartz crystals vs more tuff and less quartz crystals. The former appears to be more prevalent during the Early Coalition and the latter during the Late Coalition. This corresponds with the continuing dominance in the use of tuff as a temper during the Classic period. Ruscavage-Barz’s petrographic analysis of Santa Fe Black-on-white sherds from Bandelier National Monument also observed a similar pattern as identified by Vint. That is, sherds with “more sand than glassy pumice or more glassy pumice than sand” (1999:198). It is, however, noteworthy that she describes the presence of “glassy pumice” and not tuff. Rather she states that a small percentage of the sherds contained no glassy pumice, but sand with “different kinds of tuff,” sand only, and sherd temper (Vint 1999:200) (David Hill did the actual petrographic analysis for this study). The shift in ceramic tempering material from the Early to Late Coalition may reflect the initial use of naturally tempered clays (with more sand) vs the later addition of more pumice (or tuff) temper to the clay. Lastly, Ruscavage-Barz also identified several non-local Santa Fe Black-on-white sherds, including pastes containing fragments of granite. There are several potential sources of pumice for tempering material on the plateau. This includes the Guaje Pumice Bed, Tsankawi Pumice Bed, El Cajete Formation, and post-Bandelier tephras derived from at least two of the Valles Rhyolite domes in the caldera. They exhibit differing geochemistry and can be distinguished through various compositional analysis techniques.

Gray’s (1990) study of ceramics from the Coalition period site of Burnt Mesa Pueblo included a microscopic identification of utilityware temper types. She observed that utilitywares were tempered with fine-coarse grained sand and suggested that this tempering material resembled the sand present in mesa top anthills that had been crushed. Curewitz’s (2002) recent analysis has similar findings. Her analysis included the microscopic identification of temper materials from a Coalition period pueblo on Mesita del Buey (LA 4624). Most of the Santa Fe Black-on-white sherds contain a fine tuff and sand temper; whereas, the utilitywares mostly contain what has been referred to as “ant hill” temper. She has separated these materials into two main groups: medium tuff and sand and fine sand with quartz and feldspar crystals. The latter might also contain some mafic minerals, or mica with igneous rock fragments.

Larson et al. (1986) presented some preliminary results of their microscopic and x-ray fluorescence (XRF) analysis of biscuitware and glazeware ceramics from Pajarito Plateau and Rio Grande Valley sites. The paper mostly summarizes this research, but it notes several important patterns. Their study of the glazewares from Tsirege indicates that 78% were manufactured locally, with 11% from Cochiti and 11% from the Galisteo Basin. They note that “the texture varieties of tuff all have similar signatures and were all probably locally manufactured on the Pajarito Plateau” (Larson et al. 1986:7). Glazewares comprised only 3% of the biscuitware and glazeware assemblage from Tsirege. This is the same figure as identified by the LCT survey project at Otowi. Their study of the biscuitwares determined that more biscuitwares were obtained from valley sites during the earlier Classic period vs more locally produced biscuitwares during the later Classic period. For example, 6.5% of the biscuitwares at the later Classic period site of Tsirege were obtained from the Chama Valley area. They state that “it appears that there was more trade between biscuitware sites than between biscuitware and glaze producing sites” (Larson et al. 1986:9). This information, coupled with the presence of nonlocal micaceous wares, reflects important trade relationships between the plateau and their Tewa neighbors in the Rio Grande Valley. In addition, it shows that the XRF analysis of ceramics is a productive approach for distinguishing production areas (e.g., Olinger 1987). Olinger’s (1992) XRF study of historic Pueblo ceramics and his analyses of Coalition and Classic period ceramics from Arroyo Hondo (Habicht-Mauche 1993, 1995; Olinger 1993) also underscores this point (also see Reed 1990).

Given the current site aggregation models, we might expect more ceramics to be produced for household consumption during the Coalition period, with an increase in the production of ceramics for exchange during the Classic period (Vint 1999). If so, there may be evidence of ceramic craft specialists present at Classic period sites. Although there have been numerous studies conducted of Southwestern ceramic production (e.g., Mills and Crown 1995), the previous discussion indicates that little of this work has been done in the area of the Pajarito Plateau. The limited research that has been conducted on local ceramic production indicates that little exchange occurred between the plateau and glazeware areas to the south; whereas, more interaction appears to have taken place between the plateau and the nearby Rio Grande Valley areas (e.g., biscuitwares and micaceous utilitywares). There has only been a single study of craft specialization conducted on the plateau. Hagstrum's (1983, 1985) study of Santa Fe/Wiyo Black-on-white vs Biscuit B bowls focused on standardization as a measure of ceramic specialization. The former sample was obtained from Pindi Pueblo, and the latter was from Otowi. As she notes, Kidder had already identified standardization in design for biscuitware pottery at Pecos Pueblo (Kidder and Amsden 1931). However, she was able to quantitatively demonstrate that the Biscuit B bowls did indeed reflect greater standardization in design than the Santa Fe/Wiyo bowls. She interprets this as "constituting evidence for increased craft specialization in the Classic period" (Kidder and Amsden 1931:75).

At least one study has shown that there are significant differences in utilityware production techniques between the San Juan Basin and Rio Grande areas. Blinman and Price (1998) identified that San Juan Basin indented corrugated vessels were produced by applying the coils to the exterior of the jar. In contrast, it appears that northern Rio Grande potters produced smeared-indented corrugated vessels by applying the coils to the inside of the vessel. The implications of this study are interesting in that the presence of exterior coiling techniques on Coalition sites may reflect the presence of immigrant populations from the Colorado Plateau.

Lastly, there is little archaeological evidence for ceramic production on the plateau. Kidder (1915) does note the presence of "tufa-filled pot molds" that were recovered from Hewett's excavations of Classic period sites. He suggests that these artifacts "were used for starting coiled vessels" (Kidder 1915:426). However, Blinman (pers. comm., 2002) suggests that this was not tuff, but rather a selenite plaster similar to that found at other sites in the northern Rio Grande. A similar artifact to the one described by Kidder is also present in the collections at Bandelier National Monument; however, it appears to be lined with unfired clay (Gauthier, pers. comm. 2002). Although no ceramic firing kilns have been identified on the plateau, there is some archaeological evidence of pottery production in the Rio Grande Valley near Santa Fe. Several possible pit kilns were excavated at Las Campanas (Lakatos 1996). These kilns were oval to circular-shaped, up to 1.70 m long, and 26 cm in depth. The sides of the pits are heavily oxidized, with 20 to 40 burned cobbles being present in the pit fill. These items presumably acted as supports for the pottery. The fill contained a charcoal-stained soil with small ceramic spalls and the remains of partially reconstructible vessels. The latter were solely represented by Santa Fe Black-on-white bowls. A discard pile representing the fill from a nearby kiln was also identified at one site. It is possible that some lithic and ceramic scatter sites at LANL could represent pottery production locales containing the remains of kilns. Given current arguments for site aggregation on the plateau, it is also possible that there might be a shift from the use of pit kilns during the Coalition period to larger trench kilns during the Classic period. The latter would provide for the production of a greater number of vessels, some of which could be used for exchange. However, Gauthier (pers. comm. 2002) suggests that changes in ceramic production during the Classic period may have also involved the use of surface kilns for painted wares and pit kilns for utilitywares. This is because the later biscuitware colors tend toward tans and creams with an occasional red core that could reflect an oxidizing firing atmosphere. In contrast, the utilitywares continued to be produced using the same reducing firing conditions.

Athabaskan Technology and Exchange

Technology

Material culture items associated with Apache campsites include ceramics, lithics, and metal and glass artifacts. Brugge's (1982) review of Apache ceramics indicates that Apache utilitywares share a number of characteristics. They generally show "a preference for moderately large jar forms, usually a dark gray color but with considerable variation, thin walls, and limited decorative treatment" (1982:279). Exteriors were sometimes textured, and mica was often used as a temper or applied to the vessel. Jicarilla pottery types include Ocate and Cimmarron Micaceous; whereas, Navajo types include Dinetah, Navajo, and Pinyon Gray (Brugge 1982). Perdido Plain is a micaceous ceramic ware that was possibly produced by Faraon Apaches (Gunnerson and Gunnerson 1970, 1971). Nonetheless, as pointed out by Girard (1992), micaceous clays were used to produce plainware pottery by Apache, Hispanic, and Pueblo potters in the Taos region. However, some Tewa pottery (e.g., Tewa Polychrome) might be present as a trade item on Athabaskan sites.

Little is known concerning the nature of Apache stone tool technology. Analysis of Gobernador phase (AD 1625–1760) Navajo sites in northwestern New Mexico indicates a technology involving both core reduction and tool production; however, the emphasis on bifacial knife production is somewhat less than that found in the earlier Dinetah phase (AD 1450–1625). This is presumably due to the use of metal knives during the later Gobernador period. The projectile points are small side-notched triangular forms, with straight, concave, or notched bases. The ground stone includes millingstones, basin and trough metates, and one- and two-hand manos. The trough metates and two-hand manos were presumably used for the milling of corn at these sites (Brown 1992; Vierra 1995).

The use of metal by the Apache for arrow points, lances, and knives is documented historically and archaeologically. Barrel hoops were an important trade item used for the production of these tools (Kluckhohn et al. 1971:40; Smith 1962:32). Thompson (1980) provides a review of possible Apache metal arrow and lance points recovered in southern New Mexico and west Texas. They are generally stemmed points with rounded to angular shoulders. A single metal point has been recovered at LANL (Figure 6.22). The item was found in a cavate along Pajarito Canyon (Vierra et al. 2000). Adams et al. (2000a and 2000b) provide some excellent information on Apache metal artifacts from southeastern New Mexico, including tinklers, cooking gear,

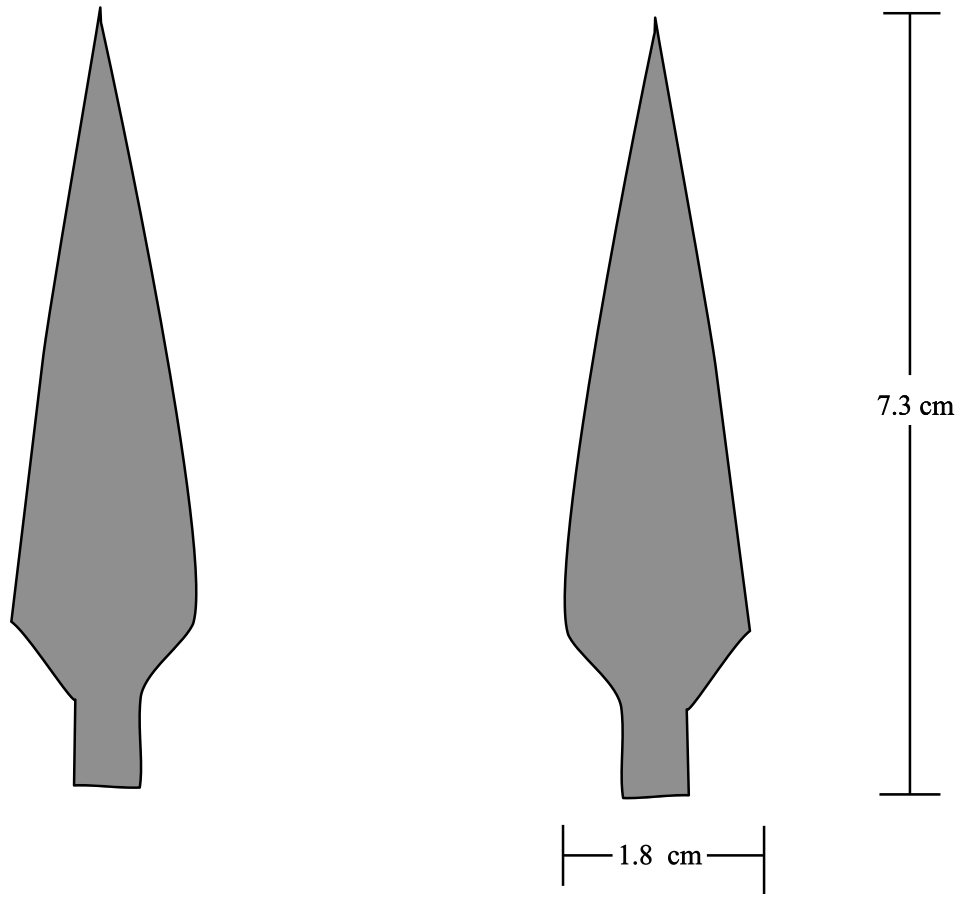


Figure 6.22. Metal projectile point from LA 86620.

bracelets, horse tack, and munitions. Their work was dramatically aided by the use of metal detectors for identifying the presence of these items.

Glass may also have been used for tools, although its availability and use was probably limited. Eidenbach (1990) describes possible 19th century Apache glass artifacts from the Sacramento Mountains. Examples of the Western Apache use of glass for arrow points and retouched tools are also provided by Ferg (1987), Tagg (1988), and Hohmann and Bradley (1988). In addition, glass trade beads dating to the 18th and 19th centuries might also be a trade item present (Earls et al. 1989).

Homestead Period Technology and Exchange

As previously discussed, the plateau homestead occupation was limited to the growing season. Some residents stayed at their rancho for the entire growing season, while others made periodic visits to these upland farming sites. In both cases, informants noted that they brought with them the supplies necessary for these farming activities. Much of this was purchased from stores in the valley. A variety of domestic and agricultural artifacts would be expected to occur at these sites.

Although excavations have been conducted at the Romero Cabin site, no final report has ever been produced. Testing at the *Vigil y Montoya* homestead site identified the presence of a variety of domestic artifacts, including metal bedsprings, window and bottle glass, enamelware sherds, earthenware fragments, ironstone sherds, shoe leather, plastic comb, nails, tin cans, lard buckets, shotgun shells, a possible hurricane lantern fragment, corrugated metal, stove pipe, bailing wire, and cut lumber. However, no artifacts directly related to agricultural activities are noted (McGehee and Larsen 1993).

There are examples from the northern Southwest of Hispanics reworking glass items into formal tools, possibly for woodworking and religious activities (Carillo, pers. comm. 1999). Given the remoteness of the plateau, homesteaders may have recycled manufactured items into other tools. This activity was indeed identified at the Romero Cabin site (McGehee and Larson 1993).

As previously noted, some of the plateau homesteaders resided at nearby San Ildefonso Pueblo. Testing at the *Vigil y Montoya* homestead site revealed the presence of historic Pueblo ceramics (McGehee and Larsen 1993). These items obviously reflect some form of interaction between Hispanics and the local Pueblos. Hispanics had close relationships with the Indians at San Ildefonso Pueblo during the early 20th century. They shared information on agricultural practices and exchanged crop seed. It was these Hispanics who introduced white corn for posole to the Pueblos. On the other hand, the Pueblos taught the Hispanics about local medicinal plants. Hispanics were the first to use agricultural machinery and they dug wells for water at the Pueblo. Previous to this, the pueblo had obtained water from the river. Although Hispanics owned homes at the Pueblo, this property reverted back to the reservation after the death of the owner. Indeed, Hispanic homes can still be seen at San Ildefonso Pueblo. They are the ones with the galvanized metal pitched-roofs. Of course Hispanic religion (i.e., Catholicism) also had an important effect on the Pueblos. Even today San Ildefonso Pueblo still does the matachines dances on Christmas day, including Pueblo dancers with Hispanic musicians. Lastly, Hispanics played an important role with respect to Pueblo social activities and, in some cases, acted as intermediaries. For example, it was Hispanic homes that separated the two plazas at San Ildefonso Pueblo (Martinez, pers. comm. 2002).

Technology and Exchange Research Questions

49. **Are the Archaic lithic assemblages dominated by the production and maintenance of bifacial tools?**
50. **What nonlocal lithic materials are present on the Archaic sites, in what form were these items brought to the sites, and what artifacts were being produced on these materials?**
51. **What information do these nonlocal materials provide concerning possible Archaic mobility patterns?**
52. **Are there significant differences between Early and Late Archaic stone tool technology, and, if so, what are the implications of these differences for understanding changes in past land-use strategies?**
53. **Do Ceramic period lithic assemblages emphasize core reduction activities?**

54. What nonlocal lithic materials are present on the Ceramic period sites, in what form were these items brought to the sties and what artifacts were being produced on the materials?
55. What is the nature of the Ceramic period ground stone assemblages?
56. How do the Ceramic period site types differ in respect to chipped and ground stone assemblage composition?
57. What types of tools are present on Ceramic period agricultural sites?
58. Can compositional studies of clay and temper sources identify distinctive signatures that can then be used to evaluate long-term changes in ceramic production and exchange on the plateau?
59. Can compositional studies of paste and temper identify different sources for these materials? If so, which of these sources are local vs nonlocal?
60. Can refiring and tensile strength studies help us understand past ceramic production techniques?
61. What nonlocal ceramics are present during the Coalition period? Besides the Red Mountain Whitewares, is there evidence for the presence of nonlocal Santa Fe Black-on-white or other intra-regional painted wares? What are the implications of these data for understanding regional trade networks?
62. What nonlocal ceramics are present during the Classic period? Besides the glazewares, is there evidence for the presence of nonlocal biscuitwares and utilitywares? What are the implications of these data for understanding regional trade networks?
63. Do utilityware vessels reflect an interior or exterior coil application technique? If an exterior technique is identified, what type of utilityware and what proportion of the utilitywares were produced using this technique?
64. Is there any evidence of ceramic production on the Ceramic period sites? Or, is there any evidence that a lithic and ceramic scatter site could reflect a kiln(s) used in pottery production?
65. Is there evidence of ceramic craft specialists during the Classic period, and if so, what are they producing for exchange?
66. What evidence is there for domestic vs. agricultural activities at the Serna Homestead site?
67. Were any manufactured items recycled into other tools?
68. Are there any historic Pueblo ceramics or other artifacts that would indicate interaction between Hispanic homesteaders and local Pueblos?

CHAPTER 7
DATA RECOVERY PLAN: METHODS

BRADLEY J. VIERRA

FIELD DATA RECOVERY PROCEDURES

General Field Procedures

Geomorphic evaluations will be conducted at all the sites before excavation. Steve Reneau (Los Alamos National Laboratory) will visit each site and assess its geomorphic context and integrity. This will include digging shovel test holes in the areas around the sites. At least one backhoe trench will also be excavated in both the White Rock and Rendija tracts in areas with the potential for buried cultural deposits. Temperature and humidity monitors will be placed within these trenches to collect data necessary for calibrating obsidian hydration calculations. A series of 10 sensors will be placed at 10 cm intervals from the surface down and left in place for at least one year.

Geophysical studies using ground-penetrating radar (GPR) will also be conducted at a select sample of sites to identify the presence of subsurface features (e.g., see Conyers and Goodman 1997). This will be especially important for the artifact scatters and the roomblock sites where subsurface features are more likely to be present. John Isaacson and Jennifer Nisengard (Los Alamos National Laboratory) will conduct the GPR survey.

Fieldwork will begin with the field assessment of each site. The crew will initially walk over the site area, delineating the site boundaries and identifying the presence of artifact concentrations and features. A central site datum and baselines for a 1 by 1 m grid system will be established. The datum will be located at the 100N/100E grid point with an elevation of 10.0 m. The intersection of the northeast corner of each grid will determine its grid coordinates. Site elevation will work the same as topographic elevation (i.e., increasing with elevation). Site maps will include a detailed topographic map. These maps will contain topographic features, the site datum, surface collected areas, excavation units, the relationship of the site and features to other natural and cultural features, activity areas, site and provenience boundaries, and point-provenienced artifacts. Each map will be documented with a legend, site number, scale, magnetic and true north arrows, names of the recorders, and date the map was drawn. Controlled surface collections will be made, with all the materials being bagged separately by individual grid unit.

Site excavation will involve the hand excavation of grid units. This technique will be used to define the extent, depth, and character of subsurface deposits. Excavations will be carried out by natural stratigraphic unit, or in cases where the stratum is greater than 10 cm in thickness, in arbitrary 10 cm levels. A stratum is defined as a distinct depositional unit. Descriptions for strata will include soil kind, texture, compactness, and color (Munsell soil chart). Excavation units will be profiled. Features will be recorded in three dimensions and will include a cross-section. Feature descriptions will include measurements, fill, stratigraphic context, construction data, and the relationship to other features. With the exception of pollen, soil, and macrobotanical samples, all hand-excavated materials will be screened with eighth-inch mesh.

A daily log will be maintained by each crew. These notes will include summary information on daily activities and preliminary interpretations of site excavations. A series of recording forms have been designed to document the variability that is expected on the sites to be examined. These forms include a field specimen catalog, instrument mapping form, stratigraphy form, grid excavation form, sample log, feature form, room floor form, room summary form, photographic log, auger form, and burial form.

All samples suitable for dating (e.g., radiocarbon, dendrochronological, archaeomagnetic, or obsidian hydration), pollen analysis, and macrobotanical analysis will be recovered during fieldwork and later selected for analysis on the basis of their potential to answer specific research questions. A catalog of all samples will be maintained throughout the project. Primary samples anticipated include pollen, flotation, macrobotanical, and radiocarbon; however, it is possible that archaeomagnetic samples from hearths and dendrochronological samples might be taken as well. Pollen and flotation samples will be taken from each cultural stratum and feature. A trowel cleaned with distilled water and dried with a sterile laboratory wipe will be used to take each pollen sample. Approximately one cup of sediment will be collected and placed within a whirly-pac. Flotation samples will consist of about two liters of sediment placed within a set of paper bags.

The sites and the components that make up the sites will be photographed with digital camera and color slides. These photographs will serve as records of each excavation unit and feature. Photographs will document features and evidence of disturbance as well. Primary documentation photographs will contain a scale and north arrow. A photographic log will be used to record all exposures and will include photograph number, subject and provenience, direction of photograph, photographer, and date.

It is possible that human remains may be encountered during excavations. Appendix B[1] presents our comprehensive agreement between the United States Department of Energy and San Ildefonso Pueblo in compliance with the Regulations of the Native American Graves Protection and Repatriation Act (NAGPRA) Title 43, Part 10, Subpart A. This outlines our field excavation, laboratory analysis, temporary storage, and final disposition procedures for the remains, associated funerary objects, sacred objects, and objects of cultural patrimony defined by NAGPRA and in consultation with San Ildefonso Pueblo. Similar agreements are being prepared with other pertinent pueblos and tribes who have been determined to have legal standing under NAGPRA to claim affinity to Native American human remains and NAGPRA-related objects.

Artifact Scatters

Artifact scatters consist of Archaic lithic scatters or Ceramic period lithic and ceramic scatters. As previously noted, a GPR study will initially be conducted at all the sites to identify the presence of any subsurface features. The site area will be surface collected, with artifact

[1] Information in the appendix is proprietary and available strictly on a need-to-know basis. Please contact the Ecology Group for assistance.

distributions and features being identified. The location of formal chipped stone tools and ground stone items will be exact provenienced during these collections; whereas, debitage and sherds will simply be collected within 1 by 1 m grid units. This surface data will be used to produce artifact density maps using Surfer Ver. 7. Block excavations will then focus on the areas containing features and/or artifact concentrations (i.e., possible activity areas). Systematic augering and isolated 1 by 1 m test pits will also be placed in other portions of the site to determine the nature and extent of subsurface deposits. Given the general lack of features on these sites, obsidian hydration dating may be used to develop a baseline for differentiating possible Archaic vs Ceramic period sites and multiple site occupations. However, the Cerro Grande fire could have adversely affected some of the surface materials present on Rendija Canyon sites.

Roomblocks

There are three Coalition period sites with linear roomblocks to be excavated. LA 86534 is in poor condition and appears to be mostly disturbed. A few rock alignments and a sparse surface artifact scatter are present. LA 12587 also has several areas with masonry blocks that could represent roomblocks. In contrast, LA 135290 consists of a single linear-shaped mound that is in good condition. A GPR study will be conducted to identify possible rock alignments, buried features, and kivas present at these sites. This technique is especially important at LA 86534, because of the poor condition of the site and lack of surface visibility due to the area being covered by piñon and juniper trees. These trees will be removed from the area before beginning excavation. GPR will also be important at LA 12587 because of the dispersed nature of the rubble that could represent the presence of multiple features. This might include small garden plots along the periphery of the site.

A basic stratigraphic sequence has been identified during previous excavations conducted at Coalition period pueblos at Los Alamos National Laboratory. This sequence includes four major stratigraphic units at a site. From top to bottom they are recent surface soil, a cap of rubble debris, post-occupational fill that possibly includes some roofing material, and interior room floor surface. Like the artifact scatters, surface collections will be conducted in the site area, including the rubble mound, areas peripheral to the mound, and middens. Isolated features and artifact concentrations will be identified during this process. Middens presumably will be characterized by a concentration of artifacts located to the east of the roomblock. Excavations on the roomblock will begin by defining wall alignments. This may be obvious from surface indications, or preliminary trenches may be excavated across the rubble areas in order to define wall alignments. Once the outline has been defined, a map will be made and individual rooms designated by a sequential series of numbers (i.e., 1-n). Room fill will then be removed in stratigraphic layers. In doing so, the eastern half of the front (east) set of rooms will be excavated first, creating a north-south cross-section through the roomblock. The same procedure will be used for the back (west) set of rooms. Each interior room floor will be mapped, including the location of features, samples, and all artifacts lying directly on the floor. Pollen samples may be taken from underneath artifacts lying on the floor, features, and other locations where the context might preserve these remains. After all the floor artifacts have been removed, samples taken, and the features excavated, a single subfloor test pit will be dug to identify the presence of any earlier floors or features.

Block excavations will also be conducted in the plaza areas surrounding the roomblocks. It is hoped that GPR studies will identify the presence of any subsurface features (e.g., kivas) located in this area. If a kiva is found, it will be excavated using the same method as the roomblock. Particular attention will also be paid to identifying plaza features and activity areas. If a midden is identified, a trench will be excavated through the long-axis of the feature to expose a single profile. This trench will then be expanded into a block excavation that encompasses most of the midden area. Care will be taken to identify and remove individual strata to isolate a complete stratigraphic sequence. Lastly, small block excavations may also be conducted around any other features identified at the site.

Fieldhouses

Possible fieldhouses consist of one- to three-room structures. These small structures will be excavated using the same technique as previously discussed for the roomblocks. In addition, limited excavations will be conducted around the periphery of the structure to identify the presence of an exterior occupational surface, features, and activity areas. Most excavations have failed to identify the presence of a clear and definable interior floor surface in these structures. It may be difficult to isolate exterior activity area surfaces as well. The presence of features and artifact distributions will be used to aid in the identification of possible occupational surfaces.

Agricultural Sites

Two agricultural sites will be excavated, a grid garden (LA 12883) and a possible check dam (LA 128804). Block excavations will be conducted at the grid garden site to identify the construction techniques used for the feature. This approach includes exposing rock alignments and excavating a cross-section through a series of grids that will enable us to define the stratigraphic sequence present. Previous pollen studies in the area indicate that the surface of these ancient fields is relatively close to the modern surface. Samples taken from 0 to 20 cm below the surface yielded most of the cultigen pollen in one study (Smith 1997:7); whereas, samples taken from deeper contexts within a B horizon yielded poor results (Dean 1997). Pollen samples will therefore be taken from the exposed stratigraphic column within one or more field grids to a depth of about 20 cm. In addition, samples will also be taken from the upslope side and the base of a grid garden rock alignment where sediment is trapped from slope wash.

A trench will be excavated perpendicular to the axis of the check dam, above and below the rock wall. The exposed stratigraphic sequence will be documented and column pollen and flotation samples taken from above and below the rock wall. Excavation will continue until a sufficient amount of the feature is exposed to fully describe its construction technique.

Athabaskan Sites

Two possible Athabaskan sites will be excavated in Rendija Canyon (LA 85864 and LA 85869). A GPR study will be conducted at each site to identify the presence of subsurface features. A metal detector will be used to locate all metal artifacts at the site, including those immediately below the surface. Test pits were excavated within the rock rings at both of these sites (Peterson and Nightengale 1993). At LA 85864 a possible hearth consisting of a burned area was identified at a depth of 16 cm below the current surface. A radiocarbon date obtained from charcoal in this feature yielded a date of AD 130±60 BP, reflecting a nineteenth century occupation. A pit excavated within the rock ring at LA 85869 also exposed a burned area 5 to 15 cm below the surface that could be the remains of an unprepared hearth. Excavations will therefore focus on the areas in and around the rock rings. This includes relocating and expanding the previous excavations. In addition, the area immediately surrounding the rings will be excavated to identify any exterior features or activity areas.

Homestead Era Site

A single Homestead Era site with cabin and multiple features will be excavated in Rendija Canyon (LA 85407). The site consists of several features, including the remnants of a log cabin, an horno, remnants of a small log structure, a corral, and two trash areas. Most of the wooden structures were burned during the Cerro Grande fire, with only a few pieces remaining from the cabin, structure, and corral. Several wood fence posts also remain along the periphery of the site. Test excavations were conducted by Peterson and Nightengale (1993) in the area of the horno and a rock alignment. Burned portions of the horno were exposed, but no cultural materials were identified around the rock alignment. Excavations at the site will focus on the area of the cabin, the small structure, the corral, and the horno. Both trash areas will be collected and a test pit excavated within the scatters. This pit will be expanded, should subsurface cultural deposits be identified. Tree-ring samples will be taken from all the features and fence posts. A GPR study of the site area will be conducted to locate the presence of a privy. If a privy is located, it will be excavated. Lastly, a metal detector will be used to locate buried metal artifacts. These items will be plotted on the site map and either described in the field or collected.

An historic log corral (LA 70026) was located in a tributary canyon to Rendija Canyon. This area was severely burned during the Cerro Grande fire and the wooden portions of the corral were totally destroyed. A rock pile still exists in the center of the corral, that was also heavily burned. A test pit will be placed near the rock pile to identify the presence of any dung or other deposits that might provide information on the possible function of the corral.

A small section of a Homestead Era wagon road (LA 86553) runs across the floor of Rendija Canyon, west of the Serna Homestead. However, the road segment could not be relocated during the post-Cerro Grande fire assessment. The area was severely burned and the fire appears to have obliterated any obvious surface evidence of the road. Therefore, no further work will be conducted at the site.

LABORATORY PROCESSING AND ANALYSIS PROCEDURES

Artifact and Sample Cataloging Procedures

Artifacts will be washed, sorted, and rebagged following the Laboratory of Anthropology curation guidelines. This includes providing provenience information on curation quality paper within each bag and using ziplock bags that are 4-ml thick. The Field Specimen (FS) catalog will be cross-checked with the bags entered into a Microsoft™ Access database. The catalog will include the following fields: site number, FS number, room number, feature number, grid coordinates, starting and ending elevations, stratum level, date, recorder, and contents. The latter will specify lithics, ceramics, ground stone, bone, metal, glass, botanical, flotation, pollen, dendro, or other. Each bag will be given an individual FS number, and the number of items within each bag will be noted in the catalog. Two additional laboratory forms will be used. These are the data conflicts and question form that describes possible errors on a bag and the samples/bag created in the laboratory form that describes new FS numbers for samples or bags created in the laboratory. This might occur with a pollen wash taken from a metate or artifacts recovered from flotation sediments. All the original field paper bag labels will be kept for future reference.

Flotation samples will be processed using the standard decant flotation system as described by Hammett and McBride (1993). Each sample will be poured into a bucket of water, agitated gently until the botanical material floats to the surface, and then decanted onto a clean piece of chiffon material to dry. This botanical material is referred to as the light flotation (or fraction). The residue at the bottom of the bucket (called the heavy flotation) will be rinsed to eliminate the soil matrix, dried, and examined to recover lithic and bone material. A soil processing form will be filled that includes information on site number, FS number(s), total bags in flotation, volume of processed soil, weight of light flotation, weight of heavy flotation, and notes. Pollen washes may be done on artifacts collected in the field, including ground stone artifacts, like manos or metates.

Native American Ceramic Artifact Analysis

The ceramic analysis will be directed towards chronology, techno-functional, and trade issues. Analysis will emphasize conventional typological identification in order to address chronology and trade issues, supplemented by the stylistic description of selected black-on-white rim sherds to support regional and interregional temporal and ethnic comparisons. Techno-functional variability will be addressed through the attributes of vessel form, temper, modifications, rim type, vessel size, and interior/exterior vessel construction technique (Wilson 2000; Blinman and Price 1998). Evidence for the local manufacture of ceramic vessels will also be identified. Eric Blinman and C. Dean Wilson (Museum of New Mexico) will supervise the analysis of Native American ceramic artifacts.

A representative sample of pottery and temper types identified during the ceramic analysis will be submitted for compositional analysis. This includes petrographic analysis using the point count method. This method provides information on the relative volume of each mineral in a sample. Elizabeth Miksa (Desert Archaeology, Inc.) will supervise the petrographic analysis. See Miksa and Heidke (2001) for a discussion of this technique. In addition, samples may also be analyzed by x-ray diffraction to identify clay mineral assemblages and the mineralogy of the temper materials. Chemical and isotopic analysis of the pottery and temper could be performed using electron microprobe (EMP) techniques and laser ablation inductively coupled plasma-mass spectrometry (LA-ICP-MS). Major and minor elements would be identified in individual mineral grains by EMP. Trace elements and isotope ratios would be determined by LA-ICP-MS. For descriptions of these techniques see Montaser (1998), Goldstein et al. (1992), and McGee and

Keil (2001). Phillip Noll, Jr. (Los Alamos National Laboratory) will supervise the chemical and mineralogical analyses.

Euro-American Artifact Analysis

The analysis of Euro-American artifacts is important for gaining information about Homestead Era chronology and activity variation. The artifacts will be separated by principal material type: glass, ceramics, metal, and other (e.g., wood, cloth, leather, and plastic). Descriptive attribute data appropriate to each group will be recorded. This includes embossing, color, hallmarks, and closure styles. Artifacts will then be placed into functional groups established to crosscut the material data sets. These include architecture, household/domestic, personal, subsistence, leisure/recreation, fuel/energy, and transportation. Ellen McGehee (Los Alamos National Laboratory) will supervise the analysis of Euro-American artifacts.

Lithic Artifact Analysis

The lithic analysis will be oriented towards collecting information on material selection, lithic reduction, and tool use (Vierra 1993a, 1998). Material selection will be studied in respect to the variation in lithic raw materials used for the production of chipped and ground stone artifacts and the possible sources of these materials. Attempts will be made to distinguish local from nonlocal materials. The chemical composition of lithic artifacts will be determined by a combination of x-ray fluorescence (XRF) and LA-ICP-MS. Major (and some minor/trace) element bulk chemistry will be determined by XRF (Shackley 1995). Trace elements will also be determined by LA-ICP-MS, however, this technique has much lower detection limits than XRF (e.g., parts per billion). Steven Shackley (University of California) will supervise the XRF analysis, and Phillip Noll, Jr. (Los Alamos National Laboratory), the LA-ICP-MS analysis.

The lithic reduction study will provide information on core reduction techniques, stages of reduction represented, and evidences of tool production/maintenance. This will include describing the variation in cores, debitage, and retouched tools. The debitage assemblage will be characterized in respect to the types of debitage present and the stages of reduction that are represented. The retouched tools are an important source of information on tool production, tool use, and site function.

The tool use analysis will provide information on tool function, including the presence/absence of use-wear and the variation exhibited by the ground stone tools. A low-power technique will be used to identify the presence of edge damage on the chipped stone artifacts. The variation in ground stone tools will be described in relation to specific tool types, artifact condition, use location, cross-section, and measurement. These data will then be used to determine whether the ground stone assemblage was designed to process a variety of plant foods, or whether it was primarily used for corn milling activities. Bradley Vierra (Los Alamos National Laboratory) will supervise the analysis of lithic artifacts.

Faunal Analysis

The analysis of faunal remains will provide important information about resource use and acquisition. The analysis will be designed to identify faunal resources used by the various inhabitants of the project area and possible season of exploitation. Several attributes will be monitored during the analysis, including species, age, element, portion, side, and evidence of butchering. The number of identified specimens (NISP) and the minimum number of individuals (MNI) per identified species will be calculated. MNI and NISP will be important in determining the relative importance and caloric value of each species. Kari Schmidt (Los Alamos National Laboratory) will conduct the faunal analysis.

Archaeobotanical and Pollen Analyses

The archaeobotanical and pollen analyses will provide important information on subsistence, seasonality, and land-use techniques. The flotation analysis includes a full sort and identification of all charred and uncharred botanical remains to the most precise taxonomic category possible (family, genus, or species). Charred seeds will also be counted. The macrobotanical analysis includes the identification of taxon, plant part, and condition for each item in the sample. Remains can be either weighed or counted, whichever is appropriate. These items are generally recovered from the screen during excavation, but can also be collected directly from an in situ context. Pamela McBride (Archaeobotanical Services) will conduct the archaeobotanical analysis.

The pollen analysis includes 200-grain pollen counts of each slide at a magnification of 400x. Pollen identifications will also be made to the most precise taxonomic category possible. After the conventional analysis, one to five slides will be scanned at 100x until rare cultigen pollen is documented or at least 1000 tracer grains have been observed. Susan Smith (Northern Arizona University) will conduct the pollen analysis.

Chronometric Dating Methods

Several chronometric dating techniques will be used during the project. For example, organic remains may be submitted for standard and accelerator mass spectrometer radiocarbon dating to Beta Analytic, Inc. Tree-ring samples will be analyzed by the Laboratory of Tree-ring Research, University of Arizona. Archaeomagnetic samples will be taken and processed by Eric Blinman (Museum of New Mexico). Obsidian hydration analysis will be conducted by Christopher Stevenson (Diffusion Laboratory, Inc.). Lastly, ceramic and lithic samples suitable for luminescence dating will be analyzed by James Feathers (University of Washington).

CHAPTER 8
SITE SELECTION METHODS FOR THE DATA RECOVERY PROGRAM

BRADLEY J. VIERRA AND STEVEN R. HOAGLAND

A total of 61 archaeological sites are present within the Airport, White Rock, and Rendija Tracts of the Land Conveyance and Transfer (LCT) Project. Sixteen of these sites were deemed not eligible for inclusion to the National Register of Historic Places (Hoagland et al. 2000). Three archeological sites and a portion of another in the White Rock Tract will be transferred to the Secretary of the Interior in trust for the Pueblo of San Ildefonso, and an additional eight archaeological sites in Rendija Canyon were identified as Traditional Cultural Properties in consultations with San Ildefonso Pueblo. Therefore, these sites will also be excluded from the data recovery program. This leaves a total of 49 archaeological sites that could be adversely impacted by the transfer of these lands to Los Alamos County.

All three of the eligible sites located within the Airport Tract, and the seven eligible sites situated within the White Rock Tract will be excavated. These sites represent the full range of variation exhibited by the project, including roomblocks, fieldhouses, a check dam, a garden plot, a lithic and ceramic scatter, and an Archaic lithic scatter.

The majority of the sites to be excavated during the data recovery program are located within the Rendija Canyon tract ($n = 39$). These consist of 3 Archaic sites, 4 Coalition/Classic period one- to three-room structures, 12 Classic period one- to three-room structures, 13 Ancestral Pueblo one- to three-room structures, a rock feature, a homestead, a wagon road, a corral, and two tipi-wickiup rings. Testing was conducted at 13 of these sites, including nine one- to three-room structures, an Archaic lithic scatter, both of the tipi-wickiup rings, and the homestead (Peterson and Nightengale 1993). As previously discussed in Chapter 7, the one- to three-room structures are quite similar. Most are characterized by a simple rock alignment representing the remains of a foundation. They often lack formal floors and features, with only a small number of artifacts being present. Given the similarity of these structures and the large number of Classic and Ancestral Pueblo one- to three-room sites represented ($n = 25$), a sample of these sites will be selected for excavation. See Chapter 6 for a discussion of these sites. The sample selection process will be based on the following criteria: site integrity, results of the previous testing program, and topographic setting.

The Rendija Tract can be divided into two topographic zones: canyon and mesa top. The canyon can be subdivided between those portions with Rendija Canyon and a small tributary named Cabra Canyon. There are six Classic period one- to three-room structures located in Rendija Canyon and none in Cabra Canyon; however, one of these sites (LA 85402) was not relocated during the LCT survey. Four of the canyon sites are in good condition (LA 86605, LA 87430, LA 127634, and LA 127835) and are distributed across the canyon floor (see Appendix A[1]). The former two sites include glazeware sherds; whereas, LA 127634 includes Biscuit B and LA

[1] Information in the appendix is proprietary and available strictly on a need-to-know basis. Please contact the Ecology Group for assistance.

127635, Biscuit A sherds. Therefore, the latter two sites may not be penecontemporaneous. In contrast, one site (LA 127628) has been heavily disturbed during the construction of a nearby fence. There is no information on previous excavations, since none of the canyon sites were tested by Peterson and Nightengale. Therefore, based on site integrity, location, and chronology, the former four sites will be selected for data recovery.

There are an additional five Classic period one- to three-room structures situated on the mesa top (Appendix A). All five of these sites were tested by Peterson and Nightengale. Two of the sites are in very good condition, with intact floors, charcoal, and artifacts being identified (LA 85413 and LA 85867). Another site was in good condition, but only yielded few artifacts and no floor, but was extensively tested with three pits (LA 85405). In contrast, the remaining two sites contained only a single test pit, no floors, and a large number of surface artifacts (LA 85408 and LA 85409); however, the former site contained some subsurface artifacts and the latter site none. Therefore, three of the five sites will be excavated: LA 85408, LA 85413, and LA 85867.

Ancestral Pueblo one- to three-room structures are distributed across Cabra Canyon, Rendija Canyon, and mesa top settings (Appendix A). Both of the sites located in Cabra Canyon will be excavated (LA 86806 and LA 86807). There are an additional nine sites situated within Rendija Canyon. Two of these sites are eroded (LA 127626 and LA 127632) and one (LA 135292) has burned stumps within the feature. LA 135291 consists of a large scatter of cobbles. This contrasts with the other small sites that generally consist of rock alignments. There is a cluster of three sites located in the central area of the canyon (LA 15116, LA 127629, LA 127630). They are all similar in size and condition, although LA 15116 contains more masonry blocks and is in somewhat better condition. The remaining three sites (LA 85403, LA 127627, LA 127633) are distributed across the canyon in a north to south direction. Together, this group (LA 135291, LA 15116, LA 85403, LA 127627, and LA 127633) reflects the range in site variability in form and distribution. These five sites will therefore be excavated.

There are only four Ancestral Pueblo sites located on the mesa top (Appendix A). Two of the four sites were tested by Peterson and Nightengale (LA 85412 and 85414); whereas, two are new sites that were found during the Cerro Grande post-fire assessment survey (LA 135294 and LA 135293). LA 85412 was disturbed by pot hunting and LA 135293 was damaged when a stump burned within the structure. LA 85414 has been affected by some erosion, but appears to be in better condition than either LA 85414 or LA 135293. LA 135294 is in good condition, consisting of a small mound with two to three rooms. Therefore, LA 135294 and LA 85414 will be excavated.

Based on this sampling strategy a total of 15 of the 25 Classic and Ancestral Pueblo one- to three-room structures will be excavated during the data recovery program. This represents a 60 percent sample that reflects the full range in variability exhibited by the sites. In addition, six of the nine sites with an undetermined eligibility status (i.e., potentially eligible) lacked integrity and were therefore not included in the excavated site sample. Overall, a total of 39 sites will therefore be excavated during the LCT data recovery program.

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APPENDIX A

Site Location Maps for Airport, White Rock, and Rendija Canyon Tracts

<u>Proprietary Information</u>

This information is available strictly on a need-to-know basis.
Please contact the Ecology Group for assistance.

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