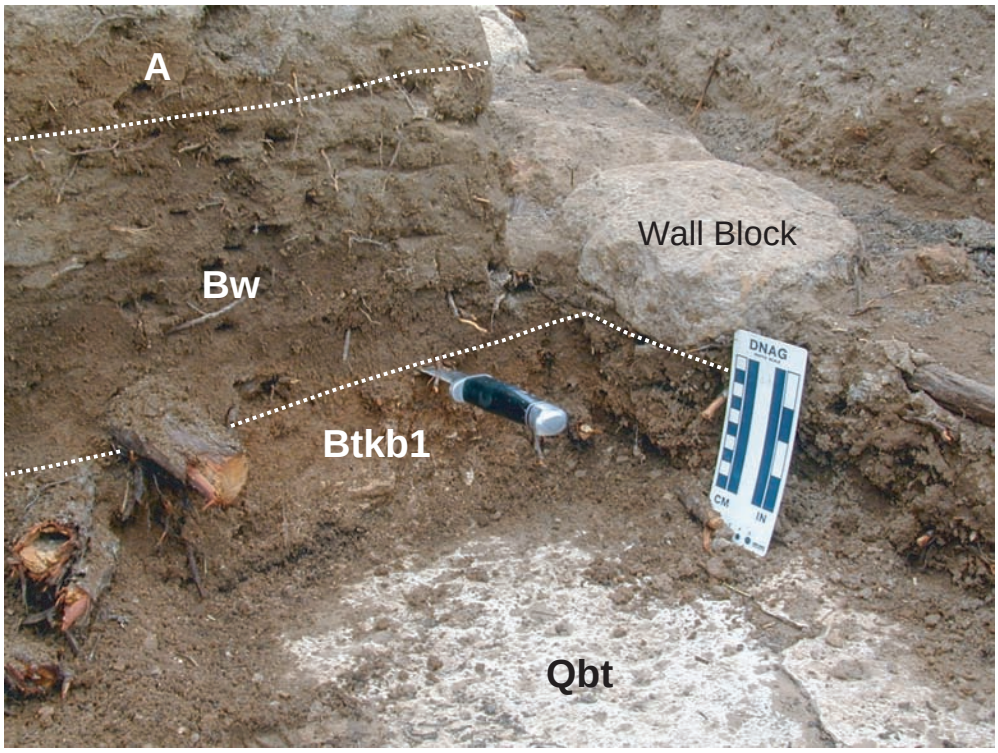
Surficial Units and Processes Associated With Archaeological Sites in Selected Land Conveyance Parcels, Los Alamos National Laboratory

Calendar Year 2002 Through February 2003 Investigations



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GLORIETA GEOSCIENCE, INC.

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SURFICIAL UNITS AND PROCESSES ASSOCIATED WITH ARCHAEOLOGICAL SITES IN SELECTED LAND CONVEYANCE PARCELS, LOS ALAMOS NATIONAL LABORATORY

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INTRODUCTION

Geomorphic studies were conducted in selected land conveyance parcels at Los Alamos National Laboratory in support of archaeological investigations preceding transfer of these parcels from the Department of Energy to Los Alamos County, San Ildefonso Pueblo, or the New Mexico Highway Department. This work included mapping and description of surficial geologic units to help define the geomorphic context of archaeological sites. This work also included identification of surficial processes associated with potential erosion or burial of cultural features.

GEOMORPHIC SETTING

Los Alamos National Laboratory is located on the Pajarito Plateau and includes a variety of landforms including gently sloping mesa tops, steep canyon walls, and canyon bottoms. This area has a complex geomorphic history over the last 10 to 15 thousand years, the time scale relevant to archaeological investigations (e.g., Reneau and McDonald, 1996; Reneau et al., 1996b). At various times, large parts of the landscape experienced deposition of alluvial, colluvial, or eolian sediments, with an associated potential to bury and help preserve archaeological sites. The landscape has also experienced significant erosion, with the associated potential to erode archaeological sites.

METHODS

Surficial geologic maps of selected land transfer parcels were prepared at a scale of 1:1200. The mapping focused on units with potential archaeological significance. Soil descriptions were made at profiles both inside and outside of identified archaeological sites following methods discussed in Birkeland (1999). Preliminary age estimates of deposits were made based on soil descriptions and comparison of the general degree of soil development to previously dated sites on the Pajarito Plateau. A ca. 4 ^{14}C ka (ka = thousands of years before present) colluvial deposit in Fence Canyon (Stop 1-4c, Reneau and McDonald, 1996, p. 62-64), at the same general elevation as the White Rock parcel, was used as a key reference for the degree of soil development in a mid-Holocene unit on that part of the plateau (Figure 1). The presence of the ca. 50-60 ka El Cajete pumice (age from Toyoda et al., 1995; Reneau et al., 1996b) interbedded with or overlying colluvial sediments, provided additional age control in some areas. The relation of deposits with varying soil characteristics to cultural material (e.g., potsherds) provided additional information on the age of some layers. The presence of remnants of a Pleistocene soil with an estimated age of at least 100-200 ka (McFadden et al., 1996) underlying

cultural deposits on mesa top settings provided a clear demarcation of cultural-versus-archaeologically sterile sediments.

Preliminary age estimates for soils in Pueblo Canyon are based on comparison with a chronosequence of Pleistocene and Holocene soils developed on a terrace sequence in Rendija Canyon (Reneau and McDonald, 1996; McDonald et al., 1996; Phillips et al., 1998). Age constraint for the Rendija Canyon fluvial terraces is provided by 13 radiocarbon dates for Holocene terraces, two radiocarbon dates for Pleistocene terraces, and cosmogenic ^{21}Ne age estimates for three terraces.

AIRPORT TRACT

Surficial Geologic Units

The Airport land transfer parcel includes a gently sloping mesa between a tributary to Pueblo Canyon on the north and DP Canyon, a tributary to Los Alamos Canyon, on the south. Bedrock beneath the mesa consists of the Tshirege Member of the Bandelier Tuff (unit Qbt). The mesa is capped by colluvium that thins to exposed bedrock near the mesa edge (Figure 2), overlain by fine-grained soils that likely constitute either eolian sediments or locally reworked eolian sediments. Recent (late Holocene) sediments unconformably overly thin Pleistocene soils. A tributary drainage to Pueblo Canyon that heads in the parcel is shallowly incised, to a depth of up to 20 m below the mesa top. The tributary drainage contains a narrow strip of young (historic in age) alluvium consisting of gravelly medium to coarse sand. Geologic maps of this area have been prepared by Griggs (1964), Goff, (1995), and Rogers (1995).

LA 86534 (Pueblo roomblock)

Site Geomorphology and Stratigraphy

LA 86534 is an ancestral Puebloan roomblock on the mesa top that dates to the early Coalition period, ca. 1150-1250 AD. The site is underlain by a thin (15 to 20 cm thick) Pleistocene Bt horizon inferred to be 100-200 ka or older, based on correlation with soils described by McFadden et al. (1996). The Bt horizon is a reddened (5YR) silty to sandy clay that is a potential clay source. Roomblocks were apparently built on top of the Bt horizon. In close proximity to the roomblock, the Bt horizon is overlain by Bw horizons formed in colluvium derived in part from the roomblock. Outside of the rubble mound surrounding the roomblock, the Bt horizon is overlain by a 20-25 cm eolian deposit that apparently post-dates the Puebloan occupation. The Bt horizon appears to be the lower part of an originally thicker Pleistocene soil that has been partially stripped by erosion. The presence of only a thin Pleistocene soil underlying young eolian deposits in the vicinity of LA 86534 suggests that erosional processes predominated in this area prior to the Coalition period.

Near (approximately 3 m northeast of) the roomblock, two episodes of mixed colluvial and eolian deposition are recorded in soil profile LA 86534b (Table 1). An AC horizon 5 cm thick, inferred to be less than 200 yrs old, overlies a 27 cm thick buried soil (Bw1b1-Bw2b1) formed in sediments derived in part from erosion of the roomblock. The Bw1b1-Bw2b1 soil is therefore

less than 750 to 850 years old. The Bw2b1 horizon overlies the Pleistocene Bt horizon. The Bw2-Bw1 horizon sequence is developed in a colluvial deposit derived from erosion of the roomblock, with fines representing likely eolian deposition. The greater abundance of tuff clasts (60-70% gravel) in the lower (Bw2b1) horizon is indicative of sediment derived primarily from the roomblock, whereas a decrease in gravel content to 10% in the Bw1b2 horizon suggests eolian deposition in the rough surface created by wall remnants and the rubble mound surrounding the ruin.

West and north of the buried roomblock, scattered tuff blocks were observed on the surface. These tuff blocks were originally thought to represent the location of a structure. However, the tuff blocks occur within or on top of an A horizon that overlies fine grained deposit dominated by silt and very fine sand with little soil development (Bw horizon, location LA 86534a, approximately 8 m west and 3 m north of the roomblock). This deposit, extending to a depth of 25 cm, apparently post-dates Puebloan occupation here. The presence of tuff blocks overlying a fine-grained, postoccupational soil lacking colluvium derived from the roomblock indicates that the surficial tuff blocks are not in place. These blocks may have been moved during highway construction. Beneath the postoccupational deposit is the reddish, clay-rich Pleistocene Bt soil horizon that directly overlies tuff bedrock. The contact between the two soil horizons is abrupt and probably records stripping of part of the older soil followed by fairly recent burial of the horizon by eolian sediments.

The mesa top soil described outside of the roomblock rubble mound (LA 86534c) comprises a non-gravelly AC horizon overlying an eroded Bt horizon (Table 1). The AC horizon consists of well-sorted fine sand and extends to a depth of 21 cm. This horizon likely represents eolian deposition, possibly mixed with fine-grained colluvium. Based on the relative absence of soil structure, the AC horizon is inferred to post-date site occupation. The 21-cm thick AC horizon and eolian deposit at LA 86534c is roughly correlative to the 25-cm thick A-Bw profile and eolian deposit at LA 86534a.

The age of the recent eolian deposit in the vicinity of LA 86534 is not well constrained. However, data from LA 12587 near White Rock (discussed below) indicate some, possibly significant eolian deposition during Coalition Period time. If both sites experienced the same eolian depositional event, it is likely to have occurred soon after abandonment of the LA 86534 roomblock, or during the late Coalition Period (1250 to 1325 AD).

Tract Summary

Site LA 86534 is an ancestral Puebloan roomblock located on a Bandelier Tuff mesa top that is buried by colluvium, derived in part from erosion of the roomblock, and eolian sediment. The majority of the site is in good archaeological context, with the exception of scattered tuff blocks located west and north of the buried roomblock that represent surface disturbance that may have occurred during highway construction. The roomblock was built on an eroded Pleistocene soil, or directly on Bandelier Tuff. This suggests that erosional processes predominated in this area prior to the Coalition period. Eolian deposition occurred after site occupation, possibly during the late Coalition period.

WHITE ROCK TRACT

Surficial Geologic Units

The White Rock land transfer parcel is within the Cañada del Buey watershed and includes part of the active stream channel and adjacent floodplains, colluvial slopes, and alluvial fans (Figure 3). Bedrock beneath most of the parcel is basalt of the Cerros del Rio volcanic field (unit Tb). The Tshirege Member of the Bandelier Tuff (unit Qbt), which overlies the Cerros del Rio basalt, is also present along the northern margin of the parcel and as an isolated mesa in the western part of the parcel. Large parts of the parcel are covered by locally derived colluvial, alluvial fan, or slopewash deposits of a variety of ages. Geologic maps of this area have been prepared by Griggs (1964), Rogers (1995), and Dethier (1997). A detailed geomorphic map of the part of the parcel along the Cañada del Buey stream channel was previously prepared by Drakos et al. (2000). In this investigation, a surficial geologic map at a scale of 1:1200 was prepared of the White Rock land transfer parcel, focused on units with potential archaeological significance (Figure 3).

Unit Qal consists of young alluvium in the main stream channel of Cañada del Buey and tributary drainages, and adjoining floodplains and stream terraces. Sediment ranges in size from silt to coarse sand and gravel, and is dominated by coarse sand in the main channels and very fine sand on the floodplains (Drakos et al., 2000). The upper sediment layers along the main channel and floodplains (approximately 0.5 to 2.0 m thick) are largely historic in age, although older sediment may be locally present at depth. Higher stream terraces along Cañada del Buey are generally above the level of historic flooding, and are inferred to be late Holocene to Pleistocene in age. The stream terraces are in part overlain by colluvium (unit Qc). These areas could have potentially been used for agriculture.

Unit Qf consists of young alluvial fans that emanate from side drainages, typically below eroding areas of colluvium. Qf is dominated by stratified fine to very fine sand, and also includes coarse sand and fine gravel layers. The upper parts of these deposits are historic in age, and older deposits are commonly present at depth. Greater than 1 m of late Holocene sediment can be present in Qf units. There is potential for burial of archaeological sites in these areas. A buried Pleistocene soil was observed at a depth greater than 1 m in one Qf soil profile. Soil descriptions of sites in Qf are presented in Table 3 (locations 4a, 4b, 19, 20)

Unit Qc is dominated by relatively fine-grained (fine to very fine sand) slopewash colluvium deposited by overland flow, and also includes rocky colluvium on hillslopes below mesas. Qc likely includes alluvial fan surfaces and underlying deposits, and eolian deposits and/or locally reworked eolian sediment. Qc includes deposits with a wide range in age, and typically has buried soils that indicate pauses in deposition, in part accompanied by local erosion. Several soil profiles suggest at least two episodes of colluvial deposition since mid Holocene time, with a lower colluvial layer likely deposited around 2 to 4 ka, and an upper colluvial layer that was likely deposited within the past 1000 years, possibly during post-Puebloan time (locations 3a, 6, 18, 3b, 3c, 19; Tables 2 and 3). Upper layers in many areas are probably late Holocene in age. In many locations, the upper colluvial layer overlies middle to early Holocene and latest Pleistocene deposits that could potentially contain buried archaeological sites, although no buried sites were

observed in gullies that cross many parts of this unit. In other areas Qc is older than 50-60 ka. Because of the spatial complexity in the depositional history of Qc, as indicated by soil descriptions (Tables 2 and 3), it was not practical to subdivide Qc into units of different ages on the map.

Sediment in unit Qc with estimated ages younger than ca. 4 ka ranges in thickness from 6 cm to >1 m at sites with soil descriptions. The thickest deposit was recorded in the eastern parcel, where greater than 1.1 m of late Holocene colluvium is present at location 22, within site LA-12765. Farther west, 70-80 cm of colluvium younger than ca. 4 ka is present on the south side of an isolated mesa of Bandelier Tuff (locations 17 and 18). The total thickness of Holocene or possibly latest Pleistocene sediment (< ~10-15 ka) reaches about 1.7 m in a gullied area in the northwestern part of the parcel (location 3a).

At one location in the south-central parcel (location 15), a piece of fossilized bone was found at a depth of about 20-30 cm eroding out of a gully wall stratigraphically below the ca. 50-60 ka El Cajete pumice. This bone was collected by Gary Morgan, New Mexico Museum of Natural History, who identified it as part of a humerus of an extinct species of bison, *Bison antiquus* (Figure 4, catalogue number NMMNH 37623, locality number L-5214). Notably, this is apparently the first recorded Pleistocene fossil from Los Alamos County, and is also one of very few bison records in New Mexico with dates older than about 20 ka (G. Morgan, per. comm.).

Unit Qc includes areas that presently experience dispersed overland flow and either local erosion or deposition. Qc also includes gullied areas where significant erosion presently occurs. Agricultural potential probably varies significantly within Qc. The areas with the highest probability of agricultural use are inferred to be at locations with relatively thick loose soils situated below long slopes and/or below mesa tops. These sites therefore receive overland flow from nearby highlands (e.g., locations 17 and 18, Tables 2 and 3) and are likely areas of active deposition and cumulic soil profiles. Location 17 has approximately 0.7 m of late Holocene (younger than 1-2 ka?) sediment overlying a Pleistocene soil. Areas with older, more consolidated soils present at shallow depths are inferred to have a lower probability of agricultural use. A grid garden is present at one location near the boundary between Qc and Tb (LA-128803), and several roomblocks are located on Qc (LA 86636, LA 86637, LA-127631, LA-128155, and LA-128805)

Unit Qec is the ca. 50-60 ka El Cajete pumice. It is present in a relatively thick (≥ 50 cm) layer within Qc on the north side of the isolated Bandelier Tuff mesa in the western parcel (locations 1 and 1a, Table 3), and thin remnants were observed within Qc farther east (site 15b, Table 2). This unit may have a high agricultural potential associated with well-drained soils.

Unit Qbt is the Tshirege Member of the Bandelier Tuff. There are no soils or only thin soils present in much of this unit, particularly along the edges of mesas, and consequently there is a high potential for erosion of cultural material in such locations. Thin, discontinuous, fine-grained deposits dominated by very fine sand occur on the isolated mesa top in the western parcel (locations 21 and 21a, Tables 2 and 3), and represent either eolian or locally reworked eolian sediment. These deposits are in part late Holocene in age (likely less than 1 ka) based on the

degree of soil development. The largest set of roomblocks in the parcel is located on this unit (LA-12587).

Unit Tb is basalt of the Cerros del Rio volcanic field. There are no soils or only thin soils present throughout the area of exposure of this unit, and consequently there is a high potential for erosion of cultural material in such locations. In other areas discontinuous colluvial or eolian sediments overlie unit Tb. Bedrock metates or grinding slicks were observed at one location in this unit along Cañada del Buey.

LA-12587 (Pueblo roomblock and Archaic lithic scatter)

Site Geomorphology and Stratigraphy

LA-12587 is a multicomponent ancestral Puebloan roomblock site situated on a small isolated Bandelier Tuff mesa, and a separate lithic scatter located south of the roomblocks. Component 1 includes Roomblock 1, which is built either directly on Bandelier Tuff, or on remnants of Pleistocene soils preserved in depressions in the undulating tuff surface. Component 2 consists of a second, younger roomblock (Roomblock 3) located west of Roomblock 1. Some sections of Roomblock 3 are built on colluvium derived from the Roomblock 1. In other areas, Roomblock 3 is built either directly on Bandelier Tuff or on remnants of Pleistocene soils. The rock alignments overlie aligned shaped blocks that may represent Roomblock 3. Component 3, the most recent, includes a field house constructed on top of the Roomblock 1 rubble (Roomblock 2) (Figure 5), and rock alignments north of the roomblocks that may represent agricultural features.

The discontinuous Pleistocene soil underlying LA-12587 consists of an eroded Btk horizon (Bt horizon with Stage I carbonate) (Table 4). Pleistocene soil thickness in the site vicinity ranges from 0 to 16 cm. The remnant Pleistocene soil is inferred to be 100-200 ka or older, based on correlation with soils described by McFadden et al. (1996). Because the White Rock pueblo site is lower in elevation than the Airport site (LA 86534), the Pleistocene soil at LA-12587 exhibits Stage I carbonate morphology (Btk horizon) whereas the Pleistocene soil at the Airport site lacks secondary carbonate accumulation. The Pleistocene soil at LA-12587 is a polygenetic soil in which the Bt horizon formed during the Pleistocene, and the Stage I carbonate formed later, probably during the Holocene (carbonate stage based on nomenclature from Gile et al. (1966)). Evidence for the polygenetic nature of Pleistocene soils in the White Rock tract is shown by several profiles where peds in Btk horizons exhibit translocated clay in ped interiors but are coated with carbonate (e.g., Table 2, profiles 3a, 6, 9, 15b, and 18).

In the vicinity of the roomblocks, the Bt horizon is overlain by Bw horizons formed in eolian or reworked eolian sediment plus colluvium derived in part from the roomblock. In areas where roomblocks are located in close proximity to one another, the component 2 walls are built on top of a lower Bwk or Bw horizon (typically a Bw2), that is overlain by a Bwk1 or Bw1 horizon (e.g., Table 2, profiles 12587-10, 12587-11 and 12587-12). Upper Bw horizons are overlain by A horizons also formed in eolian or reworked eolian sediment plus colluvium derived in part from the roomblock. Total thickness of postoccupational soils in the vicinity of the roomblocks ranges from 10 to 54 cm. Greater sediment thickness corresponds in general to the roomblock locations, except for a mound of relatively thick sediment located immediately east and north of

Roomblock 1 (Figure 6). Outside of the colluvial mound surrounding the roomblocks, postoccupational soil thickness ranges from 0 cm on stripped bedrock surfaces east, north, and west of the roomblocks (Figure 6), to 17 cm at Location 21A (Table 2). The 17-cm A-Bw profile at Location 21 overlies a stripped Btk horizon and likely represents eolian deposition that occurred both during the late Coalition Period, and that post-dates the Puebloan occupation (see below).

Component 1 (Roomblock 1 and Sheet Trash Deposits)

Roomblock 1 is an ancestral Puebloan roomblock built either directly on Bandelier Tuff or on the remnant stripped Pleistocene soil (Figure 7 – example from Roomblock 3). Eolian or reworked eolian sediment is interpreted to largely comprise the upper soil that partially buries blocks of tuff derived from wall collapses. The upper soil also includes clasts of tuff derived from the roomblocks and a variety of ceramic and lithic artifacts, and is inferred to also contain the dissolved remnants of mortar and roofing material. The different soil components are well mixed, which indicates extensive bioturbation of the postoccupational soil by burrowing and other processes. Roomblock 1 is typically buried by 30 to 40 cm of young material that overlies the former floor, the underlying Btk horizon, or Bandelier Tuff. The upper soil layers that post-date occupation are anomalous in that Bw or Bwk horizons typically strongly effervesce, indicating the presence of $CaCO_3$, (soil description 12587-7, 8, 9, and 10, Table 4) whereas other young soils nearby do not effervesce (Table 1, Location 21A). The reason for this is not certain. One hypothesis is that $CaCO_3$ was present in the mortar used in wall construction, and that this material is weathered out of the mortar and concentrated in the post-occupation soil. A soil profile with postoccupational A-Bw horizons described in sheet trash deposits approximately 17 m east of Roomblock 1 also strongly effervesce, indicating that sediments derived from the roomblock contain significant $CaCO_3$ (Table 4, description 12587-9). A postoccupational soil isopach map of the site shows that sediments derived from the roomblock have been reworked east and north of the ruin, forming a colluvial apron at least 30 cm thick extending approximately 21 m east and 16 m north of the center of the roomblock (Figure 6).

Component 2 (Roomblock 3)

Roomblock 3 is an ancestral Puebloan roomblock that, based on stratigraphic relationships, is younger than Roomblock 1. In some areas, wall blocks are set on top of a lower (Bw2 or Bwk2) horizon that contains rubble and artifacts inferred to be derived from Roomblock 1 (e.g. profiles 12587-10, 11, and 12). In other areas, Roomblock 3 walls are built either directly on Bandelier Tuff or on the remnant stripped Pleistocene soil (Figures 7 and 8). Roomblock 3 is typically buried by 20 to 30 cm of young soil that overlies the former floor, underlying soil horizons, or Bandelier Tuff. Post-occupation soils in Roomblock 3 also contain $CaCO_3$. The isopach map shows a much smaller colluvial apron emanating from Roomblock 3 (the 30 cm thick deposit extends approximately 4 m east of roomblock 3) than is associated with Roomblock 1 (Figure 6), suggesting that Roomblock 3 walls were not built as high as were the walls forming Roomblock 1. These data support the hypothesis that Roomblock 3 was not completed.

Component 3 (Roomblock 2 and Possible Agricultural Rock Alignments)

Roomblock 2 is a field house constructed on top of Roomblock 1. Soils were not described inside of Roomblock 2. A series of five soil descriptions were completed in the vicinity of the rock alignments (Figure 5). The rock alignments were constructed on top of a postoccupational Bw horizon 16 to 23 cm thick, and lie within or are partly buried by an A or AC horizon 9 to 15 cm thick (Figures 9 and 10). Shaped blocks, inferred to be part of the Roomblock 3 construction, occur within the Bw horizon and below the rock alignments (Figure 9).

Two profiles (12587-1 and 12587-5) were described outside and three profiles (12587-2, 12587-3, and 12587-4) were described inside the rock alignments. No textural differences were observed between profiles described inside versus outside the rock alignments. Soils described inside the rock alignments have a greater thickness (average 30 cm-versus-average 22 cm) than do the soils described immediately outside the rock alignments, due to generally thicker A horizons inside the rock alignments than outside the alignments (Table 4). This is observed most clearly in comparing profiles 12587-2 and 12587-1, where the A or AC horizon thins from 15 cm inside to 8 cm outside the northern rock alignment (Figure 9; Table 4). These observations indicate that the rock alignments are either acting to preferentially trap eolian or slopewash sediment, or that dirt was placed inside the alignments. The placement of dirt inside the rock alignments is suggested by the greater A horizon thickness and the absence of textural differences inside-versus-outside the rock alignments, and by the orientation of the alignments oblique to a slope with a relatively shallow gradient.

The presence of a 16 to 23-cm thick Bw horizon formed in sediment composed predominantly of eolian or reworked eolian sediment underlying the agricultural (?) rock alignments is evidence for significant eolian deposition during the Coalition (likely late Coalition) Period. Roomblock 1 was built on a stripped bedrock surface with remnant Pleistocene soils; therefore, deposition of the sediment underlying the possible agricultural rock alignments occurred subsequent to construction of Roomblock 1. Whereas eroding roomblocks provided a source for coarse colluvium, the predominantly fine-grained nature of upper Bw horizons indicates an eolian source for most of the sediment burying Component 2 features. Additional, thinner (9 to 15 cm) sediment partially buries the rock alignments, indicating smaller inputs of eolian sediment or reworked eolian sediment following the Component 3 occupation. This sediment deposition could date to the latest Coalition period, the Classic period, or the historic period.

Lithic Scatter

LA-12587 also includes an Archaic lithic scatter on the south part of the mesa. This material occurs in an area of thin soils over tuff bedrock that appears to have experienced significant erosion, and the lithic scatter may in part represent a lag left following erosion of an unknown thickness of mesa-top soils. Excavation into relatively thick pockets of soil (up to 28 cm thick) inside the main artifact scatter revealed the presence of both ceramics and obsidian flakes to the base of a weakly developed soil (Table 4, profile 12587-13). An excavation completed outside the main artifact scatter revealed a young colluvial deposit of similar thickness (20 cm) and a weakly developed soil (Table 4, profile 12587-14). Soils in the vicinity of the lithic scatter lack the Bw horizons typically observed in older postoccupational soils, and instead exhibit A-BC or

A-C horizons. This weak soil development is consistent with a postoccupational, possibly less than 500-year age for the colluvium. This observation is consistent with the interpretation that this is an actively eroding surface with minimal potential for preserving an intact archaeological record.

LA 86637 (field house and lithic/ceramic scatter)

LA 86637 includes a field house with large tuff blocks on a deeply eroded colluvial slope. The field house is situated on a pedestal > 0.5 m high between channels incised into the colluvial slope. The site also includes a lithic and ceramic scatter, which is inferred to represent reworked material transported down the colluvial slope. Because of the extensive erosion in this area, there is considered to be minimal potential for the preservation of an intact archaeological record.

Soils were described in two test pits at the site. Soil profile 86637-1 has an AC-Bw1b1-Bw2b1-Btkb2 horizon sequence interpreted to represent very young colluvium from 0 to 6 cm, overlying post-coalition period colluvium that was observed to a depth of 43 cm (Table 4). The young colluvium overlies a Pleistocene colluvial soil. Artifacts (lithics and ceramics) scattered throughout the AC, Bw1b1, and Bw2b1 horizons are interpreted to be part of the young colluvial package, and therefore are not in archaeological context.

Soil profile 86637-2 has an AC-Bwk1b1-Bwk2b1-Bkb2 horizon sequence interpreted to represent deposition of young colluvium from 0 to 10 cm, overlying 2 to 4 ka colluvium with Stage I- carbonate from 10 to 46 cm (Table 4). The age estimate for the Bwk horizons with Stage I- carbonate is based on comparison with the Fence Canyon borrow pit description (Table 2), which exhibits a Stage I carbonate with a surface age of approximately 4 ka and an 8 ka age at depth (Reneau and McDonald, 1996). The Holocene colluvium overlies a Pleistocene colluvial soil. Ceramics and lithics observed in the upper 10 cm are part of the young colluvial package, and are not in archaeological context. Lithics only were observed in the Bwk1b1 horizon, and are interpreted to be part of an older (mid-to-late Holocene) colluvial package. The lithics in the Bwk1b1 horizon were apparently reworked from an archaic site upslope, and are therefore likely not in archaeological context at this location.

LA-127625 (lithic/ceramic scatter)

LA-12765 includes scattered potsherds and lithic fragments in an area of thick late Holocene colluvium with little soil development (Table 3, Location 22; Figure 3). The colluvium here may post-date ancestral Puebloan occupation of this area, and the cultural material was likely transported to the site in runoff from nearby slopes. The cultural material is therefore likely not in archaeological context at this location.

LA-127631 (field house)

LA-127631 is a field house at the base of a low gradient colluvial hillslope, with an area of fan deposition to the southwest. Excavations at the site show the hillslope is mantled by a thin (<25 cm) layer of young colluvium overlying a Pleistocene soil (Table 4, description 127631-1). Colluvium is fine to very fine sand, and may be composed primarily of reworked eolian

sediment. The field house is buried by 10 to 19 cm of colluvium, with blocks set within a Bw horizon, at the boundary between a Bw1 and Bw2 horizon (Table 4, description 127631-2). The site stratigraphy is consistent with the field house construction corresponding to the time of construction of Component 2 (Roomblock 3) at LA-12587. Scattered lithics and potsherds occur on the surface in this area, and may largely represent a lag or may consist of material transported by surface runoff.

LA-128803 (grid gardens)

LA-128803 consists of a grid garden in an area of discontinuous thin colluvial soils over basalt bedrock. There is a long colluvial slope west of LA-128803 that provides surface runoff to the site. The grid gardens may be partially buried by slopewash colluvium. East of here the soils thin and the slope steepens above an incised channel of Cañada del Buey.

Four soil profiles were described upslope, within, and downslope of the rock alignments forming the grid garden (Figure 11). Soils were moist when described, and therefore weakly developed soil structure, if present, was difficult to discern. However, two trends are apparent in the soils described in the immediate vicinity of the grid garden. One trend is that the thickness of postoccupational soil is greater upslope and within the grid garden, ranging from 16 to 21 cm (Table 4, descriptions 128803-1, 128803-2, and 128803-3), than was observed downslope of the grid garden, where the postoccupational soil thickness was 10 cm (Table 4, description 128803-4). A second trend is that upper-horizon postoccupational soils are finer-grained (a silt loam) within and immediately down-slope of the grid garden (Table 4, descriptions 128803-2, 128803-3, and 128803-4), than was observed upslope of the grid garden (a sandy loam; Table 4, description 128803-1). Both trends are consistent with the rock alignments acting to retain surface runoff and fine-grained slopewash, and are consistent with the rock alignments functioning as a grid garden.

An additional observation was the absence of remnant Pleistocene soils in relatively deep pockets in the basalt within the rock alignments (Table 4, descriptions 128803-2, and 128803-3), although such soils were present outside the rock alignments (Table 4, description 128803-4, and in a test pit south of the alignments). This observation suggest that the area inside the alignments may have been prepared by first excavating the relatively dense, clay-rich Pleistocene soils, and replacing this material with looser soil.

Soils at LA-128803 are very weakly developed, and apparently lack development of Bw horizons observed in Coalition Period soils. It is therefore inferred that LA-128803 is likely a Classic Period feature.

LA-128804 (check dam)

LA-128804 is an apparent check dam, 6 m long, consisting of tuff clasts up to 60 cm long aligned across a shallow drainage on a colluvial slope. The dam has been partially breached by an incised channel, and some of the tuff has been transported downslope. Additional tuff blocks are scattered downgradient along this same channel to the east, and may represent the eroded remnants of similar structures.

Profile 128804-1 was described at Test Pit #1, and shows that the check dam was constructed on top of young stratified alluvium, possibly less than 100 years old, deposited in an aggrading stream channel (Table 4). Deposition of approximately 16 cm of young alluvium has occurred at Test Pit #1 and behind the west part of the dam, with minimal deposition apparent elsewhere. Soils and geomorphic data indicate that the LA-128804 is a recent structure, postoccupational in age, likely less than 100 years old.

LA-128805 (field house)

LA-128805 includes a Late Classic period field house on a broad colluvial slope that displays abundant evidence for active erosion. The field house is at the upslope end of eroding channels that extend to the east, with about 0.5 m of recent erosion estimated on the southeast side. Eroded channels also wrap around the northwest side of the structure. The tuff blocks in the field house appear to be acting as a local armor, protecting the area occupied by the field house from erosion while surrounding slopes are stripped. There is potential for some deposition of slopewash colluvium on the upslope (west) side of the field house, whereas other adjacent areas are experiencing erosion.

An examination of soils in a test pit located 1 m southeast of the southeast corner of the structure suggests that LA-128805 was constructed on an aggrading colluvial slope that experienced post-occupation deposition prior to the recent erosion that has occurred at the site. A thin (10-cm thick) A horizon is inferred to post-date occupation of the site (i.e., less than 500 yrs old). The A horizon overlies a buried (Bwb1) horizon, with soil structure development similar to that observed for older post-Coalition period soils, and is inferred to be 500 to 800 years old (Table 4, description 128805-1; Figure 12). The Bwb1 horizon overlies a buried Pleistocene soil formed in colluvium. The sequence of buried soils at this site suggests rapid deposition of colluvium, possibly during the Coalition period, with continued aggradation after abandonment of this Late Classic period field house, followed by recent erosion.

Tract Summary

Sites investigated within the White Rock Tract include a multicomponent ancestral Puebloan roomblock site situated on a small isolated Bandelier Tuff mesa (LA 12587). After abandonment, the roomblocks acted as effective traps of eolian sediment. Eolian deposition started after component 1 and prior to component 2, possibly during late Coalition time, and likely occurred in lesser amount subsequent to the late Coalition period. A colluvial apron at least 30 cm thick derived from eroded roomblocks, artifacts, and reworked eolian fine sand extends approximately 21 m east and 16 m north from the center of roomblock 1. A similar colluvial apron extends only 4 m east of roomblock 3, providing supporting evidence that roomblock 3 was not completed.

Soil-stratigraphic data provides evidence for several episodes of colluvial deposition during the Holocene in some areas of the White Rock Parcel, whereas other colluvial slopes have experienced recent erosion. As a result of active transport and deposition on colluvial slopes, artifact scatters on unit Qc are typically part of the colluvial deposit (e.g. LA 127625, LA 86637

lithic scatter, and LA 12587 Archaic lithic scatter), and are not in archaeological context. LA 128805, LA 127631, and LA 86637 field houses, and LA 128803 grid gardens are also located on colluvial slopes. Soil and stratigraphic context indicates that LA 127631 construction corresponds approximately to the time of construction of Roomblock 3 at LA 12587. Sites LA 128805 and LA 86637 are field houses situated on eroded hillslopes that do not preserve a geomorphic record that would allow correlation with other sites in the area. Soil-stratigraphic relationships observed at LA 128803 indicate that the rock alignments there are acting to retain surface runoff and fine-grained slopewash, and are consistent with the rock alignments functioning as a grid garden. Soils at LA 128803 are very weakly developed, and are consistent with interpretation of LA-128803 as a Classic period feature. The check dam at LA 128804 is likely less than 100 years old.

Many of the soil profiles examined throughout the White Rock Parcel suggest at least two episodes of colluvial deposition since mid Holocene time, with a lower colluvial layer likely deposited around 2 to 4 ka, and an upper colluvial layer that was likely deposited within the past 1000 years, possibly during post-Puebloan time (locations 3a, 6, 18, 3b, 3c, 19; Tables 2 and 3). Similar episodes of colluvial deposition were observed at the LA 86637 artifact scatter, where colluvium with reworked Puebloan artifacts overlies Archaic-age colluvium. This is similar to the two episodes of Holocene colluvial deposition observed at the White Rock Y (see below).

At one location in the south-central parcel (location 15), a piece of fossilized bone of *Bison antiquus* was found at a depth of about 20-30 cm eroding out of a gully wall stratigraphically below the ca. 50-60 ka El Cajete pumice. Notably, this is apparently the first recorded Pleistocene fossil from Los Alamos County, and is also one of very few bison records in New Mexico with dates older than about 20 ka. Descriptions completed in the vicinity of the *Bison antiquus* location and at several other sites (see Tables 2 and 3) show a complex record of Pleistocene colluvial deposition throughout the White Rock Parcel.

OTOWI GRID GARDENS

The Otowi Grid Gardens are located near LA 21596, described below in the TA-74 South Tract section. A description from the Otowi Grid Gardens is included here for completeness.

LA 21592 (grid gardens)

LA-21592 consists of grid gardens on a colluvial slope above the bottom of Bayo Canyon, on the north side of the channel and northwest of the Otowi ruins. The grid gardens are outlined by rock alignments made of locally derived clasts. The upper 8 cm of sediment inside the grid garden has a silt loam texture and exhibits an absence of soil development, indicating a young eolian and/or slopewash layer. The underlying Cbwb1 horizon, 8-20 cm deep, is sandier and contains clasts and ceramics, and likely represents soil that was present during use of the grid garden. Alternatively, the Cbwb1 horizon could represent a post-occupational deposit, although this interpretation is considered to be less likely.

TA-74 SOUTH TRACT

Surficial Geologic Units

The TA-74 South land transfer parcel is located in a relatively broad part of lower Pueblo Canyon. A generalized geologic map of the western and central part of the parcel is shown in Figure 13. Surficial geologic units within the parcel include the active stream channel and adjacent floodplains of Pueblo Canyon (unit Qal), higher stream terraces of Holocene and Pleistocene age (unit Qt), and areas of colluvium and alluvial fans on the side slopes and along tributary drainages (unit Qc). Bedrock units within the parcel include Pliocene fanglomerates of the Puye Formation (unit Tpf), and non-welded tuff and pumice beds of the Otowi Member of the Bandelier Tuff (unit Qbo). The latter includes the Guaje pumice bed (unit Qbog). The Tshirege Member of the Bandelier Tuff (unit Qbt) is exposed along the margins of the canyon but is not exposed within the parcel, although erosion of this unit is a major source for colluvium within the parcel. Geologic maps of this area have been prepared by Griggs (1964) and Rogers (1995), and detailed geomorphic maps of parts of the canyon bottom are presented in Reneau et al. (1998) and Tardiff et al. (2002). Except for a strip of young sediment along the main stream channel, the surficial geologic units in the parcel have not been studied in detail, although their characteristics and history are probably similar to units in other parts of the Pajarito Plateau such as the White Rock and Rendija Canyon parcels.

LA 86532 (historic structure)

The authors did not visit this site.

LA 21596 (grid gardens)

LA-21596 consists of grid gardens at the base of a colluvial slope adjoining floodplains or fluvial terraces in the bottom of Pueblo Canyon, below the Otowi ruins. The grid gardens are outlined by rock alignments made of locally derived clasts. Excavations through the grid gardens indicate that ceramics and lithics are present to depths of at least 50 cm, and that relatively little sediment has been deposited since construction of the rock alignments. Artifacts are abundant from 0 to 30 cm; artifacts are present but less abundant from 30 to 50 cm. Rocks forming the grid gardens are set on the Bw1 horizons in profiles 21596-1, 21596-2, and 21596-3, and are buried by only 4 to 6 cm of sediment (Table 5). These observations suggest that the grid gardens were created during a relatively late stage of occupation of Otowi Pueblo, and that a significant amount of colluvial deposition occurred at this location concurrent with Puebloan occupation. Profile 21596-4, described on the colluvial slope outside the grid garden, indicates that the thickness of young colluvium is greater than 34 cm. It is possible that human traffic or other disturbances on the steep slope between the grid gardens and the Otowi ruins accelerated the rate of colluvial transport and deposition at this location.

LA 86528 (possible rock shelter)

LA 86528 consists of a possible rock shelter site situated next to and under a large boulder on a north-facing colluvial slope, downslope from the base of a Bandelier Tuff cliff (Figure 13). The site is on the upslope side of the boulder, and extends from the colluvial slope to beneath the overhanging lip of the boulder. Three soil profiles were described within, near the edge of, and outside the overhang. Profiles 86528-1 and 86528-3 each have a thin (3 to 5 cm) AC or C horizon formed in young (less than 500 year old, possibly less than 100 year old) colluvium that buries older soil horizons (Table 5). Profiles described next to and beneath the overhang exhibit late Holocene (possibly Puebloan-age) Bwb1 horizons 10 to 15 cm thick overlying Pleistocene colluvial soils. Profile 86528-2, described on the colluvial slope outside the overhang, exhibits only young (less than 500 years old) thin (10 cm thick) colluvium overlying Pleistocene soil. Profile 86528-1, in shovel test pit #1, at the edge of the overhang, included a charcoal stain at the base of the AC horizon and a Bwb1 horizon formed in late Holocene colluvium (Table 5). The abrupt, irregular boundary between the Bwb1 and underlying Pleistocene Btb2 horizon can be interpreted as due to either cultural or non-cultural processes. One explanation is that a pit or similar excavation was dug into the Pleistocene soil, during the time the overhang was used as a rock shelter. A differing explanation, consistent with the interpretation that the overhang was not used as a rock shelter, is that the irregular boundary between the Bwb1 and underlying Bwb2 horizon was caused by erosion on the fairly steep slope projecting beneath the overhang, with an opening at the downslope end. In this scenario, subsequent partial plugging of the escape hole facilitated colluvial deposition, which was followed by a non-cultural fire.

The profiles described in the vicinity of LA 86528 are indicative of a stripped, Pleistocene colluvial hillslope overlain by thin (10 to 20 cm thick) late Holocene to historic age colluvium. Overall, the geomorphic evidence is ambiguous with respect to whether or not the overhang was used as a rock shelter. The charcoal stain at the base of the AC horizon may be of relatively recent origin, post dating the Puebloan occupation, in which case there may be very little evidence that the overhang was used as a rock shelter.

LA 86531 (lithic/ceramic scatter)

LA 86531 is a lithic and ceramic scatter situated on top of a Pleistocene fluvial fill terrace located approximately 30 m above the canyon floor. The deposit underlying the terrace comprises multiple fluvial sequences, with a coarsening upward deposit capped by imbricated boulders at the top of the deposit (Figure 14). Gravels include abundant Bandelier Tuff and Tschicoma dacite clasts. The gravel overlies fine-grained fluvial deposits and the Otowi Member of the Bandelier Tuff. The top of the terrace appears to be a stripped surface that is capped by thin (less than 20 cm thick) young soils overlying stripped Pleistocene soils or bedrock (Table 5, profiles 86531-1 and 86531-2). Based on the relatively well-developed stripped Bt horizon observed in profile 86531-1 and the height of the terrace above the canyon floor, the terrace is inferred to be mid Pleistocene in age.

Soil descriptions completed at LA 86531 are indicative of young (less than 100 years?) slopewash from 0 to 3 cm overlying a thin (7 to 11 cm thick) late Holocene/post Puebloan (?) deposit (Table 5). Charcoal (a fire stain) was observed in Test Pit #2 (profile 86531-2). Test Pit

#2 was therefore expanded northward into Test Pit #3, which revealed a Pleistocene compacted silt horizon, likely an eolian unit (profile 86531-2). The fire stain was inset into the Pleistocene soil, suggesting that the fire stain was a root burn, rather than a cultural feature.

The likely cultural horizon (the Ab1 horizon) observed in profiles 86531-1 and 86531-2 is thin. However, the presence of surficial artifact scatter on an eroded ridge top with thin soils indicates that the LA 86531 artifact scatter represents erosion of a site situated on the Pleistocene terrace. Artifacts may represent a surface lag, and may have only been transported a short distance. The presence of a carved boulder (zig zag patterns carved on the north side of a boulder) directly below the artifact scatter on the north side of the terrace shows the presence of other cultural elements at this location.

LA 110121 (lithic/ceramic scatter)

LA 110121 is a lithic and ceramic scatter situated on the eroding slope of a low ridge that is part of a dissected Guaje pumice landscape. The Guaje pumice bed is the base of the Otowi Member of the Bandelier Tuff, and overlies the Puye Formation. The thickness of post-Guaje sediment is minimal (11 cm) at this location (Table 5, profile 110121-1; Figure 15). The artifact scatter is apparently part of the thin colluvium overlying the Guaje pumice, and is therefore not in archaeological context.

LA 110126 (field house)

LA 110126 is a field house on a heavily eroded north-facing colluvial slope. Due to the extensive erosion, there is minimal potential for a preserved archaeological record outside of the structure. Excavation inside the field house revealed 29 cm of post-Puebloan soil that probably constitutes eolian sediment and/or colluvial sediment mixed with tuff clasts derived from wall collapse (Table 5, profile 110126-1). An older (Pleistocene) buried Bt soil horizon is present beneath the structure.

LA 110130 (possible field house)

LA 110130 includes rock alignments, sherds, and minor lithics, situated on the north edge of an eroded, gently east-sloping fluvial terrace above the Pueblo Canyon floodplain (Figure 13). Excavation through the rock alignments revealed 17 cm of sediment overlying a buried Bt horizon interpreted to represent a stripped or eroded late (?) Pleistocene soil (Table 5, profile 110130-1). The rock alignments include large (approximately 10 to 30 cm diameter) rocks set into or on top of the Btb1 horizon (Figure 16). The rock alignments are not clearly walls, but may represent the foundation of a structure. Alternatively, the rock alignments may represent a grid garden. Some smaller rocks were observed within the Bw horizon, but the smaller rocks do not appear to be part of the wall (?) alignments.

Classic period sherds were observed in the post-Pleistocene soil horizons, and were present in greatest abundance in the Bw horizon. The A and Bw horizons likely represent slopewash colluvium that includes reworked older soil in the Bw horizon and has partially buried the rock alignments. The artifacts observed within the A and Bw horizons are likely part of the

slopewash colluvium although their presence does suggest an association with the alignments, and a Classic age for the site. The artifacts may represent locally bioturbated material that is in reasonable archaeological context.

LA 110132 (possible field house)

LA 110132 consists of a possible rock alignment and surficial artifact scatter in thin, bouldery colluvium overlying the Guaje pumice bed. The colluvium includes reworked terrace gravels with boulders. An examination of the possible rock alignment indicated that it is probably a natural occurrence of large cobbles that are reworked terrace gravels that are part of the colluvium, and not of cultural origin.

LA 110133 (lithic/ceramic scatter)

LA 110133 consists of a light scatter of lithics and ceramics situated on a north-facing colluvial slope on the south side of Pueblo Canyon (Figure 13). LA 110133 is situated where colluvial slopes begin to steepen below the Bandelier Tuff cliffs that form the canyon walls. Two profiles were examined at LA 110133. In profile 110133-1 (Test Pit #1), artifacts were observed at depths of around 30 and 50 to 60 cm. In profile 110133-2 (Test Pit #2), sparse concentrations of artifacts were observed on the surface and from 0 to 10 cm. Both profiles exhibit AC horizons overlying BC or CB horizons exhibiting very weak soil development (Table 5). Profiles 110133-1 and 110133-2 exhibit 16 to 19 cm of very young (likely less than 100 years old) colluvium overlying post-Puebloan age colluvium to a depth of 70 cm or greater (Table 5). These profiles indicate that LA 110133 is located on a very active colluvial slope with greater than 70 cm of colluvial deposition in post-Puebloan time. The artifacts observed at this location appear to be part of the colluvium, and are not in archaeological context.

LA 117883 (archaic site)

LA 117883 is an archaic site comprising a lithic scatter on a colluvial slope that overlies a stream terrace or pair of terraces. Two profiles were described at LA 117883. Profile 117883-1 (Test Pit #1) was located on a terrace 20 m north of the Pueblo Canyon channel, and profile 117883-2 (Test Pit #2) was located approximately 32 m north of the Pueblo Canyon channel, and up slope from 117883-1. Both soil profiles exhibit an AC-C-Bwb1 or AC-C-BCb1 horizon sequence suggesting two colluvial depositional events, with older colluvium (less than 1000 to 2000 years) overlain by young colluvium (less than 500 years) (Table 5). The presence of artifacts through the entire thickness of the colluvial layer in profile 117883-1 suggests that the artifacts have been transported from upslope and are not in place. Thickness of colluvium overlying the terrace gravels thins downslope, from 101 cm at profile 117883-2 to 55 cm at profile 117883-1 (Table 5).

The buried soil developed in the buried terrace gravels at profile 17883-2 includes a Stage I carbonate suggesting a late Pleistocene to early Holocene age for the terrace. In contrast, the buried terrace gravels at profile 17883-1 lacks carbonate, soil structure, or other indicators of soil development. Soil characteristics of the horizons described in the terrace gravels at the two locations therefore suggest that the buried terrace at 117883-2 is late Pleistocene to early

Holocene in age, whereas the buried terrace at 117883-1 is late Holocene in age, based on comparison with the Qt8 soil described by McDonald et al. (1996). These data suggest that two terraces of different age are buried beneath the colluvium, with the profile 117883-1 terrace inset into the profile 117883-2 terrace.

Tract Summary

Many of the sites in TA-74 are located on active colluvial slopes. Recent (less than 650 years old), relatively thick (greater than 50 cm) colluvial deposits were observed at LA 21596, LA 110133, and LA 117883. Sites LA 110133 and LA 117883 are artifact scatters where the artifacts are part of the colluvium, and lack archaeological context. LA 21596 includes a series of grid gardens that were a relatively late stage feature relative to the occupation of Otowi Pueblo, built on top of Puebloan-age colluvium. Three sites, LA 110126 (field house), LA 86528 (possible rock shelter), and LA 110121 (lithic/ceramic scatter) are situated on eroded colluvial slopes. At LA 86528 and LA 110121, thin (10 to 11 cm thick) colluvial deposits overlie Pleistocene soil or the Guaje pumice bed. The LA 110121 artifact scatter is part of the colluvium, and lacks archaeological context. Based on the area geomorphology and soil-stratigraphic relationships, the overhanging boulder at LA 86528 may or may not be a cultural feature, but the charcoal stain in the upper (AC) soil horizon likely postdates the Puebloan occupation. LA 110130 (field house) and LA 86531 are located on the surface of somewhat dissected Pleistocene terraces. Both sites have artifacts present in the upper 20 cm that are part of slopewash colluvium or are a surface lag, but are likely to have been transported a relatively short distance from their original locations, and have the potential to provide reasonable archaeological data.

The colluvial record at the TA-74 sites is indicative of two, somewhat widespread, episodes of colluvial deposition during the past 1000 years. Many of the sites suggest one colluvial deposit has an age of less than 650 years, and a second colluvial deposit has an age of 100 years or less (Table 5). In this setting, colluvial processes have reworked many of the artifacts across low gradient colluvial slopes. Low fluvial terraces buried by young colluvium may have the best potential for preserving an intact archaeological record.

WHITE ROCK Y TRACT

Surficial Geologic Units

The eastern part of the White Rock Y parcel includes the channel of Los Alamos Canyon, incised into basalt bedrock (unit Tb), and an adjacent stream terrace that is overlain by colluvium derived from a higher, Pleistocene-age terrace (Figure 17). Terrace gravels exposed on the edge of the terrace below the elevation of the bottom of the test pits, have stage I $CaCO_3$ coatings on the undersides of clasts, suggesting an early to mid-Holocene deposit (Table 6; Figure 17). The inferred Holocene terrace is 3 to 4 m above the modern stream channel, and the Pleistocene terrace is 12 to 13 m above the modern channel.

LA 61034 (lithic/ceramic scatter)

LA-61034 consists of lithic and ceramic scatter on a colluvial slope that overlies a stream terrace. The presence of artifacts through the entire thickness of the colluvial layer suggests that the artifacts have been transported from upslope and are not in place. The horizon sequence, consisting of an A-Bw-Btj1(b1?)-Btj2(b1?)-IIBCb2 profile, is suggestive of Puebloan or post-Puebloan colluvium (the A-Bw horizons) overlying Archaic colluvium (the Btj1(b1?)-Btj2(b1?) horizons), burying Holocene terrace gravel (the IIBCb2 horizon). This interpretation is supported by the distribution of artifacts throughout the colluvial profile. Ceramics and lithics were found in excavation depths corresponding to the A and Bw horizons, whereas lithics only were found in excavation depths corresponding to the Btj1(b1?) and Btj2(b1?) horizons (Table 6). Total thickness of colluvium at LA-61034 is 40 cm.

LA 61035 (lithic/ceramic scatter)

LA-61035 consists of lithic and ceramic scatter on a colluvial slope that overlies a stream terrace. The presence of artifacts through the entire thickness of the colluvial layer suggests that the artifacts have been transported from upslope and are not in place. The presence of ceramics in the upper 30-40 cm indicates significant colluvial deposition since Puebloan occupation of this area. Total thickness of colluvium at LA-61035 exceeds 140 cm. The presence of an underlying section of colluvium with obsidian flakes but without ceramics suggests that colluvial deposition here began prior to Puebloan occupation, likely during Archaic time, and that the obsidian flakes were derived from erosion of an Archaic site upslope. The section of colluvium observed at LA-61035 has a greater thickness than the colluvial section at LA 61034. This is a result of their relative positions on the terrace; with LA-61035 located much closer to the back edge of the terrace than is LA-61034 (Figure 17).

Tract Summary

LA-61034 and LA-61035 are located on a Los Alamos Canyon stream terrace of probable Holocene age overlain by colluvium derived from an adjacent, higher Pleistocene terrace. Artifacts occur in colluvial deposits that overlie the terrace gravel, and are not in archaeological context, having been transported here from upslope. Two episodes of colluvial deposition are inferred, with a total thickness of colluvium ranging from 40 cm at LA-61034 to greater than 140 cm at LA-61035. The lower colluvial layer was likely deposited during Archaic time, and the upper colluvial layer was deposited during Puebloan time or later.

CONCLUSIONS

Archaeological sites discussed in this report are located in a variety of geomorphic settings, including colluvial slopes, mesa tops, and on fluvial terraces. An examination of sites located in these different settings indicates that mesa top sites have the best potential for preservation of an archaeological record, and that sites on colluvial slopes are typically not in archaeological context. Sites located on fluvial terraces have the potential to preserve the archaeological record, but whether or not sites are preserved in archaeological context is dependant on site specific

geomorphic processes that are dependant on factors such as the proximity of adjacent hillslopes and the slope of the terrace surface.

An examination of colluvial stratigraphy at sites throughout the study area indicates that there have been two episodes of relatively widespread colluvial deposition in the area since the mid Holocene. One episode of colluvial deposition occurred during Archaic time, likely around 2 to 4 ka, and a second period of colluvial deposition occurred within the past 1000 years, likely contemporaneous with and/or post-dating Puebloan occupation. Some sites also exhibit a very young colluvial layer, likely deposited within the past 100 years. Although a depositional record is recorded on many colluvial slopes, other slopes have experienced recent erosion. As a result of active transport and deposition on colluvial slopes, artifact scatters on colluvial slopes are typically part of the colluvial deposit, and are not in archaeological context.

Mesa top locations are characterized by Bandelier Tuff bedrock overlain by thin, discontinuous remnant Pleistocene soils and recent eolian or reworked eolian deposits. Prior to the Coalition period, mesa top surfaces were characterized by stripped surfaces with remnant eroded Pleistocene soils and exposed bedrock. Both Puebloan roomblock sites discussed in this report are located in mesa top settings. Although erosion and some colluvial transport has occurred across mesa top surfaces, roomblocks and associated artifacts are in relatively good archaeological context. Roomblocks were an effective trap for eolian sediment, and the eroding walls were a local source of coarse colluvium after site abandonment. Two eolian events are recorded in the vicinity of the mesa top sites. The earlier eolian event likely occurred during late Coalition time (1250 to 1325 AD), and the latter eolian event could date to the latest Coalition period, the Classic period, and/or the historic period.

Fluvial terraces include isolated terrace remnants with dissected tread surfaces (erosional settings), and terraces located adjacent to hillslopes where the terrace tread is buried by colluvium (depositional settings). Several sites were located where terrace surfaces are buried by colluvium. For the specific sites examined for this report, artifacts were part of the colluvium burying terrace surfaces. However, these locations have the potential for preservation of Archaic sites, or sites of an age that predates the particular colluvial package at the site location. In the case of sites located on eroding Pleistocene terrace surfaces, the archaeological sites are somewhat dissected. However, artifacts are likely transported a relatively short distance, and may have some useful archaeological context.

At one location in the south-central area of the White Rock tract, a piece of fossilized bone of *Bison antiquus* was found at a depth of about 20-30 cm eroding out of a gully wall stratigraphically below the ca. 50-60 ka El Cajete pumice. Notably, this is apparently the first recorded Pleistocene fossil from Los Alamos County, and is also one of very few bison records in New Mexico with dates older than about 20 ka. Descriptions completed in the vicinity of the *Bison antiquus* location and at several other sites on the White Rock tract show a complex record of Pleistocene colluvial deposition for this part of the Pajarito Plateau.

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