NMCRIS Activity No. 82468
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TOTAH

Time and the Rivers Flowing ~ Excavations in the La Plata Valley

Volume 2

JACKSON LAKE COMMUNITY: RESULTS FROM 16 ANCESTRAL PUEBLO SITES, FROM TRANSITIONAL BASKETMAKER III TO LATE PUEBLO III

Analysis, References, and Appendixes

H. Wolcott Toll

Office of Archaeological Studies
Museum of New Mexico
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18 Ceramic Trends in the Jackson Lake Community

C. Dean Wilson

A total of 71,013 sherds and 35 complete or partial vessels were recovered during investigations of 16 sites in the Jackson Lake community, conducted as part of the La Plata Highway project (Table 18.1). Trends noted during this study are compared to those described in other investigations in the La Plata Valley (Dykeman and Langenfeld 1987, Gilpin 2006, Hannaford 1993, Morris 1939, Whalley 1980,Vierra 1993a).

Investigations in the Jackson Lake community resulted in the documentation of occupations dating from the earliest (Transitional Basketmaker) ceramic-yielding occupation of this area to those dating to the Pueblo III period (Tables 18.2, 18.3). While sites dating to the Basketmaker III period were encountered, no components dating to the Pueblo I period were noted at Jackson Lake. The main occupation was relatively late, spanning from the Middle Pueblo II to Late Pueblo III periods. The late community at Jackson Lake was large and represents the southernmost of four large and long-lived communities oriented around great houses occurring in the La Plata Valley (Dykeman and Langenfeld 1987; Hannaford 1993; McKenna and Toll 1992). The other major late communities found in the La Plata Valley are apparently larger and are better known than the Jackson Lake community. They include the Barker Arroyo community (which includes Morris 39), the Holmes Group, and the Morris 41 community (Dykeman and Langenfeld 1987; Hannaford 1993; Holmes 1878; McKenna and Toll 1992; Moorehead 1908; Morris 1939; Whalley 1980).

Data relating to ceramic distributions at Jackson Lake sites were used to examine a variety of trends and issues. One set of issues concerns the nature and timing of the introduction of ceramic-making technology and practices into the La Plata Valley and other areas of the northern Anasazi culture area. Of particular importance is the documentation of a ceramic-bearing component dating prior to the Basketmaker III period as it is usually defined, and the determination of the relationship of the earliest ceramic components to later more common Basketmaker III components.

Another group of issues that can be addressed with Jackson Lake ceramic data relates to the nature of the development of large great house communities occupied in the La Plata Valley during the Pueblo II and Pueblo III periods. It is important to determine whether such communities resulted from a series of gradual developments and locally influenced changes, or reflect more sudden and dramatic transformations. Major changes have been postulated to have resulted from the initial abandonment

Table 18.1. Ceramics by site; sherd counts, weight (g), and percents.

Site	Count	Col. %	Weight (g)	Col. %
LA 37591	4299	6.1%	33025.0	7.6%
LA 37592	33380	47.0%	201334.0	46.5%
LA 37593	11749	16.5%	76753.0	17.7%
LA 37594	8567	12.1%	46143.0	10.6%
LA 37595	2615	3.7%	18746.0	4.3%
LA 37596	117	0.2%	524.0	0.1%
LA 37597	94	0.1%	361.0	0.1%
LA 37598	5982	8.4%	35352.0	8.2%
LA 60743	19	0.0%	78.0	0.0%
LA 60744	827	1.2%	3949.0	0.9%
LA 60745	105	0.1%	465.0	0.1%
LA 60747	297	0.4%	1436.0	0.3%
LA 60749	1674	2.4%	8346.0	1.9%
LA 60751	778	1.1%	4964.0	1.1%
LA 60752	121	0.2%	709.0	0.2%
LA 60753	389	0.5%	1142.0	0.3%
Total	**71013**	**100.0%**	**433327.0**	**100.0%**

Table 18.2. Ceramics at sites with more than 500 sherds, sherd counts by dating subgroups and site.

Dating Group	Date Range	LA 37591	LA 37592	LA 37593	LA 37594	LA 37595	LA 37598	LA 60744	LA 60749	LA 60751	Total
Unassigned	–	–	–	–	–	–	2	–	–	–	**2**
Archaic	–	–	11	–	–	–	–	–	–	–	**11**
Anasazi, not further specified	–	–	–	–	–	–	–	–	–	605	**605**
Pueblo II, not further specified	900–1100	–	–	205	–	–	2	–	–	–	**207**
Pueblo II or III	900–1300	–	–	–	–	4	11	–	83	–	**98**
Pueblo III, not further specified	1100–1300	–	–	151	–	–	703	–	312	–	**1166**
Pueblo II–III, mixed	–	314	2236	–	–	–	4178	–	–	–	**6728**
Early and Late Pueblo II	–	–	–	–	195	–	–	–	–	–	**195**
Transitional Basketmaker and Late Pueblo	–	–	–	–	221	–	–	–	–	–	**221**
Basketmaker III	575–750	–	–	–	–	–	–	–	–	173	**173**
Basketmaker III–Pueblo II mix	–	–	–	–	–	75	–	–	–	–	**75**
Mid Pueblo II	1000–1075	–	350	781	7149	2536	736	827	–	–	**12,379**
Late Pueblo II	1075–1125	673	–	10,219	229	–	350	–	–	–	**11,471**
Mostly Pueblo II, some Pueblo III	–	–	6544	329	–	–	–	–	–	–	**6873**
Transitional Pueblo II–III	1075–1150	–	3190	–	–	–	–	–	–	–	**3190**
Early Pueblo III	1125–1180	397	2795	–	–	–	–	–	–	–	**3192**
Mid Pueblo III	1150–1225	–	–	–	–	–	–	–	1279	–	**1279**
Late Pueblo III, some Pueblo II	–	2915	–	64	–	–	–	–	–	–	**2979**
Pueblo III, some Pueblo II	–	–	18,253	–	–	–	–	–	–	–	**18,253**
Total		**4299**	**33,379**	**11,749**	**7794**	**2615**	**5982**	**827**	**1674**	**778**	**69,097**

Table 18.3. Ceramics at sites with more than 500 sherds, by time period; sherd counts and percents.

Site	Early Basket-maker III		Basket-maker III		Mid Pueblo II		Late Pueblo II		Early Pueblo III		Late Pueblo III		Total
	N	Row %	N	Row %	N	Row %	N	Row %	N	Row %	N	Row %	
LA 37591	–	–	–	–	–	–	–	–	393	11.9%	2898	88.1%	**3291**
LA 37592	–	–	–	–	344	–	–	–	969	5.4%	16,508	92.6%	**17,821**
LA 37593	–	–	–	–	639	11.0%	4975	85.3%	151	2.6%	64	1.1%	**5829**
LA 37594	117	4.0%	–	–	2802	96.0%	–	–	–	–	–	–	**2919**
LA 37595	–	–	1	0.1%	1351	99.9%	–	–	–	–	–	–	**1352**
LA 37598	–	–	–	–	736	56.0%	229	17.4%	349	26.6%	–	–	**1314**
LA 60745	–	–	–	–	105	100.0%	–	–	–	–	–	–	**105**
LA 60749	–	–	–	–	–	–	–	–	1499	100.0%	–	–	**1499**
LA 60751	–	–	167	100.0%	–	–	–	–	–	–	–	–	**167**
Total	**117**	**0.3**	**168**	**0.5**	**5977**	**17.4**	**5204**	**15.2**	**3361**	**9.8**	**19,470**	**56.8**	**34,297**

N = count

of "Chacoan" great house communities at the end of the Pueblo II period and their potential reoccupation by immigrants from areas near Mesa Verde to the northeast during the Pueblo III period (Irwin-Williams and Shelley 1980; Lister and Lister 1990; Reed 2006a).

Despite the occurrence of several large Pueblo II and Pueblo III communities organized around great houses in the La Plata Valley and the nearby Animas and San Juan Rivers—the Totah (McKenna and Toll 1992; Toll 1993)—developments in these communities are often assumed to have been peripheral to those noted in better known areas such as Chaco Canyon and Mesa Verde (Irwin-Williams and Shelley 1980; Lister and Lister 1990; Morris 1928, 1939; Whalley 1980). In some schemes, Pueblo II great-house communities over a very wide area are thought to reflect participation in regional systems ultimately organized and controlled through Chaco Canyon (Doyel and Lekson 1992). A hallmark of pottery thought to reflect participation in this system is the occurrence of mineral-painted pottery with styles and surface characteristics indicative of a range of Chaco or Cibolan ware defined for this period. This system is often assumed to have collapsed during the mid-twelfth century, when many great houses in Chaco Canyon were abandoned (Judge 1991). The common occurrence of Mesa Verde Black-on-white, by definition organic-painted, at Late Pueblo III contexts throughout the northern Anasazi area in earlier great houses is sometimes attributed to the movement and influence of groups from the Mesa Verde region. Changes in pigment types and decorative styles are often assumed to reflect the replacement of an earlier Chaco mineral-paint tradition by a later Mesa Verde organic-paint tradition. If such models are correct, ceramic changes associated with these proposed shifts should be sudden and also be associated with large amounts of intrusive ceramics from the immigrant areas.

Some recent studies have attempted to explain changes in the La Plata Valley and surrounding areas during the Pueblo II to Pueblo III periods largely in terms of local developments. Pueblo II and Pueblo III communities in the La Plata and surrounding river valleys reflect large, continuous, long-term, and relatively self-sufficient adaptations to the optimal riverine environments along the La Plata, Animas, and Middle San Juan drainages. These communities span from AD 950 to 1300 (McKenna and Toll 1992; Hannaford 1993; Wilson 1996). While potters in the La Plata Valley were certainly influenced by panregional ceramic styles and techniques employed throughout most of the San Juan Basin (Toll et al. 1992), in the Totah model, developments associated with the shifts from mineral- to organic-paint types are expected to be characterized by gradual changes in pottery style and manipulations. The timing of changes in pigment use and decorated style are also expected to be similar to those noted for other long-occupied areas such as that documented at Mesa Verde National Park (Table 18.4; Abel 1955; Hayes 1964; Hayes and Lancaster 1975; Oppelt 1991; Rohn 1971, 1977; Wilson 1996).

Testing such models relies on both the development of a precise chronology and the careful monitoring of a variety of ceramic distributions. Thus, the discussions that follow about ceramic data from Jackson Lake initially focus on the dating of various sites and contexts. Ceramic distributions from dated sites are discussed, addressing a variety of issues including the determination of the rate and nature of ceramic stylistic change, and the examination of

Table 18.4. Painted and unpainted white ware by time period and paint type; counts and percents.

Paint Type	None		Organic		Mineral		% Painted	Total
	Count	Row %	Count	Row %	Count	Row %		
Early Basketmaker III	2	66.7%	–	–	1	33.3%	33.3%	**3**
Basketmaker III	11	31.4%	–	–	24	68.6%	68.6%	**35**
Mid Pueblo II	837	49.9%	66	3.9%	773	46.1%	50.1%	**1676**
Late Pueblo II	607	38.4%	292	18.5%	683	43.2%	61.6%	**1582**
Early Pueblo III	483	42.7%	430	38.1%	217	19.2%	57.3%	**1130**
Late Pueblo III	1762	28.9%	3767	61.9%	561	9.2%	71.1%	**6090**
Total	**3702**	**35.2%**	**4555**	**43.3%**	**2259**	**21.5%**	**64.8%**	**10516**

patterns of vessel production, exchange, use, and function. These issues are specifically addressed by examining distributions associated with a variety of ceramic attributes or categories reflecting the manner of decoration, area of origin, nature of production, associated technology, and function of pottery vessels. Sources this project relied on for type category and attribute discussions include Wilson and Blinman (1995a) as well as Abel (1955), Breternitz et al. (1974), Brew (1946), Hayes (1964), Hayes and Lancaster (1975), Martin (1936), Oppelt (1991), Raish (1997), Reed (1958), and Rohn (1977).

Ceramic Dating

Previous studies in adjacent areas of the Anasazi culture area provide for the determination of the time of occupation represented by a particular assemblage based on distributions of ceramic types and attributes (Franklin 19 80; Goetze and Mills 1993; Mills 1991). The recognition of ceramic-based dating groups allows for the examination of changes in population and settlement trends in the Jackson Lake community and other areas of the La Plata Valley.

Proveniences were assigned dates at two different levels of precision. Assemblages from all proveniences were assigned to dating groups based on the temporal implications of the pottery combinations noted. Because most of the sites examined during the present study contained more than one component, many of the assemblages were mixed and could not be assigned to a single dating period. In these cases ceramic dates reflect assessments of mixtures of sherds representing various dating periods. Tables 18.2 and 18.3 illustrate the number of sherds from each site placed in various dating assignments.

Because of mixture problems, it is necessary to limit more specific dating discussions to the relatively small number of unmixed and more precisely dated contexts. Contexts that could be assigned to a single distinctive period based on ceramic distributions or architectural association were assigned a component age, including Transitional Basketmaker, Classic Basketmaker, Middle Pueblo II, Late Pueblo II, Early Pueblo III, and Late Pueblo III at Jackson Lake sites. Component age assignments for each site are shown in Table 18.3. Ceramic distributions associated with assemblages assigned to these groups form the basis for subsequent discussions of ceramic trends. Because of the clear gap in occupation during the Pueblo I period and the very different nature of early and late settlements in Jackson Lake, discussions of dating contexts and the examination of various trends are presented separately for the earlier (Basketmaker-period) and later (Pueblo-period) occupations.

Early Ceramic Components

The number of ceramics from unmixed contexts at early (pre–AD 900) Jackson Lake components is very small. Contexts in the Jackson Lake community dating prior to the Pueblo periods were identified at LA 37594, LA 60751, and LA 37595 (Tables 18.5, 18.6). Data from these sites as well as a site in the Barker Arroyo locality provide the basis for dividing the long temporal span in the La Plata Valley previously assigned to Basketmaker III (Morris 1939; Shepard 1939) into several dating periods (Reed et al. 2000; Wilson and Blinman 1994; Toll and Wilson 2000). Pottery and other evidence from Jackson Lake sites indicate at least two distinct phases prior to the Pueblo periods. These include occupations assigned to the Transitional Basketmaker and Classic Basketmaker III periods as defined during investigations of the La Plata Highway project (Toll and Wilson 2000).

Transitional Basketmaker occupation. Ceramic and architectural data from the early component at LA 37594 indicate that it represents the earliest occupation identified during the La Plata Highway project (Toll and Wilson 2000). Most of the contexts excavated at this site date to the Pueblo II period, and the early component was not recognized prior to the excavation of the shallow pithouse (Pit Structure 5), dating to the initial occupation of this site. Pottery associated with this occupation exhibits characteristics similar to those noted at the earliest ceramic sites in other areas of the Southwest (Reed et al. 2000; Wilson and Blinman 1994). This pottery is characterized by fine sand temper and brown to brown-gray to gray surfaces and pastes. Surfaces are almost always undecorated, although polishing is common. These sherds were assigned to the generic type early polished utility and appear very similar if not identical to pottery from the upper San Juan region previously classified as Sambrito Utility (Dittert et al. 1963; Eddy 1961, 1966; Reed et

Table 18.5. Pottery types at Basketmaker III sites (LA 37594, LA 37595, LA 60751), including proveniences with PII presence; counts and percents.

	LA 37594		LA 37595		LA 60751		Total	
	Transitional		Classic		Classic			
	n =	%	n =	%	n =	%	n =	%
Unmixed Proveniences								
Plain rim	–	–	–	–	5	3.0	5	1.8
Plain gray	1	0.9	–	–	95	56.9	96	33.7
Corrugated gray	1	0.9	–	–	–	–	1	0.4
Polished gray	112	76.2	–	–	33	19.8	145	50.9
Basketmaker III black-on-white	–	–	–	–	11	6.6	11	3.9
Basketmaker III–Early Pueblo I black-on-white	–	–	–	–	1	0.6	1	0.4
Pueblo II–III black-on-white	1	0.9	–	–	–	–	1	0.4
Painted black-on-white	–	–	–	–	11	6.6	11	3.9
Polished white	2	1.7	1	100.0	10	6.0	13	4.6
Polished black-on-white	–	–	–	–	1	0.6	1	0.4
Total	**117**	**100.0**	**1**	**100.0**	**167**	**100.0**	**285**	**100.0**
Proveniences Also Containing Pueblo II Ceramics								
Plain rim	–	–	–	–	5	3.0	5	1.1
Pueblo II–III corrugated	–	–	1	1.3	–	–	1	0.2
Pueblo III corrugated	1	0.5	–	–	–	–	1	0.2
Plain gray	7	3.2	10	13.3	95	56.9	112	24.2
Corrugated gray	31	14.0	39	52.0	–	–	70	15.1
Mud ware	–	–	2	2.7	–	–	2	0.4
Polished gray	149	67.4	–	–	33	19.8	182	39.3
Basketmaker III black-on-white	–	–	–	–	11	6.6	11	2.4
Pueblo II black-on-white	–	–	1	1.3	–	–	1	0.2
Dogoszhi-style black-on-white	–	–	2	2.7	–	–	2	0.4
Early Pueblo III black-on-white	1	0.5	–	–	–	–	1	0.2
Basketmaker III–Early Pueblo I black-on-white	–	–	–	–	1	0.6	1	0.2
Pueblo II–III black-on-white	3	1.4	6	8.0	–	–	9	1.9
Painted black-on-white	–	–	–	–	11	6.6	11	2.4
Polished white	28	12.7	12	16.0	10	6.0	50	10.8
Polished black-on-white	1	0.5	1	1.3	1	0.6	3	0.6
Squiggle hatchure black-on-white	–	–	1	1.3	–	–	1	0.2
Total	**221**	**100.0**	**75**	**100.0**	**167**	**100.0**	**463**	**100.0**

al. 2000; Wilson 1989; Wilson and Blinman 1993). A few sherds recovered from the fill of Pit Structure 5 represented later Anasazi types and indicate some contamination from the later Pueblo II occupation dominating this site (Tables 18.5, 18.6).

Sites in Anasazi areas where similar ceramics have been recovered date from AD 200 to 550 (Reed et al. 2000; Wilson and Blinman 1994). The dating of LA 37594 to the late part of this span is supported by ^{14}C samples from wood recovered from this pithouse. Architectural similarities between Pit Structure 5 and similarly dated structures in other Anasazi areas support an occupation sometime during this span.

Thus, the early occupation at LA 37594 represents a local example of the earliest northern Anasazi ceramic phase. The earliest ceramic-bearing sites in northern Anasazi country appear to be similar to aceramic Basketmaker II sites, some of which date just slightly earlier. While aceramic Basketmaker II contexts were not encountered during the La Plata Highway project, a number of aceramic Basketmaker II sites have been excavated in the La Plata Valley (Brown 1991; Foster 1983; Hancock et al. 1988) and nearby Animas Valley (Fuller 1988; Morris and Burgh 1954; Winter 1986). The earliest ceramic sites in the northern Anasazi probably developed directly out of local aceramic Basketmaker II occupation (Matson 1991; Wilson and Blinman 1994). It is likely that a ceramic technology cen-

Table 18.6. Vessel forms at Basketmaker III sites (LA 37594, LA 37595, LA 60751), including proveniences with PII presence; counts and percents.

	LA 37594 Transitional		LA 37595 Classic		LA 60751 Classic		Total	
Vessel Form	**Count**	**Col. %**	**Count**	**Col. %**	**Count**	**Col. %**	**Count**	**Col. %**
Unmixed Proveniences								
Bowl rim	–	–	–	–	10	6.0%	**10**	**3.5%**
Bowl body	4	3.4%	–	–	35	21.0%	**39**	**13.7%**
Seed jar rim	3	2.6%	–	–	–	0.0%	**3**	**1.1%**
Cooking, storage rim	1	0.9%	–	–	3	1.8%	**4**	**1.4%**
Necked jar body	1	0.9%	–	–	8	4.8%	**9**	**3.2%**
Jar body	108	92.3%	1	100.0%	111	66.5%	**220**	**77.2%**
Total	**117**	**100.0%**	**1**	**100.0%**	**167**	**100.0%**	**285**	**100.0%**
Proveniences Also Containing Pueblo II Ceramics								
Bowl rim	2	0.9%		0.0%	10	6.0%	**12**	**2.6%**
Bowl body	19	8.6%	4	5.3%	35	21.0%	**58**	**12.5%**
Seed jar rim	3	1.4%		0.0%	–	–	**3**	**0.6%**
Olla rim	–	–	1	1.3%	–	–	**1**	**0.2%**
Cooking, storage rim	3	1.4%	1	1.3%	3	1.8%	**7**	**1.5%**
Necked jar body	8	3.6%	10	13.3%	8	4.8%	**26**	**5.6%**
Jar body	186	84.2%	59	78.7%	111	66.5%	**356**	**76.9%**
Total	**221**	**100.0%**	**75**	**100.0%**	**167**	**100.0%**	**463**	**100.0%**

tered around the production of simple undecorated forms using alluvial clays was introduced to semi-sedentary Basketmaker II groups in the northern Anasazi, probably along the same routes that agriculture centered around maize had spread earlier (Wilson et al. 1996).

The early plain "brown ware" pottery tradition appears to have originally developed in present day Mexico but spread rapidly throughout much of the southwestern United States (Crown and Wills 1996). This observation has resulted here in the assignment of sites in the Anasazi area displaying early brown ware to a distinct Transitional Basketmaker phase that is described as intermediate between Basketmaker II and Basketmaker III, dating between AD 200 and 550.

Classic Basketmaker III occupation. The next ceramic phase in the La Plata Valley is characterized by Basketmaker III gray and white ware pottery types found with pottery similar to that sometimes assigned to polished gray or Sambrito Utility. Similar combinations of pottery types persisted in many areas of the Anasazi until the beginning of the eighth century (Reed et al. 2000). Because this represents the time span most commonly attributed to the Basketmaker III period, components exhibiting this combination of pottery were placed into a dating group called Classic Basketmaker III (Reed et al. 2000; Toll and Wilson 2000).

The only well-dated Classic Basketmaker III component excavated at Jackson Lake was Pit Structure 1 at LA 60751 (Table 18.5). This represents a fairly typical Basketmaker III pithouse. Dates from a number of tree-ring samples indicated it was constructed in AD 654. Pottery types from this structure include plain polished (Sambrito Gray), plain rim and plain gray (Chapin Gray), and Basketmaker III (Chapin) black-on-white (Figs. 18.1, 18.2). The association of Sambrito Utility with Chapin Gray was also noted at collections from Classic Basketmaker III sites made during earlier surveys in the La Plata Valley (Hannaford 1993), so that the mutual occurrence of these types allows for the identification of components dating to this span, even for small assemblages. Similar combinations of pottery were noted at Basketmaker III sites described in Mesa Verde National Park (O'Bryan 1950), where Chapin Black-on-white and Chapin Gray was noted along with Twin Trees Gray, which, as originally described, is similar if not identical to Sambrito Utility (Abel 1955; Wilson and Blinman 1995b).

Pottery distributions from another site in the Jackson Lake locality (LA 37595) illustrate difficulties in recognizing Basketmaker III occupations

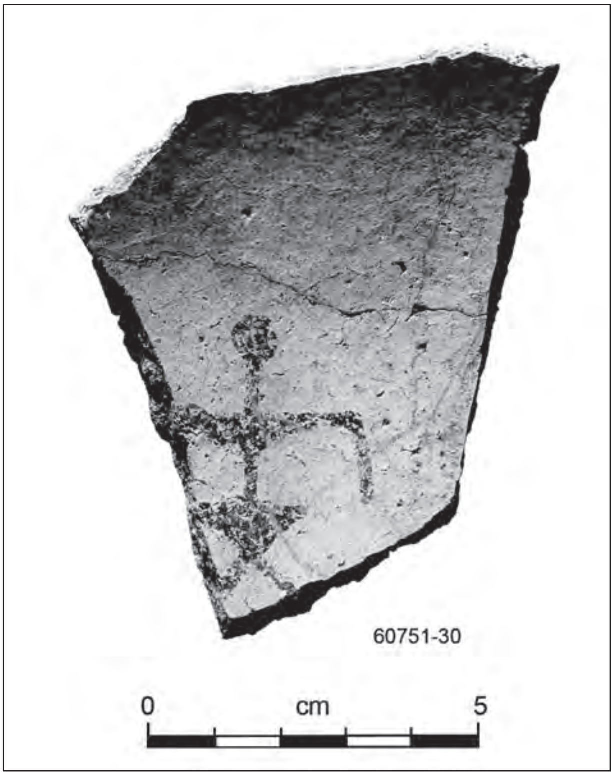


Figure 18.1. Chapin Black-on-white bowl sherd, Basketmaker III, LA 60751.

on the basis of pottery alone. This site contains an early pit structure dating to the Basketmaker III period. Only one sherd is listed as associated with the Basketmaker components of this site. The identification of the early component of this site is therefore based on architectural evidence rather than ceramic distributions. Basketmaker III components can be difficult to identify based on ceramic evidence alone, and it is likely that the number of Basketmaker III sites in the La Plata Valley has been significantly underestimated.

Distribution of early ceramic sites. Data from excavation and survey projects in the La Plata Valley provide additional information concerning the overall settlement patterns during early ceramic periods. The occurrence of pottery similar to Sambrito Utility as the sole early pottery type at collections from five sites collected during a survey by Deric Nusbaum (1935) indicate the existence of other Transitional Basketmaker sites in the lower La Plata Valley. Data from LA 50337, a site south of Jackson Lake excavated during earlier investigations by the Museum of New Mexico, indicate a long sequence of intermittent occupation from the Transitional

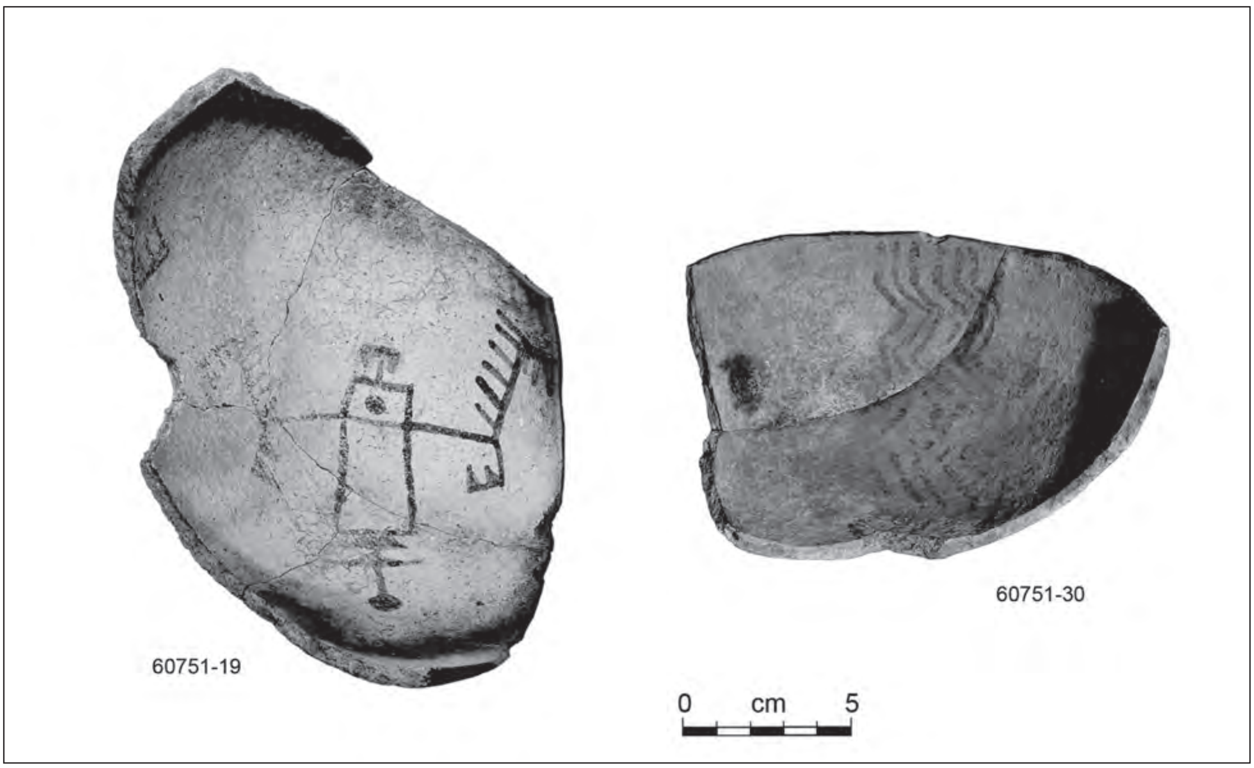


Figure 18.2. Chapin Black-on-white bowl sherds, Basketmaker III, LA 60751.

Basketmaker period to the Pueblo III period (Vierra 1993a). Early ^{14}C dates from one feature at this site imply an occupation dating to the sixth century. Eight sherds classified as Sambrito Brown and seven as indeterminate brown indicate the existence of a Transitional Basketmaker III occupation at this site (Warren 1993). While Sambrito Utility was grouped with other types to form a ceramic group dating between AD 400 and 900 (Warren 1993), I feel that Sambrito Utility is not associated with this pottery. Instead, the presence of early brown ware pottery at LA 50337 indicates that the earliest component at this site is dominated by plain brown ware and dates to the Transitional Basketmaker period.

During examinations of sherds collected during Nusbaum's (1935) survey, ceramic assemblages consisting of Sambrito Utility without later Basketmaker ceramic types were assigned to Transitional Basketmaker components. All five of the sites assigned to this period based on ceramic distributions were within five miles of the confluence the La Plata and the San Juan Rivers, or between the confluence and the Jackson Lake community. While it must be emphasized that sites dating to this period are very difficult to identify without excavation, a small population concentrated in the lower five miles of the La Plata Valley is suggested.

Assemblages containing characteristics of both Sambrito Utility and early gray and black-on-white types from survey collections and excavated sites indicate a definite increase in the number of sites in the lower La Plata Valley by the early seventh century. The association of Sambrito Utility, Chapin Gray, and Chapin Black-on-white at sites recorded during the Nusbaum survey indicate small concentrations of Basketmaker III habitation dispersed across much of the length of La Plata Valley, although one of the largest concentration of Basketmaker III sites in the lower eight miles of the La Plata Valley was at Jackson Lake (or East Side Rincon). The Eastside Rincon community (Dykeman and Langenfeld 1987:44) is on a sloping terrace immediately across the river from the Jackson Lake sites. It includes at least six pit structures, at least one great pithouse, and a number of other features exposed by a large dissecting arroyo. A pit structure in this community excavated by San Juan College yielded an archaeomagnetic date in the AD 600s. Later sites in the Jackson Lake community could easily cover other structures associated with this community.

Excavations of the La Plata Highway project did not encounter evidence of Pueblo I occupations at Jackson Lake, although one site excavated at Barker Arroyo did contain contexts dating to the very early part of the Pueblo I period (Toll and Wilson 2000). Sites dating to the Pueblo I period are sparse in Jackson Lake and other areas along the lower La Plata Valley, although Pueblo I sites are common in areas of the upper La Plata Valley, particularly along the segment just north of the Colorado border (Hannaford 1993). Pueblo I white-ware types and neckbanded gray wares were generally absent in survey collections along the lower La Plata Valley. Only two scatters and one small habitation site dating to the Pueblo I period are represented in the Nusbaum collections for the eight lowermost miles of the La Plata. Although parts of the East Rincon site have been described as dating to the Basketmaker III–Pueblo I period (Dykeman and Langenfeld 1987:44), an examination of architectural and ceramic data indicate an occupation in the Basketmaker III period.

Ceramic trends at early ceramic occupations. Examinations and comparisons of the small number of sherds associated with the early components at LA 37594 and LA 60751 provide some clues about the relationship between the earliest ceramic (Transitional Basketmaker) and the slightly later Classic Basketmaker III occupations. Our understanding of the nature of the relationship between the earliest ceramic occupations and the Classic Basketmaker III is still poor and has been the source of some controversy. The Navajo Reservoir Project represented the first attempt to recognize distinct ceramic phases from sites in the northern Anasazi country that were earlier than those previously assigned to the Basketmaker III period (Dittert et al. 1963; Eddy 1966). Ceramic distributions were used to place early sites into a series of distinct phases, including the Los Pinos, Sambrito, and Rosa phases (Dittert et al. 1963; Eddy 1961, 1966). In this scheme, the earliest ceramic sites were identified by the presence of early (Los Pinos and Sambrito) brown ware as the sole ceramic types. Later components were identified by the association of early brown ware pottery with gray and white ware types. Still later sites yielded early gray and white ware types without brown wares. This sequence was interpreted as reflecting continuity in ceramic development from the earliest ceramic phases, dominated by brown ware types, to later phases, containing both gray and white wares.

Later studies questioned the Navajo Reservoir sequence. In a broad synthesis of the prehistory of the Colorado Plateau, Berry (1982) rejected the idea of continuity between the earliest sites, dominated by brown wares, and later sites, dominated by gray wares, at Navajo Reservoir. He felt that the Sambrito phase as defined by Dittert did not exist. Instead, assemblages from Navajo Reservoir dominated by brown wares were postulated to date to the third and fourth century or to the Los Pinos phase, after which time this area was thought to have been abandoned for several centuries (Berry 1982). More recent investigations in the San Juan country tend to support Dittert's earlier interpretation of a long and continual sequence of occupations during early ceramic periods (Reed et al. 2000; Wilson and Blinman 1993, 1994). The two early ceramic sites from Jackson Lake also indicate continual occupation from brown ware–dominated Transitional Basketmaker occupations to more typical Basketmaker III components also containing gray and white ware pottery. This interpretation is supported by the presence of similar Sambrito Utility sherds at both LA 37594 and LA 60751. In addition, the assemblage from LA 60751 includes pottery that exhibits characteristics intermediate between those noted for Sambrito Utility and Basketmaker III gray- and white-ware pottery types. This range of pottery seems to reflect a sequence of gradual change in resource use and manufacturing techniques by potters in the Northern San Juan from the earliest ceramic occupations in the La Plata Valley to the Basketmaker III period. Dates from the two early Jackson Lake sites discussed here indicate they are about a century apart: LA 37594 dates to the sixth century and LA 60751 to the middle seventh century. Thus, data from early Jackson Lake sites indicate that Basketmaker gray and white wares in the La Plata Valley developed from earlier brown wares also produced in this area.

The shift from brown to gray and white wares in the northern Anasazi has often been explained in cultural terms as indicating, first, a long-distance migration by groups from the Mogollon region, who produced brown ware pottery; followed by the development of culturally distinct Anasazi groups who produced gray and white wares (LeBlanc 1982; Lucius 1981). The initial introduction of pottery manufacture into areas of the Mogollon Highlands and Colorado Plateau seem to be linked, and are probably best viewed as aspects of a related pan-regional tradition that later gave rise to various distinct traditions. More recent studies indicate that subsequent regional diversification is best interpreted in terms of shifts in resource use and functional requirements of pottery vessels (Wilson et al. 1996). The earliest ceramic technologies in the Colorado Plateau focused on the production of simple and generalized forms (Table 18.6) using widely spread alluvial or soil clays. This pottery technology was very similar to that employed during the entire occupation of the Mogollon Highlands, where alluvial soil clays dominated different southwestern landscapes. Subsequent technologies in the Colorado Plateau focused on the production of more specialized forms using geologic clays common in this region but absent in many other regions of the Southwest (Wilson et al. 1996; Reed et al. 2000).

Such a scenario is supported by comparisons of local clay sources and paste clays of pottery from the earliest ceramic sites in the La Plata Valley. Petrographic and oxidation studies of clay and pottery samples indicate that early brown wares were produced from alluvial clays occurring along the La Plata Valley. Local clays and brown wares are high in iron and consistently fire to similar deep red colors when exposed to the same firing conditions. Both also exhibit similar sand inclusions resulting from the weathering of local sandstone. Pottery associated with the earliest ceramic component are consistently thick and polished. In contrast, there is a much greater variability in both surface polish and thickness for pottery from Classic Basketmaker components exhibiting alluvial pastes. This indicates that this was a time of experimentation, resulting in the gradual development and refinement of Anasazi gray and white ware technology.

Pastes associated with gray and white wares reflect a shift to low-iron clays taken from local shale outcrops. Inclusions consist of fragments from igneous porphyries similar in composition to material commonly found in local gravel deposits. The use of low-iron clays resulted in the emergence of painted "white ware" pottery that could be easily decorated with locally available pigments. Differences in the temperature and maturation rate of the clay also made the polishing or smudging of utility wares less necessary. Thus, ceramic data from Jackson Lake indicates that changes noted in early ceramics represent a gradual shift to pottery forms more suited to the local geologic clays.

Shapes and surface manipulations indicate the production of simple and similar forms at both Transitional Basketmaker III and Classic Basketmaker III sites (Table 18.6). The majority of sherds associated with both occupations appear to be derived from jars, although neckless seed jars appear to be more common at Transitional Basketmaker III contexts, and necked wide-mouth cooking jars are more common in Classic Basketmaker III contexts. Bowls are present in low but significant frequencies at both contexts. There appears to have been a shift from more generalized storage to more specialized cooking forms.

Dating of Later Occupations

The great majority of pottery recovered from investigations at Jackson Lake indicates Late Pueblo II and Pueblo III occupations and appear to represent occupations associated with a great house community. As with other great house communities in the La Plata Valley, ceramic distributions at Jackson Lake indicate large, long-lived occupations spanning the Pueblo II to Pueblo III periods (McKenna and Toll 1992). Assemblages were assigned to ceramic dating periods primarily based on distributions of white ware types and associated pigment distributions. The Pueblo II period was divided into three ceramic dating groups, of which the Middle Pueblo II and Late Pueblo II periods were represented at Jackson Lake. The Pueblo III period was divided into two distinct ceramic dating periods, both of which were represented at Jackson Lake. Thus, ceramics from contexts excavated at Jackson Lake indicate a substantial and long-lived occupation from AD 1000 to 1300. Because of this long occupational sequence, assemblages from many contexts often reflected a mixture of pottery from more than one temporal component. In many cases, ceramic-based temporal assignments involved the recognition of mixed dating periods representing combinations of temporal components.

Pueblo II contexts. Almost all the sites excavated at the Jackson Lake locality contain ceramic types indicating occupations dating to the Middle or Late Pueblo II periods. For the northern Anasazi, the Pueblo II period has long been divided into at least two broadly defined phases, defined by the occurrence and frequencies of certain white ware types (Hayes 1964; Hayes and Lancaster 1975; Brew 1946; Martin 1936; Reed 1958). The Ackmen phase, dating between AD 900 and 1000, is characterized by assemblages dominated by Cortez (Red Mesa style) Black-on-white. The Mancos phase, which dates between AD 1000 and 1100, is characterized by assemblages dominated by Mancos (Pueblo II) Black-on-white. More recent examinations of distinct Pueblo II ceramic assemblages indicate it is possible to divide spans of the Pueblo II into even shorter periods based on the frequency of a number of types (Mills 1991; Wilson 1988; Wilson and Blinman 1995a). During the La Plata Highway project, the Pueblo II period was divided into three ceramic-based dating groups: the Early, Middle, and Late Pueblo II periods.

The lack of assemblages dominated by Red Mesa–style black-on-white, such as for Cortez Black-on-white, from Jackson Lake excavations indicates the absence of Early Pueblo II contexts. A few Red Mesa–style black-on-white sherds are present in later assemblages and may indicate some contamination from Early Pueblo II sites or heirloom vessels (Fig. 18.3).

The period often assigned to the Mancos phase of the Pueblo II can be divided into two distinctive ceramic dating phases: the Middle Pueblo II and Late Pueblo II periods. These two dating periods are differentiated by slight differences in the distribution of ceramic types and paint distributions.

Tree-ring samples from a number of sites in the Mesa Verde region indicate the occurrence of a distinctive assemblage at sites dating occupied sometime between AD 1025 and 1075 (Errickson 1993; Kent 1986; Lister 1966; Wilson 1988). The great majority of the gray wares are corrugated. Corrugated vessels usually exhibit very little eversion and are classified as Mancos (Pueblo II) Corrugated; or moderate eversion, classified as Dolores (Pueblo II–III) Corrugated. Mancos (Pueblo II) Black-on-white is the predominant formal white ware type observed, while Cortez (Red Mesa–style) Black-on-white is sometimes present in very low frequencies. The great majority of the Mancos Black-on-white sherds from sites dating to this span are decorated with mineral pigment. The distribution of ceramic types at assemblages dating to the very late part of the eleventh and first part of the twelfth centuries is very similar, although

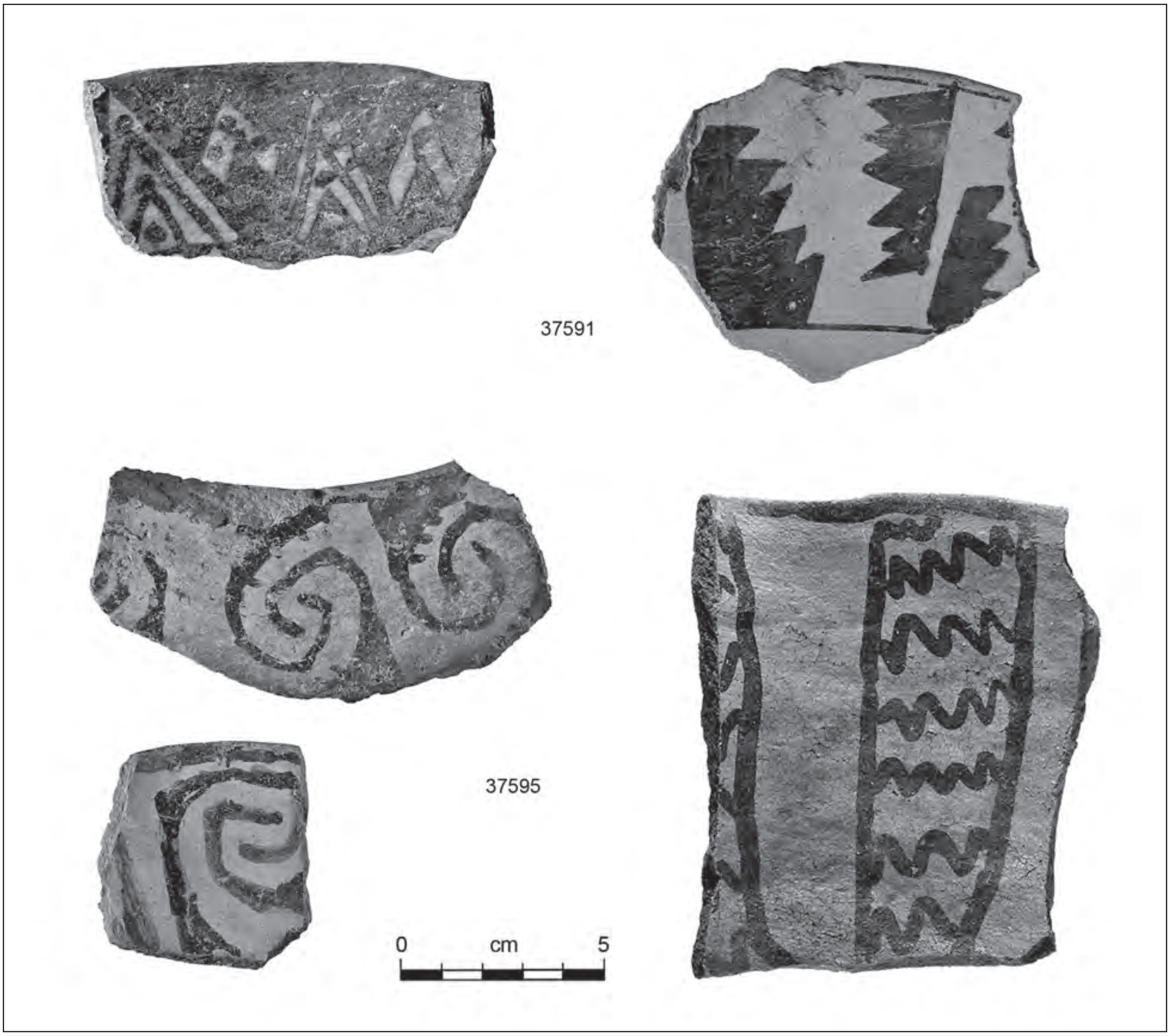


Figure 18.3. Red Mesa–style black-on-white sherds, Early Pueblo II; LA 37591 (2, top), LA 37595 (3, bottom).

slight differences can be recognized in larger assemblages (Franklin 1980; Hayes 1964; Hayes and Lancaster 1974; Swannack 1969). While Mancos Black-on-white was still the dominant formal white ware type, in most areas there is an increase in the frequency of sherds containing organic paint beginning during the late eleventh century that continued during the early twelfth century (Hayes 1964; Hayes and Lancaster 1975). McElmo Black-on-white is sometimes present in low frequencies. Corrugated vessel rim eversion tends to be more pronounced during this time, and Pueblo II–III corrugated may be more common than in the previous period. Tsegi Orange ware types become more common, and the frequency of Mesa Verde red ware types declines.

Data from several sites excavated during the La Plata Highway project indicate changes in ceramic distributions in sites dating from the Middle Pueblo II and Late Pueblo II periods. The gradual increase in the frequency of organic-painted pottery began during the Late Pueblo II period (Table 18.4). Differences between these periods are in part reflected by increases in the frequency of sherds decorated with organic paint in assemblages still dominated by Mancos Black-on-white (Figs. 18.4a, 18.4b). Because almost all Jackson Lake sites were occupied over long time spans or were

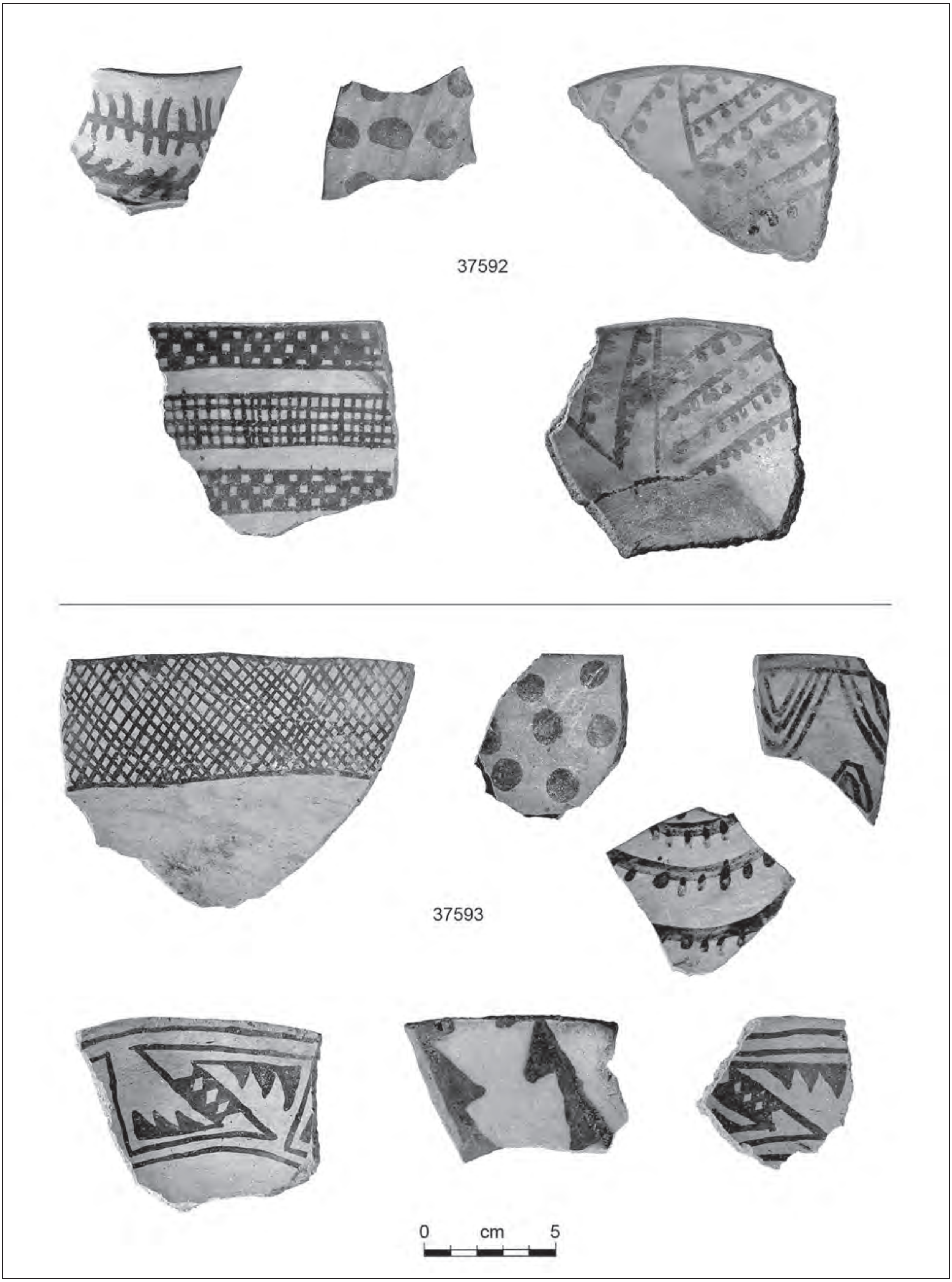


Figure 18.4a. Mancos Black-on-white sherds, Pueblo II, LA 37592 (5, top), LA 37593 (7, bottom).

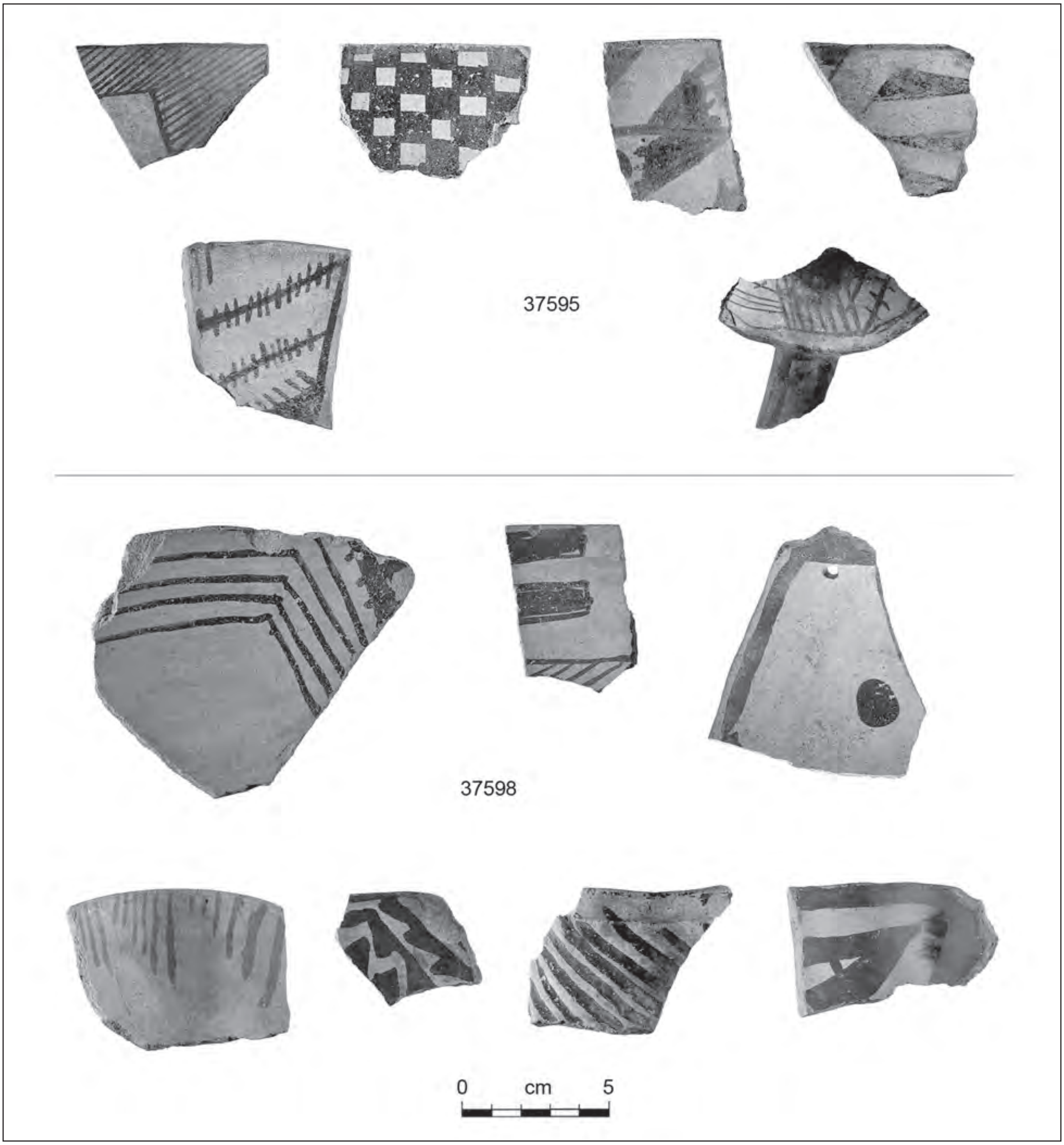


Figure 18.4b. Mancos Black-on-white sherds, Pueblo II, LA 37595 (6, top), LA 37598 (7, bottom).

later reoccupied, it is often difficult to determine if differences in paint frequencies and the presence of McElmo (Early Pueblo III) Black-on-white indicate a Late Pueblo II occupation or mixtures of some materials deriving from Pueblo II and Pueblo III components. Thus, during the assignment of ceramic dating periods based on ceramic distributions, attempts were made to examine data concerning potential mixing and contamination from different temporal components.

Ceramic distributions from several Jackson Lake sites (LA 37592, LA 37593, LA 37594, LA 37595, LA 37598, and LA 60745) indicate occupations during the Middle Pueblo II period (Table 18.8). In addition, LA 37589 and LA 37590, excavated during the La Plata Highway project and included in the nearby Cot-

Table 18.8. Pottery types at Mid Pueblo II sites; counts and percents.

	LA 37592		LA 37593		LA 37594		LA 37595		LA 37598		LA 60745		Total	
	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %
Plain rim	–	–	–	–	2	0.1%	–	–	–	–	–	–	**2**	**0.0%**
Fillet rim	–	–	1	0.2%	–	–	–	–	–	–	–	–	**1**	**0.0%**
Pueblo II corrugated	3	0.9%	9	1.4%	17	0.6%	11	0.8%	35	4.8%	–	–	**75**	**1.3%**
Pueblo II–III corrugated	1	0.3%	6	0.9%	22	0.8%	28	2.1%	6	0.8%	2	1.9%	**65**	**1.1%**
Pueblo III corrugated	–	–	1	0.2%	–	–	–	–	1	0.1%	–	–	**2**	**0.0%**
Plain gray	25	7.3%	148	23.2%	162	5.8%	102	7.5%	11	1.5%	11	10.5%	**459**	**7.7%**
Corrugated gray	242	70.3%	296	46.3%	1833	65.4%	766	56.7%	490	66.6%	47	44.8%	**3674**	**61.5%**
Incised corrugated	–	–	1	0.2%	–	–	–	–	–	–	–	–	**1**	**0.0%**
Polished gray	–	–	–	–	1	0.0%	–	–	–	–	–	–	**1**	**0.0%**
Red Mesa–Style Black-on-white	–	–	1	0.2%	7	0.2%	11	0.8%	–	–	–	–	**19**	**0.3%**
Pueblo II black-on-white	25	7.3%	31	4.9%	87	3.1%	51	3.8%	51	6.9%	2	1.9%	**247**	**4.1%**
Sosi-style black-on-white	–	–	–	–	13	0.5%	1	0.1%	3	0.4%	–	–	**17**	**0.3%**
Dogoszhi-style black-on-white	7	2.0%	6	0.9%	61	2.2%	29	2.1%	4	0.5%	1	1.0%	**108**	**1.8%**
Chaco-style black-on-white	–	–	–	–	–	–	1	0.1%	3	0.4%	–	–	**4**	**0.1%**
Pueblo II–III black-on-white	3	0.9%	26	4.1%	80	2.9%	84	6.2%	31	4.2%	16	15.2%	**240**	**4.0%**
Painted black-on-white	–	–	58	9.1%	–	–	6	0.4%	–	–	–	–	**64**	**1.1%**
Polished white	37	10.8%	45	7.0%	413	14.7%	232	17.2%	90	12.2%	18	17.1%	**835**	**14.0%**
Polished black-on-white	–	–	4	0.6%	98	3.5%	10	0.7%	3	0.4%	8	7.6%	**123**	**2.1%**
Squiggle hachure black-on-white	–	–	4	0.6%	5	0.2%	12	0.9%	2	0.3%	–	–	**23**	**0.4%**
Deadmans Black-on-red	1	0.3%	–	–	–	–	2	0.1%	3	0.4%	–	–	**6**	**0.1%**
Mesa Verde Plain Red	–	–	–	–	1	0.0%	1	0.1%	–	–	–	–	**2**	**0.0%**
Mesa Verde Black-on-red	–	–	–	–	–	–	3	0.2%	–	–	–	–	**3**	**0.1%**
Cibola indeterminate red ware	–	–	–	–	–	–	–	–	1	0.1%	–	–	**1**	**0.0%**
Tusayan Black-on-red	–	–	1	0.2%	–	–	–	–	–	–	–	–	**1**	**0.0%**
Tsegi Orange	–	–	–	–	–	–	1	0.1%	–	–	–	–	**1**	**0.0%**
Kayenta Plain Black-on-red	–	–	–	–	–	–	–	–	1	0.1%	–	–	**1**	**0.0%**
Tularosa fillet rim	–	–	1	0.2%	–	–	–	–	–	–	–	–	**1**	**0.0%**
Reserve Smudged	–	–	–	–	–	–	–	–	1	0.1%	–	–	**1**	**0.0%**
Total	**344**	**100.0%**	**639**	**100.0%**	**2802**	**100.0%**	**1351**	**100.0%**	**736**	**100.0%**	**105**	**100.0%**	**5977**	**100.0%**

Table 18.9. Paint types on white ware at Mid Pueblo II sites; counts and percents.

	None		Organic		Mineral		Total
	Count	Row %	Count	Row %	Count	Row %	
LA 37592	36	50.0%	3	4.2%	33	45.8%	**72**
LA 37593	46	26.3%	2	1.1%	127	72.6%	**175**
LA 37594	414	54.3%	36	4.7%	313	41.0%	**763**
LA 37595	233	53.4%	14	3.2%	189	43.3%	**436**
LA 37598	90	48.1%	10	5.3%	87	46.5%	**187**
LA 60745	18	40.9%	2	4.5%	24	54.5%	**44**
Total	**837**	**49.9%**	**67**	**4.0%**	**773**	**46.1%**	**1677**

tonwood Arroyo group, just south of the Jackson Lake locality, date to the Middle Pueblo II period. Pueblo II black-on-white was by far the dominant formal white ware type at all Middle Pueblo II contexts identified. Very low frequencies of Red Mesa–style black-on-white and Early Pueblo III black-on-white sherds were sometimes present in Middle Pueblo II contexts. The great majority of black-on-white sherds were decorated with mineral paint, present on 92.6 percent of all painted white ware sherds, and ranging from 90 percent to 95.4 percent of white wares from sites with Middle Pueblo II components (Table 18.9). The dominant gray ware rim form at contexts from all but two sites assigned to this period was Pueblo II corrugated (Fig. 18.4c). The exceptions were LA 37594 and LA 37595, where a majority of the corrugated rim sherds were classified as Pueblo II–III corrugated (Table 18.10).

Ceramics from two Jackson Lake sites (LA 37593 and LA 37598) were assigned to the Late Pueblo II period based on ceramic distributions (Tables 18.11, 18.12). While the majority of formal white ware types represent Pueblo II black-on-white, Early Pueblo III and Pueblo III black-on-white sherds were sometimes present in low frequencies. Excluding unpainted sherds, the proportion of white ware sherds exhibiting mineral paint was lower than in the earlier period and included 71.4 percent of the painted white wares at LA 37593 and 39.0 percent at LA 37598. The dominant corrugated rim form at both sites was Pueblo II–III corrugated. The one site with red ware associated with this occupation yielded both Mesa Verde Red Ware and Tsegi Orange types. Mogollon smudged brown wares and a single Doghoszi Black-on-white bowl were also present at LA 37593 (Fig. 18.4d; Tables 18.11, 18.12, 18.13).

Pueblo III contexts. Ceramic assemblages dating to the Pueblo III period are recognized by the presence or dominance of white ware types such as McElmo (Early Pueblo III) Black-on-white, Mesa Verde (Late Pueblo III) Black-on-white, and indeterminate Pueblo III black-on-white. The great majority of painted white wares exhibit decorations in organic paint (Table 18.4). Assemblages associated with the Pueblo III occupation were assigned to one of two dating periods using divisions similar to those previously employed in the Northern San Juan (Reed 1958; Brew 1946; Hayes 1964).

The Early Pueblo III, as used here, corresponds partly to previous definitions of the McElmo phase. The McElmo phase as previously defined probably dates between about AD 1130 and 1180 (Hayes 1964; Swannack 1969; Reed 1958; Rohn 1971; Wilson 1990; Wilson and Blinman 1988b). Organic-painted white wares dominate assemblages assigned to this dating period, and McElmo Black-on-white is common. Corrugated rim sherds are often dominated by Dolores Corrugated (Pueblo II–III). Red ware types include Tsegi Orange wares and White Mountain Redware types such Wingate Black-on-red and Puerco Black-on-red.

The Mesa Verde phase, Late Pueblo III, is defined by the presence of Mesa Verde Black-on-white (Hayes 1964; Rohn 1971, 1977; Reed 1958; Wilson 1990). Corrugated vessels associated with Pueblo III occupations often exhibit more everted rims than those associated with earlier occupations. Red ware types are generally limited to White Mountain Redware types such as St. Johns Black-on-red and St. Johns Polychrome.

Contexts dating to the Early Pueblo III period were identified at five Jackson Lake sites: LA 37591, LA 37592, LA 37593, LA 37598, and LA 60749 (Figs.

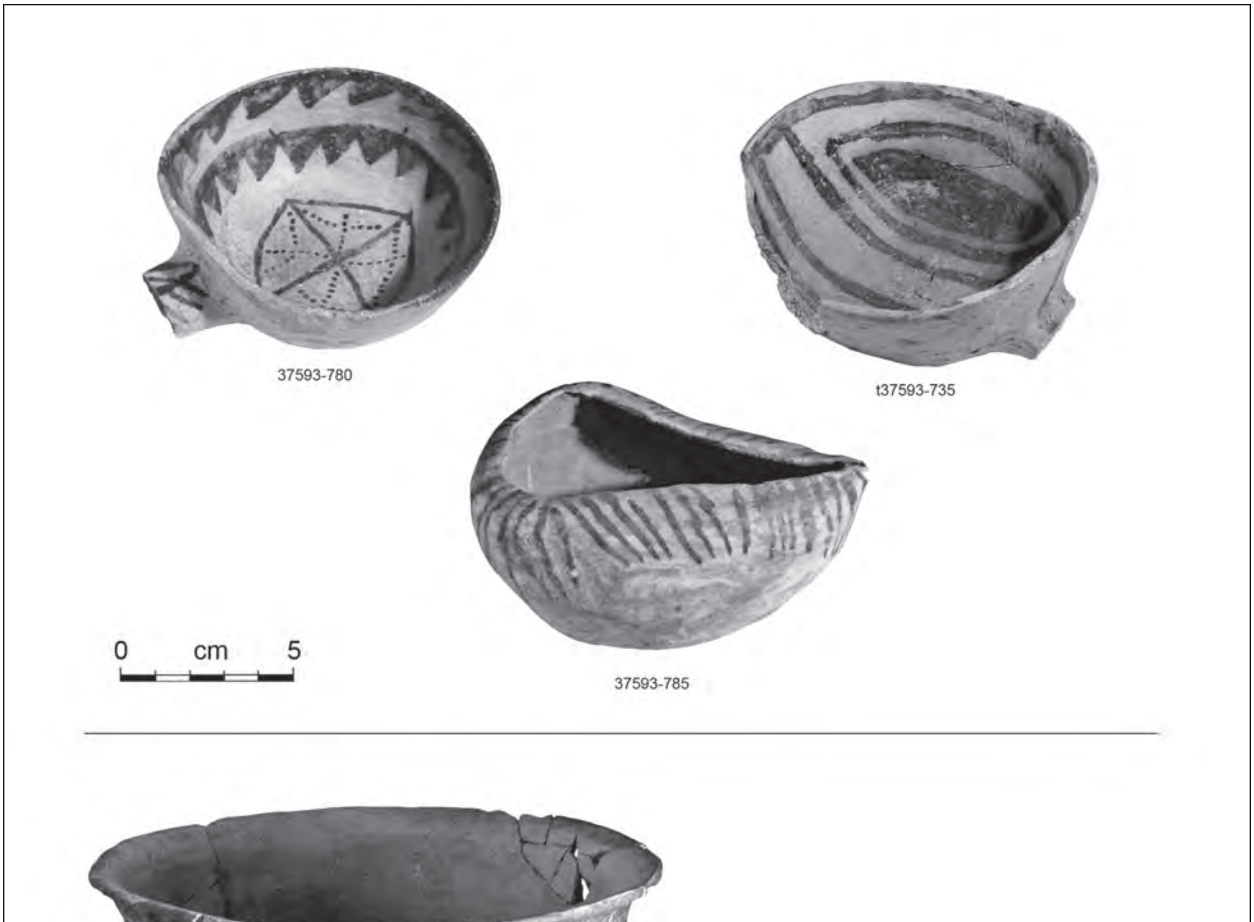


Figure 18.4c. Top: McElmo Black-on-white ladles (left and right) and effigy (center) Early Pueblo III, LA 37593; Bottom: local Payan-like corrugated jar (bottom left), Mummy Lake gray ware jar (bottom right), Pueblo II, LA 37593.

Table 18.10. Vessel forms by ware group, Mid Pueblo II sites; counts and percents.

	Gray Ware		White Ware		Red Ware		Brown Smudged Ware		Total	
	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %
Indeterminate	4	0.1%	15	0.9%	–	–	–	–	**19**	**0.3%**
Bowl rim	1	0.0%	162	9.6%	4	26.7%	–	–	**167**	**2.8%**
Bowl body	1	0.0%	400	23.8%	7	46.7%	2	100.0%	**410**	**6.9%**
Seed jar rim	–	–	5	0.3%	1	6.7%	–	–	**6**	**0.1%**
Olla rim	1	0.0%	15	0.9%	–	–	–	–	**16**	**0.3%**
Olla neck	–	–	3	0.2%	–	–	–	–	**3**	**0.1%**
Cooking, storage rim	250	5.8%	11	0.7%	–	–	–	–	**261**	**4.4%**
Necked jar body	619	14.5%	55	3.3%	1	6.7%	–	–	**675**	**11.3%**
Canteen	–	–	1	0.1%	1	6.7%	–	–	**2**	**0.0%**
Jar body	3401	79.5%	967	57.6%	1	6.7%	–	–	**4369**	**73.1%**
Ladle	2	0.0%	15	0.9%	–	–	–	–	**17**	**0.3%**
Ladle bowl	–	–	14	0.8%	–	–	–	–	**14**	**0.2%**
Ladle handle	–	–	13	0.8%	–	–	–	–	**13**	**0.2%**
Open-gourd dipper	–	–	3	0.2%	–	–	–	–	**3**	**0.1%**
Pipe	1	0.0%	–	–	–	–	–	–	**1**	**0.0%**
Non-vessel	–	–	1	0.1%	–	–	–	–	**1**	**0.0%**
Total	**4280**	**100.0%**	**1680**	**100.0%**	**15**	**100.0%**	**2**	**100.0%**	**5977**	**100.0%**

18.4c, 18.5a, 18.5b, 18.5c; Table 18.14). Contexts dating to this period were usually identified by the occurrence of Early Pueblo III black-on-white as a fairly common type, although most contexts placed into this period also contained significant frequencies of Pueblo II black-on-white. For assemblages from sites with more than 20 painted sherds, for painted sherds only, the proportion of sherds with organic paint ranged from 62.2 to 78.1 percent and averaged 66.5 percent (Table 18.15). The dominant corrugated rim form at sites where corrugated rim sherds were represented was Pueblo II–III corrugated. Red wares, present in very low frequencies, include Tsegi Orange Ware, White Mountain Red Ware, and Mesa Verde Red Ware types. The latter are contaminants from Pueblo II components. A single Mogollon Brown sherd was present at LA 60749 (Tables 18.14, 18.16).

Contexts dating to the Late Pueblo III period were identified at three Jackson Lake sites excavated during the La Plata Highway project: LA 37591, LA 37592, and LA 37593. LA 37591 and LA 37592 account for the majority of proveniences and assemblages for this period (Tables 18.17, 18.18, 18.19). The great majority of white ware sherds from contexts assigned to this period are decorated with organic paint. At LA 37591, 91.0 percent of the painted white ware is organic-painted, while at the slightly earlier and more complex LA 37592, 86.5 percent of painted white ware has organic paint (Table 18.18). Later organic pottery types include Early Pueblo III black-on-white, indeterminate Pueblo III black-on-white, Pueblo III Transitional black-on-white (Fig. 18.6), as well as Late Pueblo III (Mesa Verde Black-on-white; Fig. 18.7). Most of the corrugated rim sherds from these contexts were assigned to Pueblo II–III corrugated, while Pueblo III corrugated was the second most common type. While red ware types include low frequencies of Tsegi Orange wares and White Mountain red wares, most of the red wares associated with this occupation are White Mountain Redware types such as St. Johns Black-on-red (Table 18.17).

Late Settlement Trends

Ceramic dating of Jackson Lake sites indicates a long sequence of occupation spanning most of the Pueblo II and all of the Pueblo III periods. Ceramic data from our investigations at Jackson Lake along with information accumulated during other studies in the lower La Plata Valley may be used to examine the nature of population change and settlement patterns in this area (Dykeman and Langenfeld 1987; Hannaford 1993; Morris 1919, 1939; Whalley 1980; Vierra 1993a). Many of the sites recorded during Nusbaum's (1935) survey represent late sites associated with communities organized around earlier established great houses, including the Jackson Lake

Table 18.11. Pottery types at Late Pueblo II sites; counts and percents.

	LA 37593		LA 37598		Total	
	Count	Col. %	Count	Col. %	Count	Col. %
Plain rim	1	0.0%	–	–	**1**	**0.0%**
Pueblo II corrugated	31	0.6%	1	0.4%	**32**	**0.6%**
Pueblo II–III corrugated	160	3.2%	4	1.7%	**164**	**3.2%**
Pueblo III corrugated	10	0.2%	–	–	**10**	**0.2%**
Plain gray	568	11.4%	19	8.3%	**587**	**11.3%**
Corrugated gray	2670	53.7%	136	59.4%	**2806**	**53.9%**
Incised corrugated	2	0.0%	–	–	**2**	**0.0%**
Red Mesa–style black-on-white	8	0.2%	–	–	**8**	**0.2%**
Pueblo II black-on-white	87	1.7%	12	5.2%	**99**	**1.9%**
Black Mesa–style black-on-white	1	0.0%	–	–	**1**	**0.0%**
Sosi-style black-on-white	1	0.0%	–	–	**1**	**0.0%**
Dogoszhi-style black-on-white	106	2.1%	1	0.4%	**107**	**2.1%**
Chaco-style black-on-white	3	0.1%	–	–	**3**	**0.1%**
Early Pueblo III black-on-white	5	0.1%	–	–	**5**	**0.1%**
Pueblo II–III black-on-white	616	12.4%	25	10.9%	**641**	**12.3%**
Pueblo III black-on-white	3	0.1%	–	–	**3**	**0.1%**
Painted black-on-white	8	0.2%	–	–	**8**	**0.2%**
Polished white	585	11.8%	28	12.2%	**613**	**11.8%**
Polished black-on-white	91	1.8%	3	1.3%	**94**	**1.8%**
Transitional Pueblo III black-on-white	2	0.0%	–	–	**2**	**0.0%**
Squiggle hachure black-on-white	7	0.1%	–	–	**7**	**0.1%**
Bluff Black-on-red	1	0.0%	–	–	**1**	**0.0%**
Deadmans Black-on-red	3	0.1%	–	–	**3**	**0.1%**
Mesa Verde Plain Red	1	0.0%	–	–	**1**	**0.0%**
Kayenta indeterminate red	2	0.0%	–	–	**2**	**0.0%**
Mogollon Smudged Brown	3	0.1%	–	–	**3**	**0.1%**
Total	**4975**	**100.0%**	**229**	**100.0%**	**5204**	**100.0%**

Table 18.12. Paint types on white ware at Late Pueblo II sites; counts and percents.

Site	None		Organic		Mineral		Total	
	Count	Row %	Count	Row %	Count	Row %	Count	Row %
LA 37593	580	38.3%	267	17.6%	667	44.1%	**1514**	**100.0%**
LA 37598	27	39.7%	25	36.8%	16	23.5%	**68**	**100.0%**
Total	**607**	**38.4%**	**292**	**18.5%**	**683**	**43.2%**	**1582**	**100.0%**

community (Hannaford 1993). Data and information resulting from more recent surveys and inventories of sites in the lower La Plata Valley (Dykeman and Langenfeld 1987; Whalley 1980) also provide information about site distributions and settlement patterns. This combination of data is used to examine late Anasazi population and settlement trends in the Jackson Lake community and surrounding areas.

While none of the components at Jackson Lake excavated during the La Plata Highway project date to the Early Pueblo II period, there is some evidence of population increase in this section of the La Plata Valley by the middle tenth century (Dykeman and Langenfeld 1987; Whalley 1980). This may reflect the movement of populations into the lower La Plata Valley during the early to middle tenth century. LA 50337, below the Jackson Lake community, was excavated previously, in 1985 (Vierra 1993a). Pottery from LA 50337 indicates an occupation during the later half of the tenth century (Vierra 1993a). Ceramic distributions from sites surveyed by Nusbaum indicate a scattered occupation in the Jackson Lake community and surrounding areas during the Early Pueblo II period. Of particular significance are eight

Figure 18.4d. Doghoszi Black-on-white bowl, two views, Late Pueblo II, LA 37593.

Table 18.13. Vessel forms by ware group, Late Pueblo II sites; counts and percents.

	Gray Ware		White Ware		Red Ware		Brown Smudged Ware		Total	
	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %
Indeterminate	2	0.1%	18	1.1%	–	–	–	–	**20**	**0.4%**
Bowl rim	–	–	152	9.5%	1	14.3%	1	33.3%	**154**	**3.0%**
Bowl body	–	–	492	30.9%	3	42.9%	2	66.7%	**497**	**9.6%**
Seed jar rim	12	0.3%	2	0.1%	1	14.3%	–	–	**15**	**0.3%**
Olla rim	3	0.1%	5	0.3%	–	–	–	–	**8**	**0.2%**
Olla neck	–	–	3	0.2%	–	–	–	–	**3**	**0.1%**
Cooking, storage rim	168	4.7%	7	0.4%	–	–	–	–	**175**	**3.4%**
Necked jar body	476	13.2%	39	2.4%	–	–	–	–	**515**	**9.9%**
Jar body	2940	81.6%	842	52.9%	2	28.6%	–	–	**3784**	**72.7%**
Ladle	–	–	7	0.4%	–	–	–	–	**7**	**0.1%**
Ladle bowl	–	–	15	0.9%	–	–	–	–	**15**	**0.3%**
Ladle handle	1	0.0%	6	0.4%	–	–	–	–	**7**	**0.1%**
Open-gourd dipper	–	–	3	0.2%	–	–	–	–	**3**	**0.1%**
Bird effigy	–	–	1	0.1%	–	–	–	–	**1**	**0.0%**
Total	**3602**	**100.0%**	**1592**	**100.0%**	**7**	**100.0%**	**3**	**100.0%**	**5204**	**100.0%**

Figure 18.5a. McElmo Black-on-white sherds, Early Pueblo III, LA 37591 (3, top), LA 37592 (8, bottom), LA 37598 (2, bottom right).

Figure 18.5b.McElmo Black-on-white bowls (two), Early Pueblo III, LA 37592.

sites between the third and fourth miles, and nine sites between the fifth and sixth miles from the La Plata–San Juan confluence. These clusters of sites may represent typical small communities from which the later Jackson Lake community may have developed. Whalley (1980), among others, also postulated that some of the great house communities in this area date to the early Pueblo II period.Despite the number of Jackson Lake components assigned to the Middle or Late Pueblo II periods during the La Plata Highway project, surprisingly few Pueblo II sites from the La Plata Valley had been previously described. LA 50337 did yield evidence of occupation during the later part of the Pueblo II period. Surveys of this area, however, indicate a large concentration of Pueblo II sites at

Figure 18.5c. McElmo Black-on-white ceramic bird effigy, Early Pueblo III, LA 37592.

Jackson Lake (Dykeman and Langenfeld 1987; Hannaford 1993; Whalley 1980). A total of 28 of the sites recorded by Nusbaum between Miles 5 and 6 north of the confluence of the San Juan and La Plata Rivers dated to this period. While the great houses in the Jackson Lake community have been attributed to the Pueblo III period (McKenna and Toll 1992), ceramic collections from the Nusbaum survey indicate that at least one great house was occupied during the Middle or Late Pueblo II period. It is quite likely that the occupants of the Pueblo II sites between Jackson Lake and the confluence closely interacted with groups in the Jackson Lake community. Thus, survey data (Dykeman and Langenfeld 1987; Hannaford 1993; Whalley 1980) indicate the emergence of a distinct community oriented around a great house at Jackson Lake by the early eleventh century.

The total number of Pueblo III sites in the Jackson Lake community and other areas of the lower La Plata is slightly smaller than that noted for the Pueblo II period, although some of the largest sites noted in the Jackson Lake locality date to the Pueblo III period. Based on collections from the Nusbaum survey, 13 sites in the 5–6 mile section were assigned to Early Pueblo III components, while 10 sites were assigned to the Late Pueblo III component. While a community organized around a great house definitely persisted at Jackson Lake during the Pueblo III period, the Pueblo III Jackson Lake community may have been smaller than other Late Pueblo III communities along the La Plata River, such as Barker Arroyo and Morris 41.

Thus, ceramic data support a long occupation at the Jackson Lake community, with no apparent break from the beginning of the eleventh and end of the thirteenth century. This could contradict scenarios invoking waves of influence from Chaco and Mesa Verde along with cycles of collapse, abandonment, and reoccupation often proposed to explain differences between Pueblo II and Pueblo components at local great house communities. The nature of the occupation at Jackson Lake appears to have been similar to that noted at other communities in the La Plata Valley, where similarly long and continual occupations have been noted (Dykeman and Langenfeld 1987; McKenna and Toll 1992; Whalley 1980).

Table 18.14. Pottery types at Early Pueblo III sites; counts and percents.

Site	LA 37591		LA 37592		LA 37593		LA 37598		LA 60749		Total	
	N	Col. %	N	Col. %	N	Col. %	N	Col. %	N	Col. %	N	Col. %
Pueblo II corrugated	–	–	1	0.1%	2	1.3%		0.0%	3	0.2%	**6**	**0.2%**
Pueblo II–III corrugated	–	–	5	0.5%	8	5.3%	2	0.6%	8	0.5%	**23**	**0.7%**
Pueblo III corrugated	–	–	3	0.3%	–	–	7	2.0%	3	0.2%	**13**	**0.4%**
Plain gray	63	16.0%	273	28.2%	16	10.6%	39	11.2%	236	15.7%	**627**	**18.7%**
Corrugated gray	172	43.8%	396	40.9%	104	68.9%	159	45.6%	719	48.0%	**1550**	**46.1%**
Mud ware	–	–	2	0.2%	–	–	–	–	–	–	**2**	**0.1%**
Red Mesa–style black-on-white	–	–	–	–	1	0.7%	–	–	1	0.1%	**2**	**0.1%**
Pueblo II black-on-white	2	0.5%	30	3.1%	2	1.3%	2	0.6%	11	0.7%	**47**	**1.4%**
Sosi-style black-on-white	–	–	–	–	–	–	–	–	9	0.6%	**9**	**0.3%**
Dogoszhi-style black-on-white	2	0.5%	15	1.5%	–	–	–	–	12	0.8%	**29**	**0.9%**
Early Pueblo III black-on-white	6	1.5%	9	0.9%	2	1.3%	1	0.3%	20	1.3%	**38**	**1.1%**
Late Pueblo III black-on-white	–	–	1	0.1%	–	–	–	–	3	0.2%	**4**	**0.1%**
Pueblo II–III black-on-white	42	10.7%	109	11.2%	3	2.0%	19	5.4%	118	7.9%	**291**	**8.7%**
Pueblo III black-on-white	16	4.1%	13	1.3%	–	–	5	1.4%	26	1.7%	**60**	**1.8%**
Painted black-on-white	–	–	–	–	–	–	–	–	1	0.1%	**1**	**0.0%**
Polished white	76	19.3%	105	10.8%	8	5.3%	68	19.5%	224	14.9%	**481**	**14.3%**
Polished black-on-white	12	3.1%	4	0.4%	4	2.6%	6	1.7%	83	5.5%	**109**	**3.2%**
Transitional Pueblo III black-on-white	–	–	1	0.1%	–	–	30	8.6%	15	1.0%	**46**	**1.4%**
Squiggle hachure black-on-white	2	0.5%	1	0.1%	1	0.7%	8	2.3%	1	0.1%	**13**	**0.4%**
Deadmans Black-on-red	–	–	1	0.1%	–	–	–	–	–	–	**1**	**0.0%**
Puerco Black-on-red	–	–	–	–	–	–	–	–	2	0.1%	**2**	**0.1%**
Wingate Polychrome	–	–	–	–	–	–	–	–	2	0.1%	**2**	**0.1%**
Kayenta indeterminate red	–	–	–	–	–	–	3	0.9%	1	0.1%	**4**	**0.1%**
Mogollon Woodruff Smudged	–	–	–	–	–	–	–	–	1	0.1%	**1**	**0.0%**
Total	**393**	**100.0%**	**969**	**100.0%**	**151**	**100.0%**	**349**	**100.0%**	**1499**	**100.0%**	**3361**	**100.0%**

Table 18.15. Paint types on white ware at Early Pueblo III sites; counts and percents.

	LA 37591		LA 37592		LA 37593		LA 37598		LA 60749		Total	
	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %
None	76	48.1%	105	36.3%	8	38.1%	69	49.6%	225	42.9%	**483**	**42.7%**
Organic	64	40.5%	128	44.3%	3	14.3%	50	36.0%	186	35.5%	**431**	**38.1%**
Mineral	18	11.4%	56	19.4%	10	47.6%	20	14.4%	113	21.6%	**217**	**19.2%**
Total	**158**	**100.0%**	**289**	**100.0%**	**21**	**100.0%**	**139**	**100.0%**	**524**	**100.0%**	**1131**	**100.0%**

Table 18.16. *Vessel forms by ware group, Early Pueblo III; counts and percents.*

	Gray Ware		White Ware		Red Ware		Brown Smudged Ware		Total	
	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %
Indeterminate	5	0.2%	6	0.5%	–	–	–	–	**11**	**0.3%**
Bowl rim	1	0.0%	116	10.3%	3	33.3%	–	–	**120**	**3.6%**
Bowl body	–	–	513	45.4%	3	33.3%	1	100.0%	**517**	**15.4%**
Olla rim	–	–	3	0.3%	–	–	–	–	**3**	**0.1%**
Olla neck	–	–	1	0.1%	–	–	–	–	**1**	**0.0%**
Cooking, storage rim	103	4.6%	7	0.6%	1	11.1%	–	–	**111**	**3.3%**
Pitcher	–	–	1	0.1%	–	–	–	–	**1**	**0.0%**
Necked jar body	232	10.4%	32	2.8%	–	–	–	–	**264**	**7.9%**
Canteen	1	0.0%	–	0.0%	–	–	–	–	**1**	**0.0%**
Jar body	1874	84.4%	436	38.6%	2	22.2%	–	–	**2312**	**68.8%**
Ladle	–	–	5	0.4%	–	–	–	–	**5**	**0.1%**
Ladle bowl	–	–	4	0.4%	–	–	–	–	**4**	**0.1%**
Ladle handle	1	0.0%	3	0.3%	–	–	–	–	**4**	**0.1%**
Open-gourd dipper	–	–	3	0.3%	–	–	–	–	**3**	**0.1%**
Miniature jar body	4	0.2%	–	–	–	–	–	–	**4**	**0.1%**
Total	**2221**	**100.0%**	**1130**	**100.0%**	**9**	**100.0%**	**1**	**100.0%**	**3361**	**100.0%**

Reconstructions of settlement by groups from Chaco, abandonment, and then settlement by people from Mesa Verde during the thirteenth century have been based on investigations at large outliers such as Salmon and Aztec Ruins (Irwin-Williams 1983; Irwin-Williams and Shelley 1980; Lister and Lister 1990; Morris 1928; Reed 2006a). Other examinations of data from major outliers such as Salmon Ruins and Aztec Ruins, however, indicate a longer and more continual occupation (Franklin 1980; McKenna and Toll 1992). Salmon was originally described as having two distinct occupations (Irwin-Williams and Shelley 1980; Reed 2006a): a "Primary" occupation dating from the late eleventh to the early twelfth century, thought to represent the initial occupation established by Chacoan groups; and a "Secondary" occupation during the thirteenth century, representing a reoccupation by Mesa Verde groups (Adams 1980; Reed 2006a, 2006b). A similar sequence and gap in occupation was noted at the Box B site, a small site along the San Juan River east of Farmington (Mills 1991). The occupational gap at these sites has sometimes been attributed to drought conditions thought to have lasted from AD 1130 to 1180, which forced Anasazi groups to abandon this area of the San Juan Valley and seek temporary refuge in the Mesa Verde area (Hogan 1991). It has also been proposed that as climatic conditions improved, these groups returned to their former homes.

Not as commonly known is ceramic evidence of occupations in a series of rooms excavated at Salmon Ruins with a ceramic sequence that is clearly transitional between the primary and secondary occupations as originally defined in the course of the Salmon project (Franklin 1980). Thus, small groups of people continued to occupy this site throughout the twelfth century and into the thirteenth century, as evidenced by a long sequence of development from Mancos Black-on-white to McElmo Black-on-white to Mesa Verde Black-on-white (Franklin 1980; McKenna and Toll 1992). While the population residing at Salmon Ruins at that time appears to have been fairly small, a number of other sites along the San Juan River exhibit occupations spanning the twelfth century, creating further doubt that this area was ever abandoned during the twelfth century. There may have been, however, a decline and reorganization of population at that time. Recent dating of tree-rings from the various ruin groups associated with the Aztec Ruins community also indicate sequences of construction covering the period from the mid-eleventh through most of the thirteenth century (McKenna and Toll 1992; Stein and McKenna 1988). Limited ceramic and architectural evidence also indicates a long and continual

Table 18.17. Pottery types at Late Pueblo III sites; counts and percents.

	LA 37591		LA 37592		LA 37593		Total	
	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %
Plain rim	–	–	1	0.0%	–	–	**1**	**0.0%**
Fillet rim	–	–	–	–	5	7.8%	**5**	**0.0%**
Pueblo II corrugated	8	0.3%	14	0.1%	–	–	**22**	**0.1%**
Pueblo II–III corrugated	26	0.9%	68	0.4%	–	–	**94**	**0.5%**
Pueblo III corrugated	17	0.6%	31	0.2%	–	–	**48**	**0.2%**
Plain gray	315	10.9%	2666	16.1%	16	25.0%	**2997**	**15.4%**
Corrugated gray	1318	45.5%	8708	52.8%	14	21.9%	**10040**	**51.6%**
Mud ware	2	0.1%	22	0.1%	–	–	**24**	**0.1%**
Incised corrugated	–	–	2	0.0%	–	–	**2**	**0.0%**
Basketmaker III Black-on-white	–	–	2	0.0%	–	–	**2**	**0.0%**
Red–Mesa style black-on-white	–	–	7	0.0%	–	–	**7**	**0.0%**
Pueblo II black-on-white	29	1.0%	284	1.7%	11	17.2%	**324**	**1.7%**
Sosi-style black-on-white	–	–	3	0.0%	–	–	**3**	**0.0%**
Dogoszhi-style black-on-white	12	0.4%	65	0.4%	1	1.6%	**78**	**0.4%**
Chaco-style black-on-white	1	0.0%	1	0.0%	–	–	**2**	**0.0%**
Early Pueblo III black-on-white	15	0.5%	129	0.8%	–	–	**144**	**0.7%**
Late Pueblo III black-on-white	64	2.2%	82	0.5%	9	14.1%	**155**	**0.8%**
Pueblo II–III black-on-white	378	13.0%	2158	13.1%	3	4.7%	**2539**	**13.0%**
Pueblo III black-on-white	276	9.5%	545	3.3%	–	–	**821**	**4.2%**
Painted black-on-white	3	0.1%	2	0.0%	–	–	**5**	**0.0%**
Polished white	319	11.0%	1428	8.7%	5	7.8%	**1752**	**9.0%**
Polished black-on-white	96	3.3%	55	0.3%	–	–	**151**	**0.8%**
Transitional Pueblo III black-on-white	12	0.4%	75	0.5%	–	–	**87**	**0.4%**
Squiggle hachure black-on-white	4	0.1%	16	0.1%	–	–	**20**	**0.1%**
Mesa Verde indeterminate red	–	–	3	0.0%	–	–	**3**	**0.0%**
Deadmans Black-on-red	1	0.0%	3	0.0%	–	–	**4**	**0.0%**
Mesa Verde Plain Red	–	–	2	0.0%	–	–	**2**	**0.0%**
Mesa Verde Black-on-red	–	–	1	0.0%	–	–	**1**	**0.0%**
Cibola indeterminate red ware	–	–	63	0.4%	–	–	**63**	**0.3%**
Puerco Black-on-red	–	–	12	0.1%	–	–	**12**	**0.1%**
Wingate Black-on-red	–	–	22	0.1%	–	–	**22**	**0.1%**
St. Johns Black-on-red	–	–	2	0.0%	–	–	**2**	**0.0%**
Kayenta indeterminate red	2	0.1%	–	–	–	–	**2**	**0.0%**
Medicine Black-on-orange	–	–	1	0.0%	–	–	**1**	**0.0%**
Tusayan Polychrome	–	–	1	0.0%	–	–	**1**	**0.0%**
Citadel Polychrome	–	–	3	0.0%	–	–	**3**	**0.0%**
Tsegi Orange	–	–	7	0.0%	–	–	**7**	**0.0%**
Tsegi Black-on-orange	–	–	2	0.0%	–	–	**2**	**0.0%**
Kayenta Plain Black-on-red	–	–	1	0.0%	–	–	**1**	**0.0%**
Mogollon Smudge Brown	–	–	21	0.1%	–	–	**21**	**0.1%**
Total	**2898**	**100.0%**	**16508**	**100.0%**	**64**	**100.0%**	**19470**	**100.0%**

Table 18.18. Paint types of white wares from Late Pueblo III sites; counts and percents.

	LA 37591		LA 37592		LA 37593		Total	
	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %
None	333	27.4%	1427	29.2%	5	17.2%	**1765**	**28.8%**
Organic	803	66.1%	2993	61.2%	9	31.0%	**3805**	**62.1%**
Mineral	79	6.5%	467	9.6%	15	51.7%	**561**	**9.2%**
Total	**1215**	**100.0%**	**4887**	**100.0%**	**29**	**100.0%**	**6131**	**100.0%**

Table 18.19. Vessel forms by ware group, Late Pueblo III sites; counts and percents.

	Gray Ware		White Ware		Red Ware		Brown Smudged Ware		Total	
	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %
Indeterminate	6	0.0%	37	0.6%	–	–	–	–	**43**	**0.2%**
Bowl rim	9	0.1%	823	13.5%	32	25.4%	3	14.3%	**867**	**4.5%**
Bowl body	3	0.0%	2724	44.7%	82	65.1%	18	85.7%	**2827**	**14.5%**
Seed jar rim	1	0.0%	2	0.0%	–	–	–	–	**3**	**0.0%**
Olla rim	2	0.0%	17	0.3%	–	–	–	–	**19**	**0.1%**
Olla neck	–	–	1	0.0%	–	–	–	–	**1**	**0.0%**
Cooking, storage rim	615	4.6%	37	0.6%	–	–	–	–	**652**	**3.3%**
Pitcher	–	–	12	0.2%	–	–	–	–	**12**	**0.1%**
Necked jar body	1164	8.8%	129	2.1%	–	–	–	–	**1293**	**6.6%**
Mug	–	–	2	0.0%	–	–	–	–	**2**	**0.0%**
Canteen	1	0.0%	2	0.0%	–	–	–	–	**3**	**0.0%**
Kiva jar rim	-	0.0%	2	0.0%	–	–	–	–	**2**	**0.0%**
Jar body	11,385	86.0%	2031	33.3%	11	8.7%	–	–	**13,427**	**69.0%**
Bowl or jar body	–	–	6	0.1%	1	0.8%	–	–	**7**	**0.0%**
Ladle	1	0.0%	16	0.3%	–	–	–	–	**17**	**0.1%**
Ladle bowl	1	0.0%	86	1.4%	–	–	–	–	**87**	**0.4%**
Ladle handle	7	0.1%	121	2.0%	–	–	–	–	**128**	**0.7%**
Open-gourd dipper	–	–	31	0.5%	–	–	–	–	**31**	**0.2%**
Bird effigy	1	0.0%	2	0.0%	–	–	–	–	**3**	**0.0%**
Indeterminate effigy	–	–	2	0.0%	–	–	–	–	**2**	**0.0%**
Figurine	1	0.0%	–	–	–	–	–	–	**1**	**0.0%**
Miniature bowl	16	0.1%	2	0.0%	–	–	–	–	**18**	**0.1%**
Miniature necked jar	–	–	1	0.0%	–	–	–	–	**1**	**0.0%**
Miniature other form	1	0.0%	–	–	–	–	–	–	**1**	**0.0%**
Miniature jar body	16	0.1%	1	0.0%	–	–	–	–	**17**	**0.1%**
Keyhole handle	1	0.0%	1	0.0%	–	–	–	–	**2**	**0.0%**
Tray rim	2	0.0%	–	–	–	–	–	–	**2**	**0.0%**
Double-flared bowl	–	–	2	0.0%	–	–	–	–	**2**	**0.0%**
Total	**13,233**	**100.0%**	**6090**	**100.0%**	**126**	**100.0%**	**21**	**100.0%**	**19,470**	**100.0%**

occupation of the Aztec community (McKenna and Toll 1992). Thus, the evidence of long and continual occupation at Jackson Lake and other La Plata communities seems to be the norm rather than the exception for communities in the Totah.

Ceramic Patterns in Late Occupations

Ceramic dating of late contexts at Jackson Lake allows for the examination of change in production, decoration, exchange, and vessel use at this great house community. This information is used to test models concerning great house communities in this area. Sudden or dramatic changes in stylistic attributes may reflect abandonments and reoccupations as well as regional collapses or shifts such as those previously discussed. More gradual changes may indicate fluctuating responses of fairly self-sufficient and isolated populations to local changes. Thus, the remaining discussions examine the nature of change in decoration, technology, frequency of nonlocal pottery, and vessel forms.

Stylistic Trends

Stylistic data may be used to test regional models that argue for shifting influences from the Chaco Canyon and Mesa Verde areas (Irwin Williams and Shelley 1980; Judge 1991; Lister and Lister 1990). Previous discussions of ceramic change at northern great house sites have attempted to compare white wares from contexts dating to the Pueblo II to Pueblo III periods. Many interpretations involving the nature of both continuity of occupation and regional influences at great house communities north of the San Juan River emphasize the differences between Pueblo II mineral-painted types such as Mancos Black-on-white and Late Pueblo III organic-painted types such as Mesa

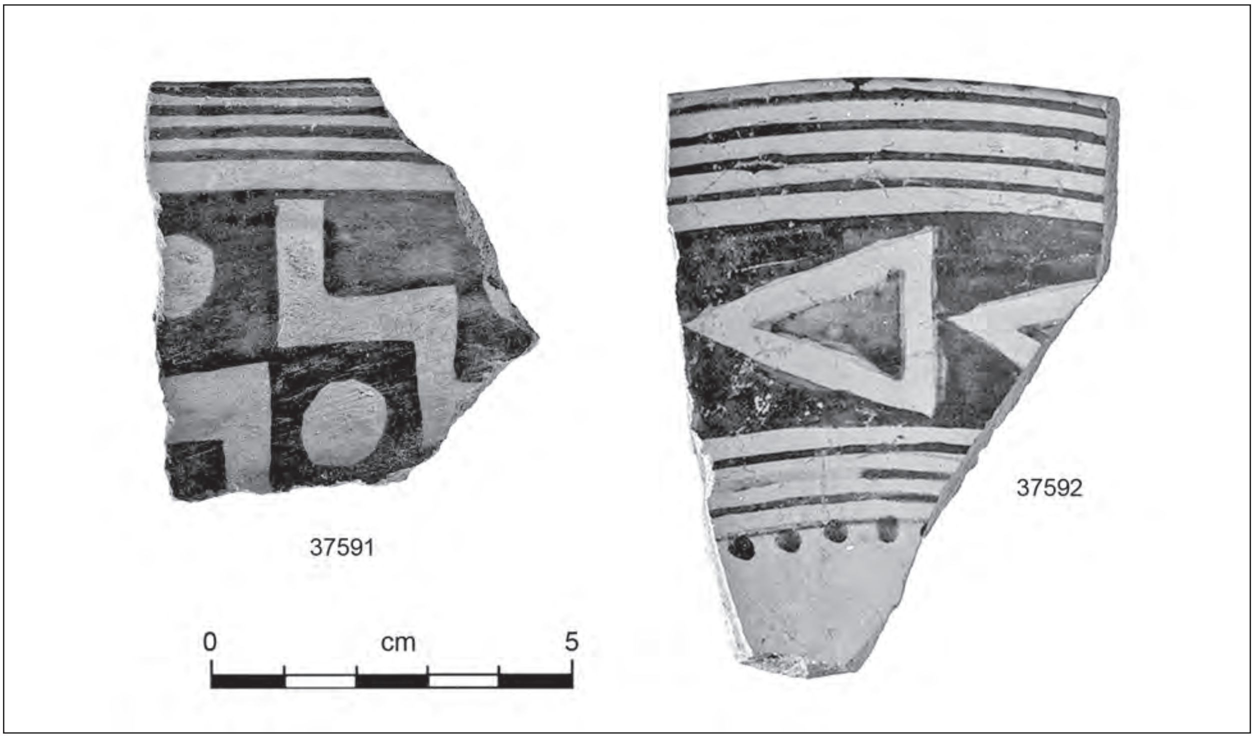


Figure 18.6. Transitional Black-on-white sherds, Pueblo III, LA 37591 (left), LA 37592 (right).

Verde Black-on-white (Wilson 1996). Since early research by Morris (1939) and Shepard (1939) in the La Plata Valley, the shift from mineral paint to organic paint was generally regarded as sudden and dramatic change. Thus, differences in designs and paint technology associated with different Pueblo II and Pueblo III types was described as having developed along divergent lines from a common source. The occurrence of mineral-painted pottery at large Pueblo II great houses north of the San Juan River was interpreted as reflecting Chacoan occupations (Bradley 1994; Irwin-Williams and Shelley 1980; Martin 1936; Morris 1939). Distinctive and well-made organic-painted pottery such as that represented by Mesa Verde Black-on-white at the same or nearby great houses was often interpreted as representing the subsequent migration of groups from the areas to the north such as the Mesa Verde area. Unfortunately, such interpretations were usually not based on studies of pottery from dated contexts. In addition, there were few attempts to document components intermediate between Pueblo II components dominated by mineral-painted white wares and Pueblo III components dominated by organic-painted white wares. The question of whether the shift from mineral to organic pigment white-ware pottery was abrupt is critical to resolving issues concerning the relationship of late Anasazi occupations in subareas of this region. Despite the occurrence of a relatively large number of large Pueblo II and Pueblo III communities organized around great houses in the La Plata Valley and adjacent areas along the Animas and San Juan Rivers (McKenna and Toll 1992; Toll 1993; Dykeman and Langenfeld 1987; Whalley 1980), the view that developments in these communities were peripheral to those in the better known regions of Chaco Canyon and Mesa Verde has persisted (Irwin-Williams and Shelley 1980; Lister and Lister 1990; Morris 1928, 1939; Whalley 1980). Thus, Pueblo II communities dominated by mineral-painted pottery types are often described as having participated in regional systems ultimately organized and controlled through Chaco Canyon (Irwin-Williams and Shelley 1990; Lekson 1991; Lister and Lister 1990; Judge 1991). A related assumption is that this system collapsed during the mid-twelfth century, resulting in the abandonment

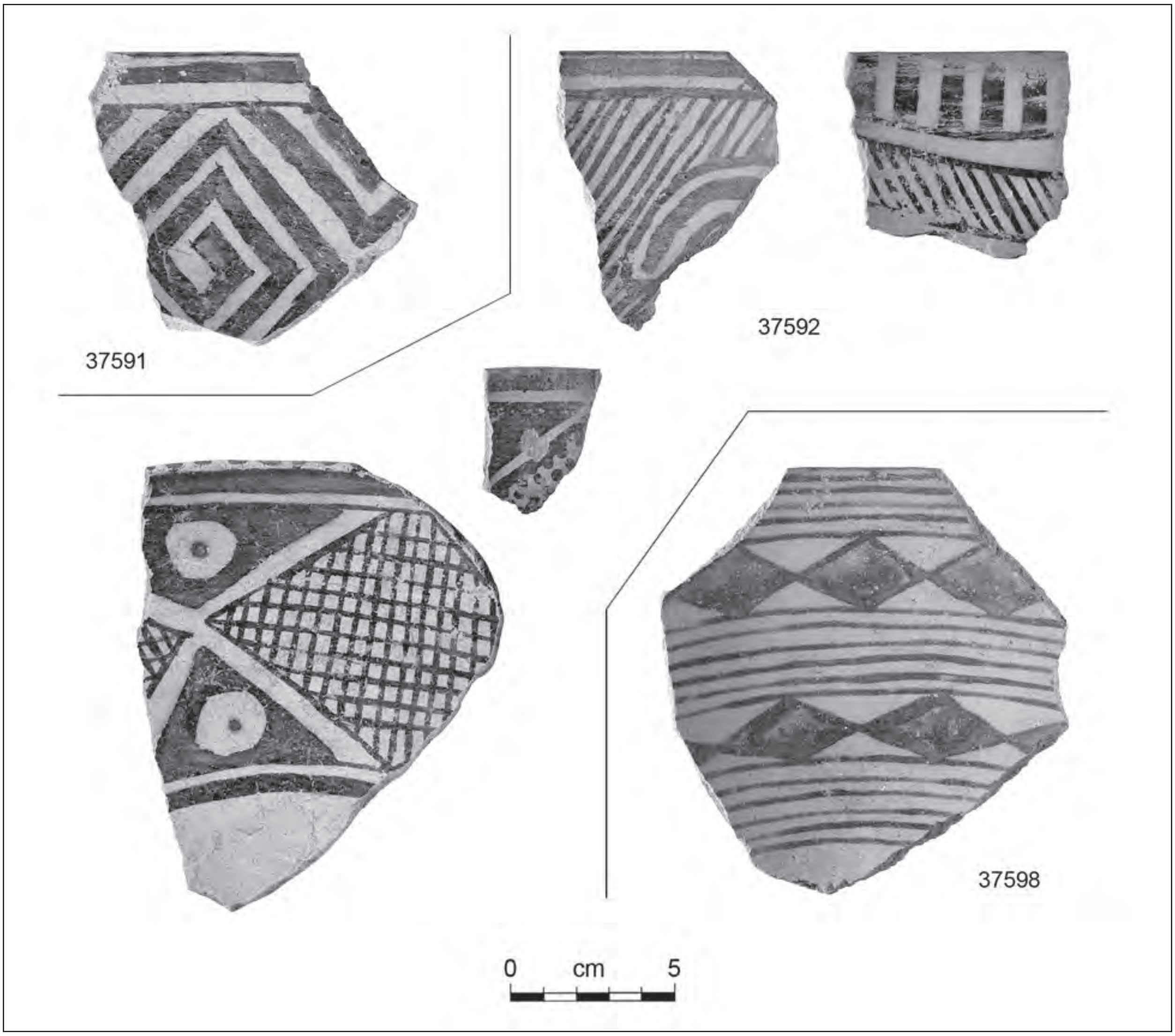


Figure 18.7. Mesa Verde Black-on-white sherds, Late Pueblo III, LA 37591 (top left); LA 37592 (4, center), LA 37598 (bottom right).

of earlier established great houses (Judge 1991). Another view, inspired by the common occurrence of organic-painted Mesa Verde Black-on-white pottery at later contexts in earlier established great houses, is that its introduction reflects the movement and influence of groups from the Mesa Verde country, who introduced distinct organic-painted pottery to groups in areas of the San Juan River to the south.

Thus, the proponents of these related scenarios seem to assume that the shift from painted decorations executed in mineral-based paint to organic pigment in outliers north of the San Juan River resulted from a shift in influence from the Chaco Canyon to the Mesa Verde area. If such models are correct, ceramic change associated with the use of different pigments should be sudden, and significant frequencies of intrusive ceramics associated with major redistribution centers of the time should be associated with these changes.

The nature of such changes is partially documented through characterization of Pueblo II and Pueblo III white wares recovered during the La Plata Highway project. Some of the attributes recorded during basic analysis of all sherds recovered by the project provide information concerning basic technological stylistic change. The supplementary "technological/stylistic analysis" system implemented with sub-samples of white wares assigned to various ceramic types provides additional data relating to such change. This analysis recorded information for 3,518 painted white-ware rim sherds from La Plata Highway sites dating from the Early to Late Pueblo III period. Data were recorded for 971 sherds from Jackson Lake community sites. Attributes recorded during this analysis included sherd thickness, surface polish, slip, core, surface and paste color, refired surface and paste color, rim form, rim and body decoration, design symmetry and element connections, design motifs, number of motifs per sherd, motif filling, line thickness, and distance between lines (Wilson 1996). These data were used to examine stylistic trends between types and through time. Unfortunately, the number of sherds examined from Jackson Lake subject to stylistic analysis from dated contexts was relatively small, and contexts associated with well-dated Pueblo III contexts were generally lacking. Comparison of change between types still provides some important information concerning the nature of change at these communities. Stylistically based comparisons may help determine the validity and nature of ceramic type categories identified during this analysis as well as providing additional information concerning the scope and nature of sherds assigned to different types important in ceramic dating. In some cases, data from stylistic analysis may be used to supplement arguments based on type distributions.

One of the basic questions addressed through these data was whether the series of changes associated with a shift from the mineral-painted Mancos Black-on-white to organic-painted Mesa Verde Black-on-white were sudden and dramatic or more gradual. This involved monitoring changes in various attributes reflecting paint pigment type and decorative style.

The rate of the shift from mineral to organic paint was documented by comparing the frequency of paint types for painted white wares from dated contexts at Jackson Lake (Tables 18.4, 18.9, 18.12, 18.15, 18.18). These distributions indicate a very gradual shift from mineral-dominated to organic-dominated white wares, similar to that noted at sites in Mesa Verde National Park (Hayes 1964). The case for a gradual change in pigment use is also supported by the observation that organic paint is better and more consistently executed during the later occupations, suggesting technological experimentation during earlier periods. Thus, an examination of changes in pigment frequencies appears to support models of a gradual rather than a sudden shift from a white ware technology dominated by mineral-painted forms to those dominated by organic-painted vessels.

Another trend with some stylistic ramifications that was examined for all sherds analyzed concerns the total coverage of painted decoration on vessels. A measurement of the relative amount of decoration on white ware vessels may be achieved by comparing the frequency of unpainted sherds to painted sherds. Such a measurement indicates an increase in the overall amount of space with painted decoration on white wares through time (Table 18.4). There was a slight increase in the frequency of decorated sherds from Middle Pueblo II to the Late Pueblo II assemblages, although this frequency does not change for Early Pueblo III contexts. There is a significant increase in the total number of painted white ware sherds at Late Pueblo III contexts. This trend is not that surprising in view of previous descriptions and illustrations of Pueblo II and Pueblo III types from the Northern San Juan, which indicate later painted types appear to exhibit painted decorations over a wider proportion of the total vessel.

The remaining trends discussed relate to stylistic data recorded for white wares. While data illustrating the distribution of traits and types is presented, most of the discussions focus on distributions between types, due to the small sample of sherds from dated contexts. Ultimately, the inclusion of data involving the larger number of sherds from sites at Barker Arroyo, just to the north, allows a more complete analysis of basic stylistic trends discussed here (see Wilson 1996 for a discussion of the combined database).

Specific vessel rim attributes recorded during stylistic analysis and discussed here include thickness (Tables 18.20, 18.21), presence and thickness of slip (Table 18.22), rim form (Tables 18.23, 18.24), rim decoration (Tables 18.25, 18.26), and use of line as a design element (Tables 18.27, 18.28). Examination of the distribution of traits across types indicates several differences. Rim forms associated with Pueblo II contexts tend to be tapered or rounded, and there was an increase first to more rounded and then flat rim shapes (Tables

Table 18.20. White ware pottery type by rim thickness; counts and percents.

Ceramic Type		Thickness (mm)							
		3.0	4.0	5.0	6.0	7.0	8.0	9.0 and 10.0	Total
Red Mesa Black-on-white	Count	0	0	7	0	2	0	0	**9**
	Row %	0.0%	0.0%	77.8%	0.0%	22.2%	0.0%	0.0%	**100.0%**
Pueblo II black-on-white	Count	1	47	170	73	11	1	0	**303**
	Row %	0.3%	15.5%	56.1%	24.1%	3.6%	0.3%	0.0%	**100.0%**
Early Pueblo III black-on-white	Count	1	18	83	81	17	2	0	**202**
	Row %	0.5%	8.9%	41.1%	40.1%	8.4%	1.0%	0.0%	**100.0%**
Late Pueblo III black-on-white	Count	0	1	33	65	26	0	0	**125**
	Row %	0.0%	0.8%	26.4%	52.0%	20.8%	0.0%	0.0%	**100.0%**
Pueblo III black-on-white	Count	1	8	79	107	33	0	1	**229**
	Row %	0.4%	3.5%	34.5%	46.7%	14.4%	0.0%	0.4%	**100.0%**
Transitional Pueblo III black-on-white	Count	0	2	45	48	9	0	0	**104**
	Row %	0.0%	1.9%	43.3%	46.2%	8.7%	0.0%	0.0%	**100.0%**
Total Count		**3**	**76**	**417**	**374**	**98**	**3**	**1**	**972**
Percent of Total		**0.3%**	**7.8%**	**42.9%**	**38.5%**	**10.1%**	**0.3%**	**0.1%**	**100.0%**

Table 18.21. White ware rim thickness by time period; counts and percents.

Period		Thickness (mm)				
		3.0 and 4.0	5.0	6.0	7.0	Total
Middle Pueblo II	Count	10	39	20	8	**77**
	Row %	13.0%	50.6%	26.0%	10.4%	**100.0%**
Late Pueblo II	Count	8	24	13	3	**48**
	Row %	16.7%	50.0%	27.1%	6.3%	**100.0%**
Early Pueblo III	Count	0	3	1	2	**6**
	Row %	0.0%	50.0%	16.7%	33.3%	**100.0%**
Total Count		**18**	**66**	**34**	**13**	**131**
Percent of Total		**13.7%**	**42.7%**	**26.0%**	**9.9%**	**100.0%**

Table 18.22. White ware pottery type by slip type; counts and percents.

Ceramic Type		Unslipped	Wash or Thin Slip	Thick Slip	Total
Red Mesa–style black-on-white	Count	7	2	0	**9**
	Row %	77.8%	22.2%	0.0%	**100.0%**
Pueblo II black-on-white	Count	204	87	12	**303**
	Row %	67.3%	28.7%	4.0%	**100.0%**
Early Pueblo III black-on-white	Count	124	59	19	**202**
	Row %	61.4%	29.2%	9.4%	**100.0%**
Late Pueblo III black-on-white	Count	70	41	14	**125**
	Row %	56.0%	32.8%	11.2%	**100.0%**
Pueblo III black-on-white	Count	143	68	18	**229**
	Row %	62.4%	29.7%	7.9%	**100.0%**
Transitional Pueblo III black-on-white	Count	61	28	15	**104**
	Row %	58.7%	26.9%	14.4%	**100.0%**
Total Count		**609**	**285**	**78**	**972**
Percent of Total		**62.7%**	**29.3%**	**7.8%**	**100.0%**

Table 18.23. White ware pottery type/time period by rim form; counts and percents.

Ceramic Type/ Time Period		Indeterminate	Tapered	Rounded	Flat	Angled	Other	Total
Red Mesa	Count	0	1	6	2	0	0	**9**
Black-on-white	Row %	0.0%	11.1%	66.7%	22.2%	0.0%	0.0%	**100.0%**
Pueblo II	Count	33	78	115	69	2	6	**303**
black-on-white	Row %	10.9%	25.7%	38.0%	22.8%	0.7%	2.0%	**100.0%**
Early Pueblo III	Count	15	10	65	111	0	1	**202**
black-on-white	Row %	7.4%	5.0%	32.2%	55.0%	0.0%	0.5%	**100.0%**
Late Pueblo III	Count	2	2	21	96	1	3	**125**
black-on-white	Row %	1.6%	1.6%	16.8%	76.8%	0.8%	2.4%	**100.0%**
Pueblo III	Count	6	7	58	158	0	0	**229**
black-on-white	Row %	2.6%	3.1%	25.3%	69.0%	0.0%	0.0%	**100.0%**
Transitional Pueblo II	Count	3	3	28	69	0	1	**104**
black-on-white	Row %	2.9%	2.9%	26.9%	66.3%	0.0%	1.0%	**100.0%**
Total Count		**59**	**101**	**293**	**505**	**3**	**11**	**972**
Percent of Total		**6.1%**	**10.4%**	**30.1%**	**52.0%**	**0.3%**	**1.1%**	**100.0%**

Table 18.24. White ware rim form by time period; counts and percents.

Time Period		Indeterminate	Tapered	Rounded	Flat	Angled	Other	Total
Middle Pueblo II	Count	10	13	38	13	1	2	**77**
	Row %	13.0%	16.9%	49.4%	16.9%	1.3%	2.6%	**100.0%**
Late Pueblo III black-on-white	Count	6	14	8	20	0	0	**48**
	Row %	12.5%	29.2%	16.7%	41.7%	0.0%	0.0%	**100.0%**
Early Pueblo III	Count	0	0	3	3	0	0	**6**
	Row %	0.0%	0.0%	50.0%	50.0%	0.0%	0.0%	**100.0%**
Total Count		**16**	**27**	**49**	**36**	**1**	**2**	**131**
Percent of Total		**12.2%**	**20.6%**	**37.4%**	**27.5%**	**0.8%**	**1.5%**	**100.0%**

18.23, 18.24). This change is associated with an increase in the thickness of wall. During the Middle Pueblo II period, rim sherds were overwhelmingly unpainted or solidly painted (Tables 18.25, 18.26), and there was a gradual increase in ticked dots or dashes, and then more complex ticked designs through time. Design elements and layouts also become more formalized through time. Patterns in line thickness, line spacing, and motif type and interaction also indicate a series of gradual changes through time.

The nature of changes in the various attributes examined varies, since different traits change at different rates and on different schedules. Dating and stylistic data from Jackson Lake sites along with similar data from Barker Arroyo sites indicate a long continuum of development from Pueblo II mineral-painted types to Late Pueblo III types. These data seem to best support models of continual occupation and development, rather than those suggesting a series of disruptions and waves of influence.

Exchange and Production

Previous investigations at late Anasazi sites in the San Juan Basin and along the La Plata, Animas, and San Juan drainages have examined various regional patterns of pottery production and exchange (Blinman and Wilson 1993; Franklin 1980, 1991; Mathien 1993; Whalley 1980; Wilson 1980, 1985). Many of these studies have interpreted distributions of nonlocal ceramics and artifact types at Pueblo II sites as reflecting influence and control from a large panregional system centered in Chaco Canyon, where very high frequencies of nonlocal pottery have been noted (Mathien 1993; Toll 1981, 1984, 1985; Toll and McKenna 1987, 1997; Blinman and Wilson 1993). In addition, high frequencies of similar

Table 18.25. White ware pottery type/time period by rim decoration; counts and percents.

Ceramic Type/Period		Indeterminate	Undecorated	Solid Paint	Ticked Dots	Ticked Other	Total
Red Mesa–style black-on-white	Count	1	2	6	0	0	**9**
	Row %	11.1%	22.2%	66.7%	0.0%	0.0%	**100.0%**
Pueblo II black-on-white	Count	45	156	85	10	7	**303**
	Row %	14.9%	51.5%	28.1%	3.3%	2.3%	**100.0%**
Early Pueblo III black-on-white	Count	20	43	10	114	15	**202**
	Row %	9.9%	21.3%	5.0%	56.4%	7.4%	**100.0%**
Late Pueblo III black-on-white	Count	4	13	5	85	18	**125**
	Row %	3.2%	10.4%	4.0%	68.0%	14.4%	**100.0%**
Pueblo III black-on-white	Count	17	53	11	120	28	**229**
	Row %	7.4%	23.1%	4.8%	52.4%	12.2%	**100.0%**
Transitional Pueblo II black-on-white	Count	13	14	2	65	10	**104**
	Row %	12.5%	13.5%	1.9%	62.5%	9.6%	**100.0%**
Total Count		**100**	**281**	**119**	**394**	**78**	**972**
Percent of Total		**10.3%**	**28.9%**	**12.2%**	**40.5%**	**8.0%**	**100.0%**

Table 18.26. White ware rim decoration by time period; counts and percents.

Time Period		Indeterminate	Undecorated	Solid Paint	Ticked Dots	Ticked Other	Total
Middle Pueblo II	Count	13	31	30	3	0	**77**
	Row %	16.9%	40.3%	39.0%	3.9%	0.0%	**100.0%**
Late Pueblo II	Count	10	20	1 3	4	1	**48**
	Row %	20.8%	41.7%	–	8.3%	2.1%	**100.0%**
Early Pueblo III	Count	0	1	2	3	0	**6**
	Row %	0.0%	16.7%	33.3%	50.0%	0.0%	**100.0%**
Total Count		**23**	**52**	**45**	**10**	**1**	**131**
Percent of Total		**17.6%**	**39.7%**	**34.4%**	**7.6%**	**0.1%**	**100.0%**

nonlocal pottery types at Pueblo II great house communities outside Chaco Canyon and decreases in frequencies at later Pueblo III components in the same areas have led to conjecture concerning the role of Pueblo II great houses in a Chaco-centered exchange system (Lekson 1991; Irwin-Williams and Shelley 1980; Judge 1991; Mathien 1993; Toll 1984; Whalley 1980).

It is important to note that the frequency of nonlocal ceramics at various great houses north of Chaco may be more variable than is sometimes assumed (Wilson 1993). Thus, the occurrence of a community organized around a great house does not necessarily indicate strong participation in previously defined interregional exchange networks. Ceramic data from the Jackson Lake community are used here to examine both local and regional patterns of ceramic production and exchange at a long-occupied community.

Given the wide use of similar decorative styles and technologies throughout much of the northern Anasazi country (Toll et al. 1992), pottery produced in different regions and localities is usually best distinguished by the presence of temper resources known to have been used in certain locations. Even resource-based distinctions of nonlocal pottery are often difficult because of the widespread occurrence and use of similar resources found in various areas of the northern Anasazi. Still, it may be possible to identify pockets of distinct temper use at various geographic scales, allowing for at least the partial documentation of the movement of pottery vessels from other areas.

The clay and temper resources used by potters in the La Plata Valley reflect the geology occurring along the tributaries of the middle portion of the San Juan River. Abundant clay sources are present in weathered Cretaceous shale outcrops as well as

Table 18.27. White ware rim decoration: line elements, by time period; counts and percents.

Time Period		Indeterminate	No Framing Lines	Single Thin	Single Thick	Thin Incorporated	Thick Incorporated	Multi-thin	Multi-thick	Multi-sized	All Over	Total
Middle Pueblo II	Count	8	29	2	5	20	8	2	2	0	1	**77**
	Row %	10.4%	37.7%	2.6%	6.5%	26.0%	10.4%	2.6%	2.6%	0.0%	1.3%	**100.0%**
Late Pueblo II	Count	1	28	3	2	6	3	2	3	–	–	**48**
	Row %	2.1%	58.3%	6.3%	4.2%	12.5%	6.3%	4.2%	6.3%	–	–	**100.0%**
Early Pueblo III	Count	–	2	–	–	–	1	3	–	–	–	**6**
	Row %	–	33.3%	–	–	–	16.7%	50.0%	–	–	–	**100.0%**
Total Count		**9**	**59**	**5**	**7**	**26**	**12**	**7**	**5**	**0**	**1**	**131**
Percent of Total		**4.6%**	**45.0%**	**3.8%**	**5.3%**	**19.8%**	**9.2%**	**5.3%**	**3.8%**	**0.0%**	**0.8%**	**100.0%**

Some indeterminate orientations not included.

Table 18.28. White ware rim decoration: line elements, by pottery type; counts and percents.

Ceramic Type		Indeterminate	No Framing Lines	Single Thin	Single Thick	Thin Incorporated	Thick Incorporated	Multi-thin	Multi-thick	Multi-sized	All Over	Total
Red Mesa-style black-on-white	Count	2	6	0	1	0	0	0	0	0	0	**9**
	Row %	22.2%	66.7%	0.0%	11.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	**100.0%**
Pueblo II black-on-white	Count	17	158	12	22	51	26	12	2	2	0	**302**
	Row %	5.6%	52.3%	4.0%	7.3%	16.9%	8.6%	4.0%	0.7%	0.7%	0.0%	**100.0%**
Early Pueblo III black-on-white	Count	9	65	15	5	73	23	1	11	0	0	**202**
	Row %	4.5%	32.2%	7.4%	2.5%	36.1%	11.4%	0.5%	5.4%	0.0%	0.0%	**100.0%**
Late Pueblo III black-on-white	Count	0	11	3	52	6	4	2	0	46	1	**125**
	Row %	0.0%	8.8%	2.4%	41.6%	4.8%	3.2%	1.6%	0.0%	36.8%	0.8%	**100.0%**
Pueblo III black-on-white	Count	20	67	11	40	40	31	9	9	1	1	**229**
	Row %	8.7%	29.3%	4.8%	17.5%	17.5%	13.5%	3.9%	3.9%	0.4%	0.4%	**100.0%**
Transitional Pueblo III black-on-white	Count	1	0	1	1	0	0	61	37	3	0	**104**
	Row %	1.0%	0.0%	1.0%	1.0%	0.0%	0.0%	58.7%	35.6%	2.9%	0.0%	**100.0%**
Total Count		**49**	**307**	**42**	**121**	**170**	**84**	**85**	**59**	**52**	**2**	**971**
Percent of Total		**5.0%**	**31.6%**	**4.3%**	**12.5%**	**17.5%**	**8.7%**	**8.8%**	**6.1%**	**5.4%**	**0.2%**	**100.0%**

Some indeterminate orientations not included.

redeposited alluvial sources. Along the La Plata Valley, pottery-quality clay sources are derived from shale exposures associated with the Nacimiento, Kirtland, and Fruitland Formations (Patuszak 1968). Clays derived from these formations range from marginal to very high in quality, and include high-iron yellow red and red-firing as well as buff-firing low-iron clays. Shale-derived sources generally contain very few aplastic inclusions, so it is necessary to add additional temper (Shepard 1939). Alluvial clays found along the La Plata River and nearby drainages have high iron content and contain numerous fine sand inclusions.

The terraces along the La Plata are covered with gravels deposited by retreating glaciers during the Pleistocene period. The postglacial rivers have cut into the later glacial beds and reworked them, creating coarse pebbly channel fill overlain by recent floodplain deposits (Patuszak 1968). Abundant cobbles are found on terraces and in channels, and these appear to have been used as temper for pottery made using local shale-derived clays. Petrographic analysis of cobbles collected along the La Plata and Animas drainages indicates that a variety of rock types, including granite, andesite, diorite, and quartz latite, were available. Petrography also shows that these rock types were used as temper (Morgenstein 1996).

Only during the earliest occupations were alluvial clays used in the production of pottery such as Sambrito Utility. The combination of clays derived from local shale outcrops and temper derived from igneous cobbles from gravel deposits or crushed sherd was consistently utilized in Anasazi gray and white ware pottery produced in the La Plata Valley and other areas of the Northern San Juan. In fact, Mesa Verde (or Northern San Juan) tradition pottery types are distinguished from those associated with other regional traditions by the presence of temper derived from crushed igneous porphyries. Pottery produced in other regions is distinguished by the use of other rock types as temper. For example, pottery from vessels originating in the Cibola or Kayenta regions contains quartz sand temper, while those produced in the Chuska regions are tempered with trachyte.

Production of pottery in the La Plata Valley is indicated by the presence of pottery-making tools or clays at Jackson Lake and Barker Arroyo sites, and the presence of firing kilns in areas to the north (Brown 1991). It may be possible to examine some patterns of local production and exchange through the distribution of refired paste colors of northern San Juan gray and white ware types.

Refiring analysis provides a basic characterization of clay in clay and ceramic samples. This involves firing all samples to standardized oxidizing conditions and temperatures of 950 degrees C, which allows for the common comparison of samples based on the color resulting from types and amounts of mineral impurities (particularly iron). Sample colors are recorded using Munsell color categories. While refired color does not indicate specific clay composition, a comparison of range of color found in clays and ceramics provides a rough determination of potential variation in source clays.

Refiring of clay samples derived from shale and alluvial clays within or near Jackson Lake indicates the presence of clays firing to a wide range of colors. While most clays collected fired to yellow-red, red, pink, and buff firing sources were also noted. Refiring of chips from white ware and gray ware sherds associated with various occupations indicates pastes firing to a wide range of colors, although there are definite trends in the paste color of both gray and white ware sherds through time (Tables 18.29, 18.30).

The majority of local gray ware sherds from Pueblo II contexts at Jackson Lake sites fire to buff colors, while those from Pueblo III contexts fire to yellow-red or red colors. This change from lighter to redder firing paste clays was fairly gradual through time, but appears to have been most dramatic from the Pueblo II to Pueblo III period. Thus, there was a shift from rarer buff-firing clay sources to the common red-firing sources. This could reflect technological factors relating to the lower temperatures required to fire high-iron clay in a neutral atmosphere, or decreased intraregional exchange of white wares through time (Wilson 1994).

Refiring of white ware sherds indicates a similar decrease in buff-firing clays and an increase in pink-firing clays, although the trend is less dramatic than that observed for gray ware types. This has sometimes been interpreted as indicating a slight preference for redder-firing clays in later organic-painted types (Shepard 1939), although buff-firing clays continued to have been commonly employed in white ware production in the La Plata Valley. Even more dramatic are increases in red-firing clays at Salmon

Table 18.29. Munsell color designations for refired corrugated gray ware by time period; counts and percents.

Munsell color		Period				
		Middle Pueblo II	Late Pueblo II	Early Pueblo III	Late Pueblo III	Total
2.5YR	Count	0	1	7	25	**33**
	Row %	0.0%	3.0%	21.2%	75.8%	**100.0%**
5YR	Count	19	2	35	44	**100**
	Row %	19.0%	2.0%	35.0%	44.0%	**100.0%**
7.5YR	Count	52	21	35	25	**133**
	Row %	39.1%	15.8%	26.3%	18.8%	**100.0%**
10 or 2.5YR	Count	90	50	17	14	**171**
	Row %	52.6%	29.2%	9.9%	8.2%	**100.0%**
Total Count		**161**	**74**	**94**	**108**	**437**
Percent of Total		**36.80%**	**16.90%**	**21.50%**	**24.70%**	**100.0%**

Table 18.30. Munsell color designations for refired white ware sherds by time period; counts and percents.

Munsell color		Period				
		Middle Pueblo II	Late Pueblo II	Early Pueblo III	Late Pueblo III	Total
2.5YR	Count	0	1	4	0	**5**
	Row %	0.0%	20.0%	80.0%	0.0%	**100.0%**
5YR	Count	16	11	71	5	**103**
	Row %	15.5%	10.7%	68.9%	4.9%	**100.0%**
7.5YR	Count	54	30	198	20	**302**
	Row %	17.9%	9.9%	65.6%	6.6%	**100.0%**
10 or 2.5Y	Count	146	45	240	17	**448**
	Row %	32.6%	10.0%	53.6%	3.8%	**100.0%**
Total Count		**216**	**87**	**513**	**42**	**858**
Percent of Total		**25.2%**	**10.1%**	**59.8%**	**4.9%**	**100.0%**

Ruins, along with temper changes, which have been interpreted as reflecting a decrease in intraregional exchange of San Juan white wares (Wilson 1985).

Similar trends have been noted at sites in the surrounding areas to the south and east, including Salmon Ruins and the Box B site along the San Juan River, as well as other nearby sites along the San Juan and Animas drainages (Wilson 1980, 1985; Franklin 1991; Raish 1997). A higher frequency of pottery from sites in these areas fires to yellow-red colors than in the La Plata Valley, where more of the pottery fires to buff colors. Areal trends are strongest for the corrugated utility ware at sites dating to the Pueblo II period, which may indicate the utilization of buff-firing clays in the La Plata Valley and red-firing sources at sites along the San Juan and Animas Rivers. This may reflect the use of low-iron clays from the Fruitland Formation in areas of the La Plata Valley, and the general absence of low-iron clays along the San Juan and Animas Rivers (Wilson 1985). It is also possible that some of the high-iron clays used at sites along the San Juan were from alluvial deposits, and reflect between-valley differences in preferences for river clays versus those from Cretaceous shale outcrops (Wilson 1985).

While a basic trend of a decrease in the number of sherds firing to buff and an increase in those firing to redder colors was noted for both gray and white ware, the nature of the trends noted for different ware groups differ. For example, this shift was much more dramatic for gray wares (Tables 18.29, 18.30) and may reflect a gradual shift of potters along the La Plata drainage to red-firing clays long used by potters along the San Juan River. In contrast, potters along the La Plata drainage appear to have continued to use similar buff-firing clays in the production of white ware vessels (Table 18.30). Occurrence of significant frequencies of buff-firing pottery and San Juan white-ware types at some Pueblo II sites along the middle San Juan may reflect the exchange of pottery with other areas, such as the La Plata Valley. Pottery-making traditions there appear to have long focused on the production of pottery with tempers and styles typical of pottery produced elsewhere in the San Juan, as well as on making a distinct (Animas) variety of Cibola pottery, but with clays with low silt and high iron content (Reed 2006a). Thus, pastes noted in the majority of the pottery produced in the La Plata Valley appear to be distinct from those noted in local pottery produced in other drainages of the middle San Juan. Changes noted in pastes from late Pueblo III contexts may indicate an increase in the exchange of pottery from other areas of the middle San Juan.

The distribution of tempering material provides additional information on the production and possible exchange of pottery vessels at both the local and regional level (Wilson and Blinman 1988a). Identifications of pottery produced in much of the surrounding area are limited by the fact that crushed igneous rock similar in appearance was utilized over most of the Totah and Mesa Verde regions (Abel 1955; Breternitz et al. 1974; Franklin 1980; Shepard 1939; Wilson and Blinman 1995a), so that temper identifications are only useful in the recognition of a few distinctive regional traditions to the south. A few pockets, or tracts, where distinctive temper was utilized within the Mesa Verde region, have been identified (Wilson and Blinman 1995a), so that temper variation within San Juan ceramic types may be useful in documenting some regional exchange.

The identification of tempering materials and technological attributes may help to identify ceramics produced in other regions of the Southwest. In many cases, the placement of pottery into types belonging to nonlocal traditions was limited to the subsample of sherds for which temper was recorded, although it was sometimes possible to identify nonlocal types on the basis of stylistic or technological characteristics. Nonlocal regional ceramic traditions represented in low frequencies at Jackson Lake sites include Cibola White Ware, Chuska White Ware, White Mountain Red Ware, Tusayan White Ware, Tsegi Orange Ware, and Mogollon Brown Ware types (Table 18.31). The combination of data relating to the distribution of ceramic traditions and temper distributions recorded for gray and white wares provides information about resource use and exchange. Both distributions indicate that while sherds with nonlocal temper types are present, the frequency of sherds clearly derived from nonlocal vessels is quite low in assemblages of all late periods. This parallels Whalley's (1980) findings from their sites in the Jackson Lake area, where Cibola sherds are more common in the earlier groups, followed by San Juan red wares and Chuskan wares. In the later group the most common intrusive sherd type is White Mountain Redware, followed by Cibola, and Chuskan wares are less than 1 percent overall in both time divisions (Table 18.32).

The great majority of gray wares exhibit similar crushed igneous temper, so that almost all gray wares were assigned to the Mesa Verde tradition in all periods (Tables 18.31, 18.33). Petrographic analysis of a sample of gray wares indicate a variety of rock types (Morgenstein 1996), which appear to have largely been derived from local gravels. Rock types identified include granites granodiorites, diorites, monzonites, gabbros, and porphyritic andesites. Sandstone occurs in samples from the Jackson Lake locality. There does not appear to be any other major rock type distinctions between Jackson Lake and Barker Arroyo localities for gray wares, and for the most part seems to reflect variability in types of rock occurring with the locally occurring gravel deposits as well as pottery that may have been produced in other areas of the San Juan region. Extremely low frequencies of gray ware sherds assigned to the Chuska tradition were based on the presence of trachyte temper, and to the Cibola or Kayenta regions based on the presence of sand temper, which were associated with most temporal components. The exception to the dominance of igneous temper is in gray wares exhibiting quartz sand from Late Pueblo III contexts, where sand is present in 12.2 percent of all gray wares from which temper was examined. Characteristics of this sand temper indicate a possible local source utilized only during the Late Pueblo III period.

A wider range of tempers is represented in white ware types dating to the Pueblo II more than to the Pueblo III period (Tables 18.31, 18.33), although the great majority of sherds from components from all

Table 18.31. Ceramic tradition by ware group and time period; counts and percents.

	Gray Ware		White Ware		Red Ware		Smudged Ware		Total	
	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %
Basketmaker III										
Mesa Verde	–	–	19	100.0%	–	–	–	–	**19**	**30.6%**
Sambrito	43	100.0%	–	–	–	–	–	–	**43**	**69.4%**
Total	**43**	**100.0%**	**19**	**100.0%**	**–**	**–**	**–**	**–**	**62**	**100.0%**
Mid Pueblo II										
Mesa Verde	1301	100.0%	309	97.2%	11	73.3%	–	–	**1621**	**99.1%**
Cibola	–	–	2	0.6%	1	6.7%	–	–	**3**	**0.2%**
Chuska	–	–	7	2.2%	–	0.0%	–	–	**7**	**0.4%**
Kayenta	–	–	–	–	3	20.0%	–	–	**3**	**0.2%**
Mogollon	–	–	–	–	–	–	2	100.0%	**2**	**0.1%**
Total	**1301**	**100.0%**	**318**	**100.0%**	**15**	**100.0%**	**2**	**100.0%**	**1636**	**100.0%**
Late Pueblo II										
Mesa Verde	1392	99.9%	481	95.6%	5	71.4%	–	–	**1878**	**98.5%**
Cibola	–	–	2	0.4%	–	–	–	–	**2**	**0.1%**
Chuska	1	0.1%	18	3.6%	–	–	–	–	**19**	**1.0%**
Kayenta	–	–	2	0.4%	2	28.6%	–	–	**4**	**0.2%**
Mogollon	–	–	–	–	–	–	3	100.0%	**3**	**0.2%**
Total	**1393**	**100.0%**	**503**	**100.0%**	**7**	**100.0%**	**3**	**100.0%**	**1906**	**100.0%**
Early Pueblo III										
Mesa Verde	406	100.0%	139	97.2%	1	11.1%	–	–	**546**	**97.7%**
Cibola	–	–	–	–	4	44.4%	–	–	**4**	**0.7%**
Chuska	–	–	4	2.8%	–	0.0%	–	–	**4**	**0.7%**
Kayenta	–	–	–	–	4	44.4%	–	–	**4**	**0.7%**
Mogollon	–	–	–	–	–	–	1	100.0%	**1**	**0.2%**
Total	**406**	**100.0%**	**143**	**100.0%**	**9**	**100.0%**	**1**	**100.0%**	**559**	**100.0%**
Late Pueblo III										
Mesa Verde	642	99.8%	742	99.3%	5	8.8%	–	–	**1389**	**95.8%**
Cibola	–	–	2	0.3%	45	78.9%	–	–	**47**	**3.2%**
Chuska	1	0.2%	3	0.4%	–	0.0%	–	–	**4**	**0.3%**
Kayenta	–	–	–	–	7	12.3%	–	–	**7**	**0.5%**
Mogollon	–	–	–	–	–	–	3	100.0%	**3**	**0.2%**
Total	**643**	**100.0%**	**747**	**100.0%**	**57**	**100.0%**	**3**	**100.0%**	**1450**	**100.0%**
Group Total										
Mesa Verde	3741	98.8%	1690	97.7%	22	25.0%	–	–	**5453**	**97.1%**
Cibola	–	–	6	0.3%	50	56.8%	–	–	**56**	**1.0%**
Chuska	2	0.1%	32	1.8%	–	0.0%	–	–	**34**	**0.6%**
Kayenta	–	–	2	0.1%	16	18.2%	–	–	**18**	**0.3%**
Mogollon	–	–	–	–	–	–	9	100.0%	**9**	**0.2%**
Sambrito	43	1.1%	–	–	–	–	–	–	**43**	**0.8%**
Total	**3786**	**100.0%**	**1730**	**100.0%**	**88**	**100.0%**	**9**	**100.0%**	**5613**	**100.0%**

periods are tempered with material that could have been obtained locally. Most late white ware sherds from Jackson Lake were tempered with crushed igneous rock, sherds, or a mixture of the two. Petrographic analysis of "local "white ware sherds from sites in the Jackson Lake locality and elsewhere in the La Plata Valley indicates tempering material that may include dacite and porphyritic andesites, metamorphics, diorites, basaltic ash, sandstone fragments, and pyroxenes (Morgenstein 1996). Through time, white ware types from Jackson Lake (Table 18.34) and other localities in the La Plata Valley de-

Table 18.32. Whalley sites, ceramic traditions by site numberand date range; counts and percents.

Whalley Site	Cibola	Chuska	San Juan Red Ware	White Mountain Red Ware	Polished Smudged Brown Ware	Total
AD 1050–1130						
7400 TT1 G1*	6.5	0.5	1	–	–	**201**
5074 G6	8.3	–	–	–	–	**52**
5076 G5	3.5	0.5	1	–	–	**199**
7672 G3	3.8	–	–	–	–	**52**
7674 G3	–	–	1.8	–	–	**55**
7678 G3	–	–	–	–	–	**59**
7691 G3	–	–	–	–	–	**17**
Total	**23**	**3**	**5**	**0**	**0**	**655**
Total %	**3.5%**	**0.5%**	**0.8%**	**0.0%**	**0.0%**	**100.0%**
AD 1130–1200						
7400 TT2 G8	0.3	0.3	0.3	2.3	0.3	**310**
7677 G8	–	1.1	–	–	–	**90**
5075 G7	–	1.4	–	–	–	**71**
7683 G7	4	–	–	–	–	**50**
Total	**3**	**3**	**1**	**7**	**1**	**521**
Total %	**0.6%**	**0.6%**	**0.2%**	**1.3%**	**0.2%**	**100.0%**

*G = Whalley temporal group
Data from Whalley (1980:147–153)

crease in vessels tempered with sherd and increase in those tempered with rock. Similar trends in white ware temper have been noted at other great houses in the Totah region (Franklin 1980, 1991; Mills 1991; Shepard 1939; Whalley 1980; Wilson 1993). The gradual increase in frequency of crushed rock tempered white wares from Pueblo II to Pueblo III in the Totah contrasts with trends noted in areas of the northern San Juan such as Mesa Verde, where sherd temper continued to dominate white ware assemblages (Franklin 1989; Shepard 1939). The boundary for the use of different tempering materials in white ware production during the Pueblo III period seems to lie somewhere between the La Plata River and Mesa Verde National Park. The use of different tempering materials in white ware vessels appears to have gradually developed within the two regions. This difference seems to contradict models of Mesa Verde colonization of the Totah, since one would expect the movement or influence from the Mesa Verde to result in the occurrence of nonlocal sherd temper pottery or the use of sherd in the Mesa Verde area tradition.

The presence of nonlocal tempers and styles on white and red wares also provides information concerning exchange with other regions. Such evidence indicates that nonlocal pottery from the Chuska, Cibola, Kayenta, and Mogollon regions was present at all late Jackson Lake components, but extremely rare. Nonlocal pottery types represent less than 5 percent of all decorated white wares (Tables 18.31, 18.33). Thus, data from Jackson Lake indicate remarkably conservative trends in pottery exchange between groups at Jackson Lake and surrounding regions. Data from other studies indicate higher frequencies of nonlocal pottery during the Early Pueblo II period (Whalley 1980; Wilson 1993). The frequency of nonlocal pottery dropped during the Middle Pueblo II period and remained low during subsequent occupations in the La Plata Valley. While earlier studies indicated that the concentration of nonlocal pottery may have been higher at Pueblo II great houses, our study indicates similarly low distributions at all site types.

Trends in the La Plata Valley seem to contrast with those noted in other areas of the Totah. Sites along the San Juan, for instance, exhibit high frequencies of Chuskan and Cibolan tradition pottery types. This suggests significant exchange with areas to the south during the Pueblo II period, which is,

Table 18.33. Temper type by ware group and time period; counts and percents.

	Gray Ware		White Ware		Red Ware		Brown Smudged Ware		Total	
	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %
Basketmaker III										
Igneous	–	–	19	67.9%	–	–	–	–	–	–
Quartz sand	116	100.0%	9	32.1%	–	–	–	–	**125**	**86.8%**
Total	**116**	**100.0%**	**28**	**100.0%**	**–**	**–**	**–**	**–**	**144**	**100.0%**
Middle Pueblo II										
Igneous	1295	99.0%	128	24.8%	10	66.7%	–	–	**1433**	**77.8%**
Igneous and sand	–	–	10	1.9%	–	–	–	–	**10**	**0.5%**
Quartzite	7	0.5%	5	1.0%	–	–	–	–	**12**	**0.7%**
Fine sandstone	–	–	1	0.2%	–	–	–	–	**1**	**0.1%**
Sherd	1	0.1%	160	31.0%	4	26.7%	–	–	**165**	**9.0%**
Igneous and sherd	–	–	158	30.6%	–	–	–	–	**158**	**8.6%**
Igneous, sand, sherd	–	–	10	1.9%	–	–	–	–	**10**	**0.5%**
Quartz and sherd	–	–	1	0.2%	–	–	–	–	**1**	**0.1%**
Fine sandstone, sherd	–	–	1	0.2%	–	–	–	–	**1**	**0.1%**
Quartz sand	5	0.4%	20	3.9%	1	6.7%	–	–	**26**	**1.4%**
Quartz sand, sherd	–	–	15	2.9%	–	–	1	50.0%	**16**	**0.9%**
Trachybasalt	–	–	5	1.0%	–	–	–	–	**5**	**0.3%**
Trachybasalt, sherd	–	–	2	0.4%	–	–	–	–	**2**	**0.1%**
Mogollon tuff	–	–	–	–	–	–	1	50.0%	**1**	**0.1%**
Total	**1308**	**100.0%**	**516**	**100.0%**	**15**	**100.0%**	**2**	**100.0%**	**1841**	**100.0%**
Late Pueblo II										
Indeterminate	2	0.1%	12	1.8%	–	–	–	–	**14**	**0.7%**
None	–	–	0.2	0.0%	–	–	–	–	**3**	**0.1%**
Igneous	1359	96.8%	285	42.8%	5	71.4%	–	–	**1649**	**79.2%**
Igneous and sand	1	0.1%	18	2.7%	–	–	–	–	**19**	**0.9%**
Quartzite	21	1.5%	19	2.9%	–	–	–	–	**40**	**1.9%**
Fine sandstone	–	–	3	0.5%	–	–	–	–	**3**	**0.1%**
Sherd	7	0.5%	99	14.9%	–	–	–	–	**106**	**5.1%**
Igneous and sherd	9	0.6%	136	20.4%	–	–	–	–	**145**	**7.0%**
Igneous, sand, sherd	–	–	8	1.2%	–	–	–	–	**8**	**0.4%**
Quartz and sherd	–	–	6	0.9%	–	–	–	–	**6**	**0.3%**
Fine sandstone, sherd	–	–	2	0.3%	–	–	–	–	**2**	**0.1%**
Quartz sand	2	0.1%	12	1.8%	–	–	–	–	**14**	**0.7%**
Quartz sand, sherd	2	0.1%	47	7.1%	2	28.6%	–	–	**51**	**2.4%**
Trachybasalt	1	0.1%	18	2.7%	–	–	–	–	**19**	**0.9%**
Trachybasalt, sherd	–	–	1	0.2%	–	–	–	–	**1**	**0.0%**
Mogollon tuff	–	–	–	–	–	–	3	100.0%	**3**	**0.1%**
Total	**1404**	**100.0%**	**666.2**	**100.0%**	**7**	**100.0%**	**3**	**100.0%**	**2083**	**100.0%**
Early Pueblo III										
Igneous	403	99.0%	93	48.9%	1	11.1%	–	–	**497**	**81.9%**
Igneous and sand	2	0.5%	5	2.6%	–	–	–	–	**7**	**1.2%**
Sherd	–	–	45	23.7%	4	44.4%	–	–	**49**	**8.1%**
Igneous and sherd	1	0.2%	32	16.8%	–	–	–	–	**33**	**5.4%**
Igneous, sand, sherd	–	–	5	2.6%	–	–	–	–	**5**	**0.8%**
Quartz sand	1	0.2%	4	2.1%	–	–	1	100.0%	**6**	**1.0%**
Quartz sand, sherd	–	–	2	1.1%	4	44.4%	–	–	**6**	**1.0%**
Trachybasalt	–	–	2	1.1%	–	–	–	–	**2**	**0.3%**
Trachybasalt, sherd	–	–	2	1.1%	–	–	–	–	**2**	**0.3%**
Total	**407**	**100.0%**	**190**	**100.0%**	**9**	**100.0%**	**1**	**100.0%**	**607**	**100.0%**

Table 18.33 (continued)

	Gray Ware		White Ware		Red Ware		Brown Smudged Ware		Total	
	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %
Late Pueblo III										
None	4	0.3%	–	–	–	–	–	–	**4**	**0.1%**
Igneous	1352	90.2%	934	66.5%	10	7.9%	–	–	**2296**	**75.3%**
Igneous and sand	8	0.5%	104	7.4%	–	–	–	–	**112**	**3.7%**
Fine sandstone	–	–	5	0.4%	–	–	–	–	**5**	**0.2%**
Sherd	1	0.1%	144	10.3%	33	26.2%	–	–	**178**	**5.8%**
Igneous and sherd	3	0.2%	102	7.3%	1	0.8%	–	–	**106**	**3.5%**
Igneous, sand, sherd	–	–	28	2.0%	–	–	–	–	**28**	**0.9%**
Quartz and sherd	–	–	–	–	1	0.8%	–	–	**1**	**0.0%**
Fine sandstone, sherd	–	–	2	0.1%	–	–	–	–	**2**	**0.1%**
Quartz sand	128	8.5%	60	4.3%	17	13.5%	–	–	**205**	**6.7%**
Quartz sand, sherd	1	0.1%	20	1.4%	64	50.8%	–	–	**85**	**2.8%**
Trachybasalt	2	0.1%	3	0.2%	–	–	–	–	**5**	**0.2%**
Trachybasalt, sherd	–	–	2	0.1%	–	–	–	–	**2**	**0.1%**
Mogollon tuff	–	–	–	–	–	–	21	100.0%	**21**	**0.7%**
Total	**1499**	**100.0%**	**1404**	**100.0%**	**126**	**100.0%**	**21**	**100.0%**	**3050**	**100.0%**
Group Total										
Indeterminate	2	0.0%	12	0.4%	–	–	–	–	**14**	**0.2%**
None	7	0.1%	–	–	–	–	–	–	**7**	**0.1%**
Igneous	4409	93.1%	1459	52.0%	26	16.6%	–	–	**5894**	**76.3%**
Igneous and sand	11	0.2%	137	4.9%	–	–	–	–	**148**	**1.9%**
Quartzite	28	0.6%	24	0.9%	–	–	–	–	**52**	**0.7%**
Fine sandstone	–	–	9	0.3%	–	–	–	–	**9**	**0.1%**
Sherd	9	0.2%	448	16.0%	41	26.1%	–	–	**498**	**6.4%**
Igneous and sherd	13	0.3%	428	15.3%	1	0.6%	–	–	**442**	**5.7%**
Igneous, sand, sherd	–	–	51	1.8%	–	–	–	–	**51**	**0.7%**
Quartz and sherd	–	–	7	0.2%	1	0.6%	–	–	**8**	**0.1%**
Fine sandstone, sherd	–	–	5	0.2%	–	–	–	–	**5**	**0.1%**
Quartz sand	252	5.3%	105	3.7%	18	11.5%	1	3.7%	**376**	**4.9%**
Quartz sand, sherd	3	0.1%	84	3.0%	70	44.6%	1	3.7%	**158**	**2.0%**
Trachybasalt	3	0.1%	28	1.0%	–	–	–	–	**31**	**0.4%**
Trachybasalt, sherd	–	–	7	0.2%	–	–	–	–	**7**	**0.1%**
Mogollon tuff	–	–	–	–	–	–	25	92.6%	**25**	**0.3%**
Total	**4737**	**100.0%**	**2804**	**100.0%**	**157**	**100.0%**	**27**	**100.0%**	**7725**	**100.0%**

Table 18.34. Rock vs. sherd temper in white ware by time period; counts and percents.

	Mid Pueblo II		Late Pueblo II		Early Pueblo III		Late Pueblo III		Total	
	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %
Rock	143	30.2%	322	56.4%	98	44.5%	670	80.4%	**1233**	**58.8%**
Sherd and rock	171	36.1%	150	26.3%	77	35.0%	76	9.1%	**474**	**22.6%**
Sherd	160	33.8%	99	17.3%	45	20.5%	87	10.4%	**391**	**18.6%**
Total	**474**	**100.0%**	**571**	**100.0%**	**220**	**100.0%**	**833**	**100.0%**	**2098**	**100.0%**

however, absent in the subsequent Pueblo III occupation (Franklin 1980; Irwin-Williams 1980; Whalley 1980). Despite the proximity of and similarities between sites along the Middle San Juan and La Plata drainages, then, participation in regional exchange systems varied significantly during the Pueblo II period (Whalley 1980).Similar differences in intrusive ceramics were noted for Pueblo II occupations at two communities in the San Juan Basin investigated as part of the Transwestern Pipeline Expansion project (Bradley 1994). These included the El Llano–Escalon community, west of Chaco Canyon, and the Standing Rock community, about 20 miles to the south of El Llano–Escalon. While Cibolan-pottery-dominated sites were associated with both communities, significant proportions of Chuskan ceramics were imported into the El Llano but not into the Standing Rock community (Bradley 1994). Thus, while the El Llano–Escalon community was apparently well outside the area of production of Chuska pottery, its location between Chaco and the Chuska foothills facilitated the movement of Chuska pottery into this area. In contrast, while Standing Rock was almost as close to the Chuska region as El Llano, differences in its location and setting may have put it just outside this network.

Likewise, the Pueblo populations in the La Plata Valley seem to have participated relatively little in exchange with areas to the south, at least as a receiver of ceramic vessels. Although contemporary groups along the Middle San Juan River were much more deeply involved, the La Plata was apparently just outside this system. Slight differences in location, setting, and ecology may have resulted in these differences in participation by groups along the San Juan and those in the La Plata Valley.It is also possible that the low frequencies of nonlocal pottery in the La Plata Valley reflect conditions favorable for pottery production, such as a long history of self-sufficiency, and the availability of wood and quality low-iron clays. Such conditions may have even contributed to communities in the La Plata becoming centers of production of white ware during the Pueblo III period, as indicated by the concentration of specialized Pueblo kiln features away from the main sites (Brown 1991). These represent specialized features specifically designed for the firing of Pueblo III organic-painted white ware pottery (Swink 1993; Toll et al. 1992; Wilson 1991) and may indicate the production of white ware pottery beyond the scale of the local household. The role of La Plata communities as an important exporting center of organic-painted black-on-white during the Pueblo III period may partially account for the decline in distinct intrusive types in sites along the Middle San Juan. Further studies examining the possibility that Pueblo III white ware vessels found over large areas of the Totah and San Juan Basin may have been produced in the La Plata Valley are certainly warranted.

Evidence relating to a relatively low amount of exchange of pottery vessels between groups in the La Plata Valley and other regions during the Pueblo II or III periods, along with that indicating substantial local pottery production and a long and continuous ceramic tradition in the La Plata Valley, support long, self-sufficient occupation in the La Plata Valley (McKenna and Toll 1992). Major shifts in regional networks proposed to have been centered in Chaco and Mesa Verde appear to have had little effect on ceramic production and exchange in the La Plata Valley. The conservative nature of the trends along the La Plata may reflect favorable conditions for agriculture, which allowed a long-lived and stable occupation. Abundant ceramic resources and fuel could have encouraged pottery production by local potters and eventually led to the export of finely made white ware pottery vessels.

Vessel Function and Use

Vessel use is most strongly reflected by ceramic ware and vessel form. Distributions of these categories provide the primary information concerning the type of use and changes in use. Attributes relating to vessel size, wear patterns, soot deposits, surface manipulation, technological attributes, and paste characteristics also reflect uses of vessels in various activities.

Interpretations based on the distribution of sherds differ in nature and resolution from those based on whole vessels. The advantage of sherd-based distributions is that they are usually represented in large samples distributed through a variety of situations. Sherds, however, represent limited and incomplete samples of the vessels from which they were derived, and are often not recovered from their actual context of use. The occurrence of whole vessels provides more complete information concerning the use of specific containers and their location. The recovery of whole vessels is rare, however, and they are absent in many contexts. Data on functionally related sherd distributions (including those belonging to reconstructible vessels) from dated contexts is presented first, followed by a discussion of distributions associated with all whole or partial vessels recovered from various contexts.

The relative rate of pottery breakage and discard is best assessed with sherd data. A simple approach to monitoring rates of pottery accumulation is to compare the relative quantities of different classes of artifacts deposited at dated contexts. Chipped stone debitage is suitable for such a comparison, due to its common occurrence and the consistency of the lithic technology during various Anasazi occupations in the La Plata Valley. It is possible to assume that quantities of flaked lithics discarded were fairly constant through time. Examination of the overall amount of ceramics and debitage shows relative rates of ceramic deposition.

Lithics and ceramics were both weighed in grams. Weights of both artifact classes noted for a given context were compared. Weights were used instead of counts because counts are highly influenced by postdepositional breakage. Cores and formal tools were excluded because of potential biases resulting from large size and weight from individual items. For each dating period, a ratio of the weights of the two artifact classes was calculated by dividing the total weight of the ceramics by the total weight of the lithics. Increases in this ratio are assumed to reflect higher rates of breakage and discard of pottery associated with increased use.

Table 18.35 illustrates ratios of ceramic to debitage weights at dated contexts from Jackson Lake. The ratios are fairly similar during the Basketmaker occupations. Pueblo II ratios are much higher. Following the Middle Pueblo II period, there was a gradual decrease in the overall ratio of ceramics to lithics. The main increase in the frequency of ceramics occurred sometime between the Early Pueblo II and Middle Pueblo II periods, as further indicated by data from Barker Arroyo. Increases in the total frequency of sherds have also been noted during the Pueblo periods for assemblages in the Northern Mogollon Highlands investigated during the Luna project (Wilson 1999a, 1999b).

Basic functional trends may also be examined by looking at frequencies of pottery belonging to different ware groups, particularly for the later occupations. Gray utility wares produced during the Pueblo II and Pueblo III periods are overwhelmingly wide mouth cooking/storage forms, and decorated wares are usually forms associated with serving (bowls) or water storage (ollas or necked jars). At Jackson Lake, frequencies of ware groups at Middle Pueblo II sites are similar to the Early Pueblo III period assemblages, although there tends to be a very slight drop in the overall frequency of gray wares through time (Table 18.36). The apparent stability in ware frequency in the La Plata Valley does contrast with trends observed in some areas of the Northern San Juan, where significant decreases in gray ware and increases in white ware have been noted for assemblages spanning the Middle Pueblo II to Late Pueblo III period (Wilson 1988).

Distributions of vessel forms within various ware groups were also examined (Tables 18.6, 18.10, 18.13, 18.16, 18.37, 18.38, 18.39, 18.40). Within gray wares the proportion of corrugated to plain vessels decreases from Mid Pueblo II to Early Pueblo III, with a slight uptick in plain gray in Late Pueblo III (Table 18.37). Late assemblages appear to have been fairly similar: the great majority of gray wares were represented by similarly shaped cooking/storage jars. Other gray ware forms present in extremely low frequencies include ollas, seed jars, bowls, and pipes. The majority of white wares in all periods are bowls, although a wide range of forms was represented in significant frequencies. Other late white ware vessel forms include cooking/storage jars, ollas, seed jars, canteens, gourd dippers, bowl dippers, and effigies. The majority of red ware sherds also appear to have been from bowls, although various jar forms were also noted.

Because it is difficult to determine the exact form of many body sherds, frequencies of various forms were compared for rim sherds only (Table 18.41). Distributions noted in rim ware forms indicate several trends, not as strongly indicated by the distributions of all sherds. Trends include a fairly dramatic decrease in the frequency of gray cooking storage jar forms for the total rim sherds and an increase in white ware bowls.

Rim radius measurements may indicate trends in vessel size through time (Figs. 18.8, 18.9, 18.10). Rim radius distributions for gray cooking/storage jars are very similar for all periods, averaging 10.7 cm, with the exception of those in the Late Pueblo II period, where the average is much higher (11.45

Table 18.35. Sherd-to-debitage weight (g) by time period.

	Transitional Basketmaker	Classic Basketmaker II	Mid Pueblo II	Late Pueblo II	Early Pueblo III	Late Pueblo III
Sherd weight (g)	809.0	2194.0	54438.0	37405.0	20808.0	87418.0
Debitage weight (g)	738.0	1435.0	19573.0	13657.0	11017.0	50820.0
Sherd-to-lithic ratio	1.1	1.5	2.8	2.7	1.9	1.7

Table 18.36. Ware groups by time period; counts and percents.

Ware Group	Mid Pueblo II		Late Pueblo II		Early Pueblo III		Late Pueblo III		Total	
	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %
Gray ware	4280	71.6%	3602	69.2%	2221	66.1%	8852	67.6%	**18995**	**68.7%**
White ware	1689	28.3%	1592	30.6%	1130	33.6%	4219	32.2%	**8630**	**31.2%**
Red ware	15	0.3%	10	0.2%	10	0.3%	20	0.2%	**55**	**0.2%**
Total	**5977**	**100.0%**	**5204**	**100.0%**	**3361**	**100.0%**	**13091**	**100.0%**	**27633**	**100.0%**

Table 18.37. Plain gray and corrugated gray wares by time period; counts and percents.

Ware Group	Mid Pueblo II		Late Pueblo II		Early Pueblo III		Late Pueblo III		Total	
	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %
Corrugated gray	4866	87.9%	2921	83.5%	3592	75.4%	1384	80.6%	**12763**	82.3%
Plain gray	670	12.1%	577	16.5%	1173	24.6%	334	19.4%	**2754**	17.7%
Total	**5536**	**100.0%**	**3498**	**100.0%**	**4765**	**100.0%**	**1718**	**100.0%**	**15517**	100.0%

Table 18.38. Grouped vessel forms by ware group,entire Jackson Lake community sample; counts and percents.

Grouped Forms	Gray ware		White ware		Red ware		Brown, smudge ware		Total	
	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %
Bowl	98	.2%	10,849	51.8%	225	81.8%	36	94.7%	**11,208**	**15.8**
Jar	49,482	99.4%	9221	44.0%	43	15.6%	2	5.3%	**58,748**	**82.7**
Olla	16	.0%	110	.5%	0	0.0%	0	0.0%	**126**	**.2**
Special Closed	22	.0%	42	.2%	3	1.1%	0	0.0%	**67**	**.1**
Ladle	38	.1%	499	2.4%	0	0.0%	0	0.0%	**537**	**.8**
Specialized	5	.0%	10	.0%	0	0.0%	0	0.0%	**15**	**.0**
Minis/Effigies	48	.1%	15	.1%	0	0.0%	0	0.0%	**63**	**.1**
Indeterminate	53	.1%	192	.9%	4	1.5%	0	0.0%	**249**	**.4**
Total	**49,762**	**100.0%**	**20,938**	**100.0%**	**275**	**100.0%**	**38**	**100.0%**	**71,013**	**100.0**

cm). The rim radius recorded for white ware bowls indicates that bowls from the Pueblo II period tend to be wider than in other periods (Fig. 18.9). With the exception of this trend, there is a gradual increase in overall white ware bowl size through time. There appears to have been no consistent change in size of ladles or bowl dippers through time; the small sample suggests a preference for ladles with diameters of 5.0 to 5.5 cm in all periods (Fig. 18.10).

While qualities of gray ware corrugated pottery appear to have been similar through time, several functionally related changes seem to have occurred in white ware vessels between the Middle Pueblo II and Late Pueblo III periods. Vitrification and hardness indicates that pottery was fired at significantly higher temperatures beginning during Early Pueblo III and culminating in Late Pueblo III pottery. Such changes appear to be related to evi-

Table 18.39. Vessel form by ware group, entire Jackson Lake community sample; counts and percents.

	Gray Ware		White Ware		Red Ware		Brown Smudged Ware		Total	
	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %
Indeterminate	17	0.1%	76	0.7%	–	–	–	–	**93**	**0.3%**
Bowl rim	13	0.1%	1261	12.0%	40	25.5%	4	14.8%	**1318**	**3.8%**
Bowl body	16	0.1%	4156	39.5%	95	60.5%	23	85.2%	**4290**	**12.5%**
Seed jar rim	16	0.1%	9	0.1%	2	1.3%	–	–	**27**	**0.1%**
Olla rim	6	0.0%	40	0.4%	–	–	–	–	**46**	**0.1%**
Olla neck	–	–	8	0.1%	–	–	–	–	**8**	**0.0%**
Cooking, storage rim	1139	4.8%	62	0.6%	1	0.6%	–	–	**1202**	**3.5%**
Pitcher	–	–	13	0.1%	–	–	–	–	**13**	**0.0%**
Necked jar body	2499	10.6%	256	2.4%	1	0.6%	–	–	**2756**	**8.0%**
Mug	–	–	2	0.0%	–	–	–	–	**2**	**0.0%**
Canteen	2	0.0%	3	0.0%	1	0.6%	–	–	**6**	**0.0%**
Kiva jar rim	1	0.0%	2	0.0%	–	–	–	–	**3**	**0.0%**
Jar body	19,818	84.0%	4278	40.6%	16	10.2%	–	–	**24,112**	**70.3%**
Bowl or jar body	–	–	6	0.1%	1	0.6%	–	–	**7**	**0.0%**
Ladle	3	0.0%	43	0.4%	–	–	–	–	**46**	**0.1%**
Ladle bowl	1	0.0%	119	1.1%	–	–	–	–	**120**	**0.3%**
Ladle handle	9	0.0%	143	1.4%	–	–	–	–	**152**	**0.4%**
Open-gourd dipper	–	–	40	0.4%	–	–	–	–	**40**	**0.1%**
Bird effigy	1	0.0%	3	0.0%	–	–	–	–	**4**	**0.0%**
Indeterminate effigy	–	–	2	0.0%	–	–	–	–	**2**	**0.0%**
Figurine	1	0.0%	–	–	–	–	–	–	**1**	**0.0%**
Miniature bowl	16	0.1%	2	0.0%	–	–	–	–	**18**	**0.1%**
Miniature necked jar	–	–	1	0.0%	–	–	–	–	**1**	**0.0%**
Miniature other form	1	0.0%	–	–	–	–	–	–	**1**	**0.0%**
Pipe	1	0.0%	–	–	–	–	–	–	**1**	**0.0%**
Miniature jar body	20	0.1%	1	0.0%	–	–	–	–	**21**	**0.1%**
Nonvessel	–	–	1	0.0%	–	–	–	–	**1**	**0.0%**
Keyhole handle	1	0.0%	1	0.0%	–	–	–	–	**2**	**0.0%**
Tray rim	2	0.0%	–	–	–	–	–	–	**2**	**0.0%**
Double-flared bowl	–	–	2	0.0%	–	–	–	–	**2**	**0.0%**
Total	**23,583**	**100.0%**	**10,530**	**100.0%**	**157**	**100.0%**	**27**	**100.0%**	**34,297**	**100.0%**

dence of specialized firing features or kilns dating to the Pueblo III period, including those noted in areas of the La Plata Valley north of Jackson Lake (Brown 1991). The control and temperatures provided by the use of such features allowed for the production of highly fired pottery decorated with organic paint, which is the hallmark of Pueblo III pottery technology (Toll et al. 1992; Swink 1993; Wilson 1991). The strikingly attractive black-on-white pottery produced during such firing was very hard, durable, and nonporous, representing a distinct technological improvement. The degree of polish also increased through time (Tables 18.42, 18.43). Another change noted through time is increasingly thick vessel walls (Tables 18.15, 18.16). This change may be partly related to improvements in the firing of white ware vessels.

Whole Vessels

Attributes recorded for each of the complete or partially complete vessels identified include type, completeness, form, wear patterns, sooting patterns, rim diameter, and height. In addition, scale profiles of each vessel were sketched. A total of 35 vessels were examined from Jackson Lake sites. Tables 18.44, 18.45, 18.46, 18.47, 18.48, 18.49, 18.50 present data relating to characteristics of each complete vessel from various phases. The sample includes 3 vessels from a Basketmaker III site, 15 from Middle Pueblo II sites, 6 from Late Pueblo II sites, 8 from Early Pueblo III sites, and 3 from a Late Pueblo III site.

A range of wares and vessel forms are represented, although most of the vessels are gray ware cooking/storage jars. White ware vessels are almost

Table 18.40. Vessel form by ware group and time period, entire Jackson Lake community sample; counts and percents.

	Gray Ware		White Ware		Red Ware		Smudged, Brown Ware		Total	
	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %
Early Basketmaker III										
Bowl body	3	2.6%	1	33.3%	–	–	–	–	**4**	**3.4%**
Seed jar rim	3	2.6%	–	–	–	–	–	–	**3**	**2.6%**
Cooking, storage rim	1	0.9%	–	–	–	–	–	–	**1**	**0.9%**
Necked jar body	–	–	1	33.3%	–	–	–	–	**1**	**0.9%**
Jar body	107	93.9%	1	33.3%	–	–	–	–	**108**	**92.3%**
Total	**114**	**100.0%**	**3**	**100.0%**	**–**	**–**	**–**	**–**	**117**	**100.0%**
Basketmaker III										
Bowl rim	2	1.5%	8	22.9%	–	–	–	–	**10**	**6.0%**
Bowl body	9	6.8%	26	74.3%	–	–	–	–	**35**	**20.8%**
Cooking, storage rim	3	2.3%	–	–	–	–	–	–	**3**	**1.8%**
Necked jar body	8	6.0%	–	–	–	–	–	–	**8**	**4.8%**
Jar body	111	83.5%	1	2.9%	–	–	–	–	**112**	**66.7%**
Total	**133**	**100.0%**	**35**	**100.0%**	**–**	**–**	**–**	**–**	**168**	**100.0%**
Middle Pueblo II										
Indeterminate	4	0.1%	15	0.9%	–	–	–	–	**19**	**0.3%**
Bowl rim	1	0.0%	162	9.6%	4	26.7%	–	–	**167**	**2.8%**
Bowl body	1	0.0%	400	23.8%	7	46.7%	2	100.0%	**410**	**6.9%**
Seed jar rim	–	–	5	0.3%	1	6.7%	–	–	**6**	**0.1%**
Olla rim	1	0.0%	15	0.9%	–	–	–	–	**16**	**0.3%**
Olla neck	–	–	3	0.2%	–	–	–	–	**3**	**0.1%**
Cooking, storage rim	250	5.8%	11	0.7%	–	–	–	–	**261**	**4.4%**
Necked jar body	619	14.5%	55	3.3%	1	6.7%	–	–	**675**	**11.3%**
Canteen	–	–	1	0.1%	1	6.7%	–	–	**2**	**0.0%**
Jar body	3401	79.5%	967	57.6%	1	6.7%	–	–	**4369**	**73.1%**
Ladle	2	0.0%	15	0.9%	–	–	–	–	**17**	**0.3%**
Ladle bowl	–	–	14	0.8%	–	–	–	–	**14**	**0.2%**
Ladle handle	–	–	13	0.8%	–	–	–	–	**13**	**0.2%**
Open gourd dipper	–	–	3	0.2%	–	–	–	–	**3**	**0.1%**
Pipe	1	0.0%	–	0.0%	–	–	–	–	**1**	**0.0%**
Non-vessel	–	–	1	0.1%	–	–	–	–	**1**	**0.0%**
Total	**4280**	**100.0%**	**1680**	**100.0%**	**15**	**100.0%**	**2**	**100.0%**	**5977**	**100.0%**
Late Pueblo II										
Indeterminate	2	0.1%	18	1.1%	–	–	–	–	**20**	**0.4%**
Bowl rim	–	–	152	9.5%	1	14.3%	1	33.3%	**154**	**3.0%**
Bowl body	–	–	492	30.9%	3	42.9%	2	66.7%	**497**	**9.6%**
Seed jar rim	12	0.3%	2	0.1%	1	14.3%	–	–	**15**	**0.3%**
Olla rim	3	0.1%	5	0.3%	–	–	–	–	**8**	**0.2%**
Olla neck	–	–	3	0.2%	–	–	–	–	**3**	**0.1%**
Cooking, storage rim	168	4.7%	7	0.4%	–	–	–	–	**175**	**3.4%**
Necked jar body	476	13.2%	39	2.4%	–	–	–	–	**515**	**9.9%**
Jar body	2940	81.6%	842	52.9%	2	28.6%	–	–	**3784**	**72.7%**
Ladle	–	–	7	0.4%	–	–	–	–	**7**	**0.1%**
Ladle bowl	–	–	15	0.9%	–	–	–	–	**15**	**0.3%**
Ladle handle	1	0.0%	6	0.4%	–	–	–	–	**7**	**0.1%**
Open gourd dipper	–	–	3	0.2%	–	–	–	–	**3**	**0.1%**
Bird effigy	–	–	1	0.1%	–	–	–	–	**1**	**0.0%**
Total	**3602**	**100.0%**	**1592**	**100.0%**	**7**	**100.0%**	**3**	**100.0%**	**5204**	**100.0%**

Table 18.40 (continued)

	Gray Ware		White Ware		Red Ware		Smudged, Brown Ware		Total	
	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %
Early Pueblo III										
Indeterminate	5	0.2%	6	0.5%	–	–	–	–	**11**	**0.3%**
Bowl rim	1	0.0%	116	10.3%	3	33.3%	–	–	**120**	**3.6%**
Bowl body	–	–	513	45.4%	3	33.3%	1	100.0%	**517**	**15.4%**
Olla rim	–	–	3	0.3%	–	–	–	–	**3**	**0.1%**
Olla neck	–	–	1	0.1%	–	–	–	–	**1**	**0.0%**
Cooking, storage rim	103	4.6%	7	0.6%	1	11.1%	–	–	**111**	**3.3%**
Pitcher	–	–	1	0.1%	–	–	–	–	**1**	**0.0%**
Necked jar body	232	10.4%	32	2.8%	–	–	–	–	**264**	**7.9%**
Canteen	1	0.0%	–	–	–	–	–	–	**1**	**0.0%**
Jar body	1874	84.4%	436	38.6%	2	22.2%	–	–	**2312**	**68.8%**
Ladle	–	–	5	0.4%	–	–	–	–	**5**	**0.1%**
Ladle bowl	–	–	4	0.4%	–	–	–	–	**4**	**0.1%**
Ladle handle	1	0.0%	3	0.3%	–	–	–	–	**4**	**0.1%**
Open gourd dipper	–	–	3	0.3%	–	–	–	–	**3**	**0.1%**
Miniature jar body	4	0.2%	–	–	–	–	–	–	**4**	**0.1%**
Total	**2221**	**100.0%**	**1130**	**100.0%**	**9**	**100.0%**	**1**	**100.0%**	**3361**	**100.0%**
Late Pueblo III										
Indeterminate	6	0.0%	37	0.6%	–	–	–	–	**43**	**0.2%**
Bowl rim	9	0.1%	823	13.5%	32	25.4%	3	14.3%	**867**	**4.5**
Bowl body	3	0.0%	2724	44.7%	82	65.1%	18	85.7%	**2827**	**14.5**
Seed jar rim	1	0.0%	2	0.0%	–	–	–	–	**3**	**0.0%**
Olla rim	2	0.0%	17	0.3%	–	–	–	–	**19**	**0.1%**
Olla neck	–	–	1	0.0%	–	–	–	–	**1**	**0.0%**
Cooking, storage rim	615	4.6%	37	0.6%	–	–	–	–	**652**	**3.3**
Pitcher	–	–	12	0.2%	–	–	–	–	**12**	**0.1%**
Necked jar body	1164	8.8%	129	2.1%	–	–	–	–	**1293**	**6.6**
Mug	–	–	2	0.0%	–	–	–	–	**2**	**0.0%**
Canteen	1	0.0%	2	0.0%	–	–	–	–	**3**	**0.0%**
Kiva jar rim	–	–	2	0.0%	–	–	–	–	**2**	**0.0%**
Jar body	11,385	86.0%	2031	33.3%	11	8.7%	–	–	**13,427**	**69.0**
Bowl or jar body	–	–	6	0.1%	1	0.8%	–	–	**7**	**0.0%**
Ladle	1	0.0%	16	0.3%	–	–	–	–	**17**	**0.1%**
Ladle bowl	1	0.0%	86	1.4%	–	–	–	–	**87**	**0.4**
Ladle handle	7	0.1%	121	2.0%	–	–	–	–	**128**	**0.7**
Open gourd dipper	–	–	31	0.5%	–	–	–	–	**31**	**0.2%**
Bird effigy	1	0.0%	2	0.0%	–	–	–	–	**3**	**0.0%**
Indeterminate effigy	–	–	2	0.0%	–	–	–	–	**2**	**0.0%**
Figurine	1	0.0%	–	–	–	–	–	–	**1**	**0.0%**
Miniature bowl	16	0.1%	2	0.0%	–	–	–	–	**18**	**0.1%**
Miniature necked jar	–	–	1	0.0%	–	–	–	–	**1**	**0.0%**
Miniature other form	1	0.0%	–	–	–	–	–	–	**1**	**0.0%**
Miniature jar body	16	0.1%	1	0.0%	–	–	–	–	**17**	**0.1%**
Keyhole handle	1	0.0%	1	0.0%	–	–	–	–	**2**	**0.0%**
Tray rim	2	0.0%	–	–	–	–	–	–	**2**	**0.0%**
Double-flared bowl	–	–	2	0.0%	–	–	–	–	**2**	**0.0%**
Total	**13,233**	**100.0%**	**6090**	**100.0%**	**126**	**100.0%**	**21**	**100.0%**	**19,470**	**100.0%**

Table 18.41. Vessel forms with selected rim types, by ware group for for late time periods; counts and percents.

Vessel Form		Mid Pueblo II	Late Pueblo II	Early Pueblo III	Late Pueblo III	Total
Gray Ware						
Jar, cooking/storage	Count	250	168	103	413	**934**
	Row %	26.8%	18.0%	11.0%	44.2%	**100.0%**
Other rims	Count	2	15	2	8	**27**
	Row %	7.4%	55.6%	7.4%	29.6%	**100.0%**
White Ware						
Bowl	Count	162	152	116	591	**1021**
	Row %	15.9%	14.9%	11.4%	57.9%	**100.0%**
Jar, cooking/storage	Count	11	7	7	22	**47**
	Row %	23.4%	14.9%	14.9%	46.8%	**100.0%**
Olla rim	Count	15	5	3	10	**33**
	Row %	45.5%	15.2%	9.1%	30.3%	**100.0%**
Seed jar	Count	5	2	0	1	**8**
	Row %	62.5%	25.0%	0.0%	12.5%	**100.0%**
Other rims	Count	1	0	1	1	**3**
	Row %	33.3%	0.0%	33.3%	33.3%	**100.0%**
Red Ware						
Bowl rim	Count	4	1	4	7	**16**
	Row %	25.0%	6.3%	25.0%	43.8%	**100.0%**
Jar rim	Count	1	1	1	0	**3**
	Row %	33.3%	33.3%	33.3%	0.0%	**100.0%**
Total		**451**	**351**	**237**	**1053**	**2092**

as common as gray wares, and while dominated by bowl forms, they are represented by a variety of other forms, including ollas, canteens, ladles, effigies, and pitchers. Vessel shapes, type of ware, and sooting noted on most gray ware jars are consistent with use in cooking. Basal wear and absence of sooting on white bowls and other forms are consistent with serving.

Examination of vessel distributions from various proveniences may provide information on their context of use (Tables 18.44–18.50). These indicate fairly small assemblages associated with both floor and burial assemblages. Larger assemblages tended to have both gray and white ware vessels, indicating a variety of activities. No major changes through time in the number or type of vessels associated with floors or burials were noted.

Ceramics at Jackson Lake: Conclusions

Data resulting from the analysis of ceramics recovered from sites in the Jackson Lake community in the course of the La Plata Highway project provide important clues about the changing nature of occupation in the southernmost Anasazi community in the La Plata Valley. Examinations of this ceramic data provided an opportunity to examine trends relating to the origin, production, decoration, exchange, and function of pottery associated with two distinct sequences of occupation documented for the Jackson Lake locality in the southern portion of the La Plata Valley.

The earliest of these occupational sequences seem to be associated with the initial occupation of the lower-most portion of the La Plata Valley by ceramic-producing groups during the timespan sometimes attributed to the middle and late portions of the Basketmaker period. Differences in the distribution

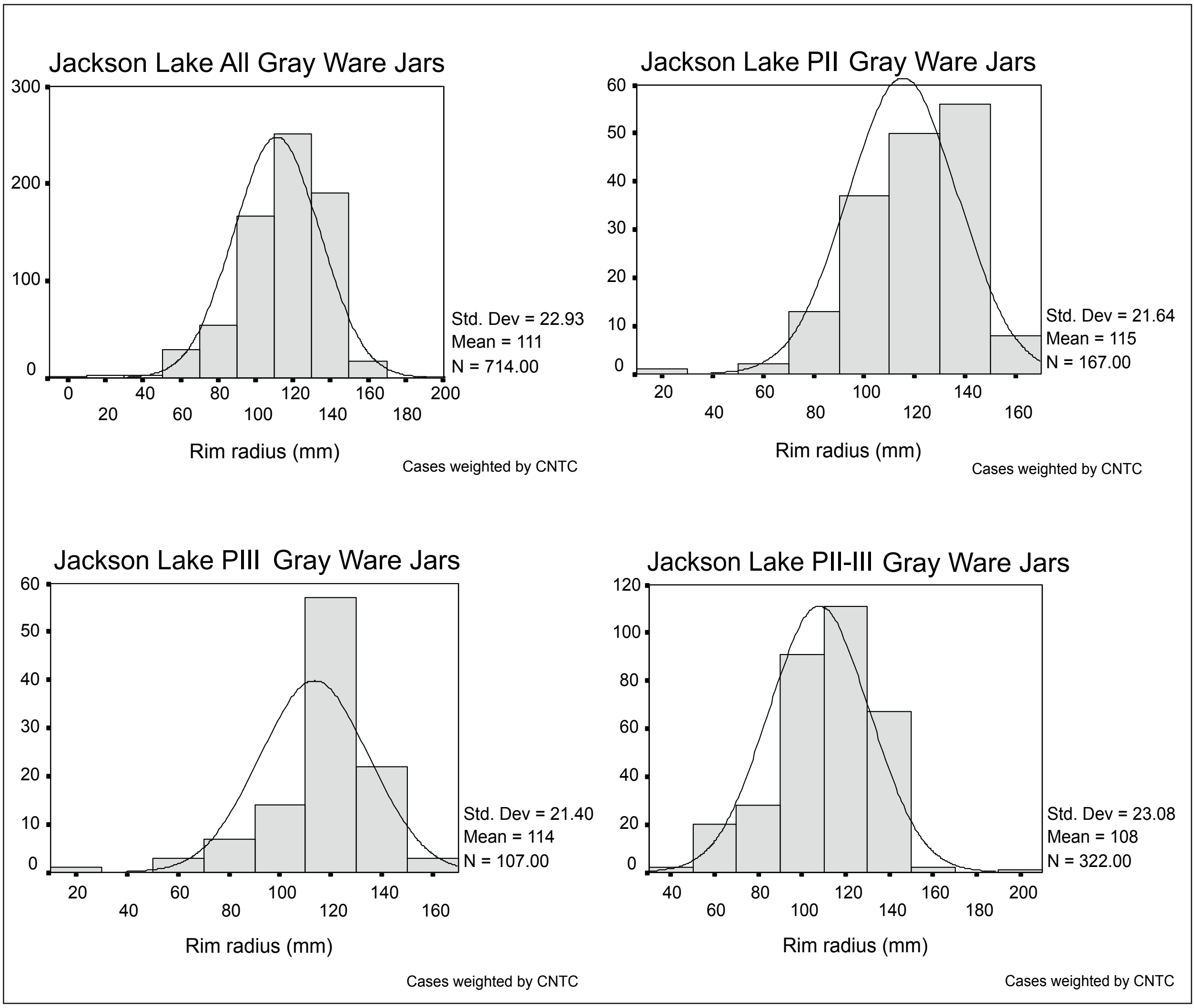


Figure 18.8. Jackson Lake community (all sites), gray ware jars, rim radii (counts) by period; bar chart.

of pottery types identified at these Basketmaker III sites are interpreted as reflecting an important but poorly understood transition that appears to have occurred across the Colorado Plateau. Notable was the occurrence of polished utility brown ware as the sole pottery found in the earliest component at LA 37594, which consisted of a shallow pithouse that dated to the sixth century. Pottery from this component reflects the spread of generalized ceramic technologies and forms characteristic of the earliest ceramic vessels produced in regions across the Southwest. The dominance of Basketmaker III white and gray ware ceramic types commonly noted at Basketmaker III sites scattered across the Colorado Plateau was noted at another pithouse (LA 60751) in the Jackson Lake community that was occupied during the seventh century. Observations relating to the associated ceramics and the dating of these sites, as well as similar Basketmaker III sites scattered across the Colorado Plateau provide the basis for the definition and examination of long-term trends associated with Basketmaker-period components. This combination of pottery reflects both the initial introduction and spread of a similar ceramic technology by about AD 200 that is reflected by similar simple and expedient undecorated forms characterized by the use of self-tempered alluvial clays with a high iron content. During the sixth century, there was a gradual transition to the production of distinct gray and white ware types characterized by more durable and spe-

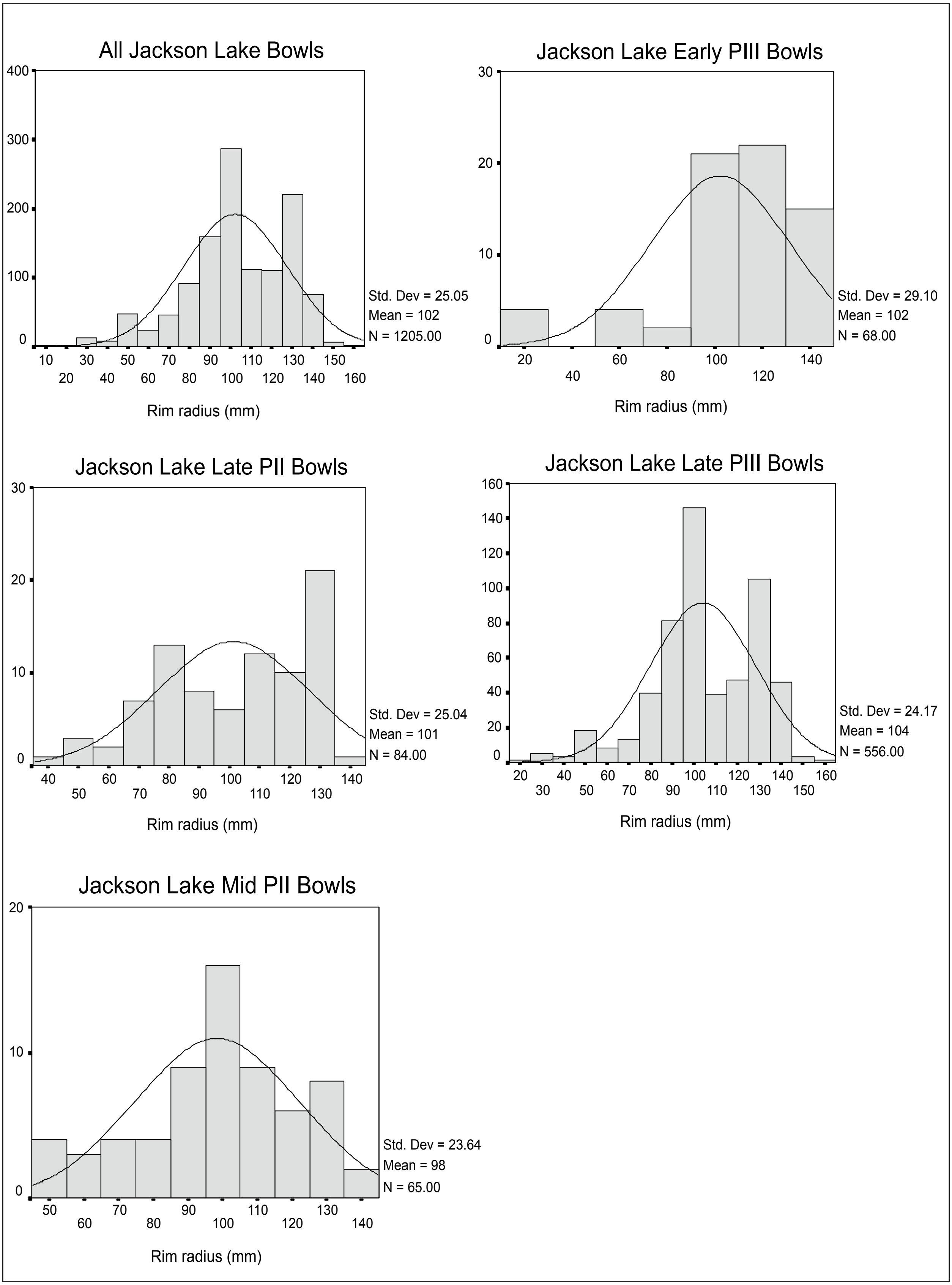


Figure 18.9. Jackson Lake community (all sites), white ware bowls, rim radii (counts) by period, bar chart.

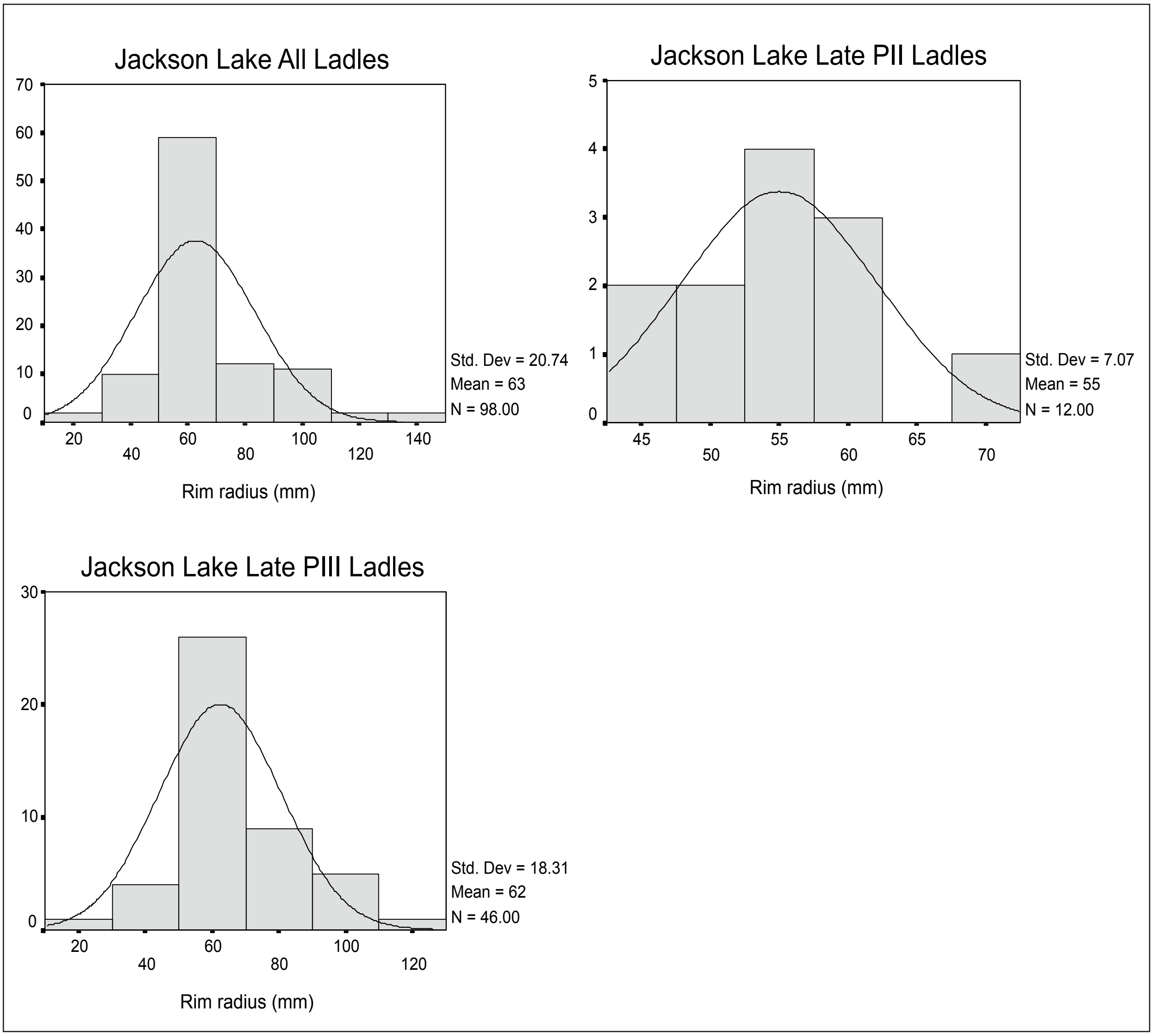


Figure 18.10. Jackson Lake community (all sites), white ware ladles, rim radii (counts) by period, bar chart.

cific vessel forms using clays from shale outcrops. Other innovations included the addition of aplastic temper, and firing in a more controlled neutral atmosphere to produce a gray or white surface.

Ceramic distributions from the Jackson Lake community, indicative of components dating from the Pueblo II through the Pueblo III periods, provide clues concerning trends associated with the larger great house communities spread across much of the La Plata Valley and elsewhere in the Colorado Plateau. The assignment of ceramic dates to assemblages from various sites associated with the Jackson Lake community indicate a long and continuous occupation that may have spanned about three centuries, including most of the Pueblo II and Pueblo III periods as usually defined. Stylistic analysis applied to white wares indicated a series of very gradual changes that seem to reflect a long sequence of continual occupation and development. The great majority of the pottery recovered and analyzed from the project sites exhibit a combination of tempers and clays that reflect local production, although this pottery also appears to reflect earlier (Pueblo II period) ties with sites in the Chaco region to the south and later influences and ties with the Mesa Verde region to the north.

Table 18.42. White ware surface polish by pottery type; counts and percents.

Pottery Type (white ware)	Surface Polish									
	None and Indeterminate		Light		Moderate		Heavy		Total	
	Count	Row %	Count	Row %	Count	Row %	Count	Row %	Count	Row %
Red Mesa Black-on-white	–	–	3	33.3%	6	66.7%	–	–	**9**	**100.0%**
Pueblo II black-on-white	4	1.3%	93	30.7%	195	64.4%	11	3.6%	**303**	**100.0%**
Early Pueblo III black-on-white	0	0.0%	35	17.3%	158	78.2%	9	4.5%	**202**	**100.0%**
Late Pueblo III black-on-white	2	1.6%	9	7.2%	86	68.8%	28	22.4%	**125**	**100.0%**
Pueblo III black-on-white	–	–	27	11.8%	175	76.4%	27	11.8%	**229**	**100.0%**
Transitional Pueblo III black-on-white	1	1.0%	16	15.4%	77	74.0%	10	9.6%	**104**	**100.0%**
Total	**7**	**0.7%**	**183**	**18.8%**	**697**	**71.7%**	**85**	**8.7%**	**972**	**100.0%**

Table 18.43. White ware surface polish by time period; counts and percents.

Time Period	Surface Polish									
	None and Indeterminate		Light		Moderate		Heavy		Total	
	Count	Row %	Count	Row %	Count	Row %	Count	Row %	Count	Row %
Middle Pueblo II	3	3.9%	17	22.1%	54	70.1%	3	3.9%	**77**	**100.0%**
Late Pueblo II	0	0.0%	23	47.9%	24	50.0%	1	2.1%	**48**	**100.0%**
Early Pueblo III	0	0.0%	1	16.7%	4	66.7%	1	16.7%	**6**	**100.0%**
Total	**3**	**2.3%**	**41**	**31.3%**	**82**	**62.6%**	**5**	**3.8%**	**131**	**100.0%**

Table 18.44. Reconstructible vessels from Basketmaker III contexts by site, with attribute details.

Site	Loc.	Vessel No.	Pottery Type	Temper	Form	Complete-ness	Paint	Slip	Wear, Sooting	Rim Diam.	Height
LA 60751	PS 1, Bench	1	polished gray	sand	jar	N/A	none	none	partly sooted	indet.	indet.
LA 60751	PS 1, Bench	2	Chapin Black-on-white	crushed igneous	bowl	25%	mineral	none	some basal wear	25 cm	11 cm
LA 60751	PS 1, Bench	3	Chapin Black-on-white	crushed igneous	bowl	N/A	mineral	Fugitive Red	sooted, both sides	indet.	indet.

Loc. = Location; PS = pit structure; indet. = indeterminate; Diam. = Diameter

Table 18.45. Reconstructible vessels from Mid Pueblo II contexts by site, with attribute details.

Site	Location	Vessel No.	Pottery Type	Temper	Form	Completeness	Paint	Slip	Wear and Sooting	Rim Diameter (cm)	Height (cm)
LA 37592	Burial 7	3	Mancos Black-on-white	igneous	bowl	40%	mineral	–		75.0	**?**
LA 37592	Burial 7	7	Mesa Verde Corrugated Gray	igneous	pitcher	NA	none	none	heavily sooted	80.0	140.0
LA 37593	Pit Structure 1, floor	1	Mancos Black-on-white	crushed igneous, sherd	olla	NA	mineral	none	none	8.0	?
LA 37593	Pit Structure 1, Feature 1	2	Dolores Corrugated	crushed igneous	cooking/ storage jar	NA	none	none	NA	?	?
LA 37593	Pit Structure 1, Floor 1	3	Dolores Corrugated	crushed igneous	cooking/ storage jar	20%	none	none	heavy sooting over	13.0	16.0
LA 37593	Pit Structure 1, floor	4	Mancos Black-on-white	crushed igneous	jar base	20%	mineral	none	light wear on base	?	?
LA 37593	Burial 2	5	Dolores Corrugated	crushed igneous	cooking/ storage jar	85%	none	Mp	interior is heavily eroded	25.0	34.0
LA 37593	Feature 1, Burial 2	9	Mancos Black-on-white	crushed igneous, sand	bowl	30%	mineral	Mp	base lightly abraded	18.0	8.0
LA 37593	Burial 2	10	Corrugated body	crushed igneous	jar	NA	none	none	heavily sooted exterior, organic residue on interior	?	?
LA 37594	Feature 3, Room 1	1	Dolores Corrugated	crushed igneous	cooking/ storage jar	NA	none	none	base heavily sooted	28.0	?
LA 37594	Room 1, Floor 2	2	Corrugated body	crushed igneous	jar	NA	none	none	top half of vessel heavily sooted	?	?
LA 37594	Feature 1, Level 3	3	Mancos Black-on-white	crushed igneous, sherd	olla	60%	mineral	none	no wear or sooting noted	8.0	?
LA 37595	Room 2, Floor 2	1	Indeterminate corrugated	?	seed jar	100%	mineral	none	base abraided, exterior sooted	8.0	11.5
LA 37595	Burial 1	2	Deadmans Black-on-red	crushed igneous	canteen	60%	mineral	none	base heavily abraded	?	15.0?
LA 37595	Pit Structure 1, Layer 5	3	Dolores Corrugated	crushed igneous	cooking/ storage jar	50%	none	none	heavily sooted over most of the exterior	22.0	?
LA 37595	Pit Structure 1, Feature 1, Layer 5	4	Dolores Corrugated	crushed	cooking/ storage jar	NA	none	none	upper vessel heavily sooted	21.0	?
LA 37595	Pit Structure 1, Layer 5	5	Dolores Corrugated	crushed igneous	cooking/ storage jar	NA	none	none	exterior heavily sooted	21.0	?

? = indeterminate, NA = not applicable

Table 18.46. Reconstructible vessels from Late Pueblo II contexts by site, with attribute details.

Site	Location	Vessel	Pottery Type	Temper	Form	Completeness	Paint	Slip	Wear and Sooting	Rim Diameter (cm)	Height (cm)
LA 37593	Burial 1	8	Mancos Black-on-white	crushed igneous	ladle	70%	organic	medium	base lightly worn; dipper wear near rim	9.0	4.0
LA 37593	Room 3, Layer 8	11	Dogoszhi Black-on-white	sand	bowl	100%	organic	medium	base lightly worn; Fire Cloud on exterior	20.0	11.5
LA 37593	Room 1, Floor 1	12	Dolores Corrugated	crushed igneous and sherd	cooking/ storage jar	NA	none	none	moderately sooted	22.0	?
LA 37593	Room 1, Layer 1	13	Dolores Corrugated	crushed igneous	cooking/ storage jar	NA	none	none	lightly sooted	21.0	?
LA 37593	Feature 2	16	Pueblo II–III black-on-white	crushed igneous	duck effigy	100%	organic	none	none	?	5.5
LA 37593	Feature 4, Room 3	17	Dolores Corrugated	crushed igneous	jar	80%	none	none	repair holes; moderately sooted	22.0	40.0

? = indeterminate, NA = not applicable

Table 18.47. Reconstructible vessels from Early Pueblo III contexts by site, with attribute details.

Site	Location	Vessel	Pottery Type	Temper	Vessel Form	Completeness	Paint	Slip	Wear and Sooting	Rim Diameter (cm)	Height (cm)
LA 37592	Pit Structure 1, Layer 4	1	Pueblo II–III black-on-white	crushed igneous and sherd	duck effigy	35%	organic	none	heavily abraded base	?	6.0
LA 37592	Burial 6	8	Dolores Corrugated	crushed igneous and sherd	cooking/ storage jar	95%	none	none	lower vessel heavily sooted	8.5?	13.0
LA 37592	Burial 6	12	McElmo Black-on-white	crushed igneous	bowl	100%	organic	none	abrasion on base	20.0	8.0
LA 37592	Feature 1, Level 1	14	Dolores Corrugated	crushed igneous	cooking/ storage jar	not applicable	none	none	heavily sooted	16.0	–
LA 37593	Burial 3	18	McElmo Black-on-white	crushed igneous	ladle	75%	organic	none	base slightly abraded	9.5	4.5
LA 37593	Room 1, Floor 1	19	Dolores Corrugated	crushed igneous	cooking/ storage jar	70%	none	none	sooting along exterior bottom	?	?
LA 37593	Room 1, Floor 1	20	Pueblo II–III black-on-white	crushed igneous	jar	–	organic	none	repair holes	?	?
LA 37598	–	1	Mesa Verde Corrugated	crushed igneous	cooking/ storage jar	30%	none	none	?	23.0?	?

? = indeterminate

Table 18.48. Reconstructible vessels from Late Pueblo III contexts by site, with attribute details.

Site	Location	Vessel No.	Type	Temper	Form	Completeness	Paint	Slip	Wear, Sooting	Rim Diam.	Height
LA 37593	Extramural Area 1, Feature 2 (major storage cist), Level 1	6	Mancos Black-on-white	crushed igneous	bowl	35%	mineral	mod.	reshaped with repair holes; base wear	20 cm	–
LA 37593	Extramural Area 1, Feature 2 (major storage cist), Level 4	7	Mummy Lake Gray	crushed igneous	cooking/ storage jar	95%	none	none	moderate vessel abrasion, entire vessel sooting; heavy rim abrasion	15 cm	22 cm
LA 37593	Extramural Area 1, Feature 2 (major storage cist), BHT	15	McElmo Black-on-white	sand	pitcher	–	organic	mod.	base heavily worn	N/A	N/A

N/A = not applicable; mod. = moderate.; BHT = backhoe trench

Table 18.49. Reconstructible vessels by site/provenience and time period, with pottery type, vessel form, and sherd count.

Site	Provenience	Vessel No.	Ceramic Type	Vessel Form	Sherd Count
Basketmaker III					
LA 60751	Pit Structure 1, Floor 2, bench	1	Sambrito Utility	jar	38
		2	Chapin Black-on-white	bowl	2
		3	Chapin Black-on-white	bowl	3
Middle Pueblo II					
LA 37593	Pit Structure 1, floor and features	2	Dolores Corrugated	cooking/storage jar	25
		1	Mancos Black-on-white	olla	50
		3	Dolores Corrugated	cooking/storage jar	84
		4	Mancos Black-on-white	jar base	7
LA 37593	Burial 2	5	Dolores Corrugated	cooking/storage jar	57
		10	corrugated body	jar	3
		9	Mancos Black-on-white	bowl	2
LA 37594	Room 1, floor and features	1	Dolores Corrugated	cooking/storage jar	343
		2	corrugated body	jar	1
LA 37594	Extramural Area 2, Level 3	3	Mancos Black-on-white Sosi	olla	17
LA 37594	Pit Structure 1, Layer 4	4	Mancos Black-on-white	bowl	2
LA 37595	Pit Structure 1, Level 2, Burial 1	1	indeterminate corrugated	seed jar	1
LA 37595	Pit Structure 1, Level 2, Burial 1	2	Deadmans Black-on-red	canteen	1
LA 37595	Pit Structure 1, Layer 4, bench	4	Dolores Corrugated	cooking/storage jar	7
LA 37595	Pit Structure 1, Layer 5	3	Dolores Corrugated	cooking/storage jar	63
LA 37595	Pit Structure 1, Layer 5	5	Dolores Corrugated	cooking/storage jar	12
Late Pueblo II					
LA 37593	Room 1, Layer 1	13	Dolores Corrugated	cooking/storage jar	47
LA 37593	Room 1, floor	14	Dolores Corrugated	cooking/storage jar	60
LA 37593	Room 3, Layer 810	11	Dogoszhi Black-on-white	bowl	1
LA 37593	Room 3, Feature 4	12	Dolores Corrugated	jar	136
LA 37593	Room 103, indeterminate, Feature 6	16	Pueblo II-III black-on-white	duck effigy	1
LA 37593	Burial 1	8	Mancos Black-on-white	ladle	1
Early Pueblo III					
LA 37592	Pit Structure 1, Backhoe Trench, NW 1/4	2	McElmo Black-on-white	bowl	46
		10	Mancos Black-on-white	pitcher	4
LA 37592	Pit Structure 1, Layer 4	1	Pueblo II-III black-on-white	duck effigy	1
LA 37592	Room 203, fill	4	Mancos Black-on-white	bowl	20
LA 37592	Burial 6	8	Dolores Corrugated	cooking/storage jar	12
		12	McElmo Black-on-white	bowl	20
LA 37592	Room 201, Floor 1, subfloor vessel Feature 3	9	Dolores Corrugated	cooking/storage jar	75
LA 37593	Extramural Area 1, Feature 5 (cist), Burial 3	18	McElmo Black-on-white	Ladle	1
LA 37598	Room 103, Floor 1	1	Mesa Verde Corrugated	cooking/storage jar	49
Late Pueblo III					
LA 37593	Extramural Area 1, Feature 2 (major storage cist)	7	Mummy Lake Gray	cooking/storage jar	16
		6	Mancos Black-on-white	bowl	10
		15	McElmo Black-on-white	pitcher	9

Table 18.50. Reconstructible vessels without definitive time period association, by site/provenience and pottery type, with attribute details and dimensions.

Site	Provenience	Vessel No.	Ceramic Type	Temper	Vessel Form	Paint Type	Diameter (mm)	Height (mm)
LA 37591	Extramural Area 1, Feature 1	1	Mesa Verde Corrugated	igneous	cooking, storage	–	130.0	–
LA 37592	Pit Structure 1	2	Mesa Verde Pueblo III Black-on-white	igneous	bowl	organic	290.0	150.0
LA 37592	Room 203	4	Mesa Verde Pueblo II–III Black-on-white	igneous	bowl rim	organic	190.0	100.0
LA 37592	Burial 2	5	McElmo Black-on-white	igneous	bowl rim	organic	130.0	60.0
LA 37592	Burial 2	6	McElmo Black-on-white	igneous	bowl rim	organic	190.0	80.0
LA 37592	Burial 6	8	Dolores Corrugated	igneous	cooking, storage	–	85.0	130.0
LA 37592	Room 201, Floor 1	9	Dolores Corrugated	igneous	cooking, storage	–	240.0	210.0
LA 37592	Pit Structure 1	10	Mancos Black-on-white (squiggle hachure)	igneous and sherd	pitcher	mineral	70.0	–
LA 37592	Room 201, Floor 3	11	Mesa Verde Corrugated Gray	igneous	necked jar	–	–	–
LA 37592	Pit Structure 1, Layer 6	15	Pueblo III black-on-white	sherd	bowl body	organic	–	–
		15	Pueblo II–III black-on-white	sherd	jar body	organic	–	–
LA 37594	Pit Structure 1	4	Mancos Black-on-white	igneous and sherd	bowl rim	mineral	170.0	–

19 Chipped Stone from the Jackson Lake Community

H. Wolcott Toll

Excavations along the La Plata Highway provided large quantities of raw data with potential for examining any number of questions. Areas on which we decided to focus fall into a few major categories: (1) Archaeologists generally define communities by means of site distributions. Can we also see community relationships in material culture distinctions? That is, do we have the analytical acuity to distinguish intercommunity and even intracommunity differences? (2) What is the relationship of these communities to the larger regional picture (Fig. 19.1)? Since these sites were occupied during the construction and use of the great houses in Chaco Canyon, and since great houses are present in the La Plata Valley and the Totah, how did these communities interact with the regional systems, and how did they affect each other? (3) What are we able to say about the decade-to-decade life of the residents of the valley? How did it change, and how did it remain constant? Again, what are the sources of change and stasis?

Lithic analysis is in many ways a difficult and perhaps in some ways inappropriate avenue on which to approach these questions. Though there are large numbers of artifacts, linking the attributes we are presently able to observe with cultural processes is highly inferential. The scarcity of formal tools and the expediency of most Anasazi lithic technology make the study of style, function, and change a challenge. Most lithic artifacts would be useful for a wide variety of tasks, and many such tasks would leave little or no observable trace on the artifact. With the exception of projectile points—of which there are only 77 in the sample—chipped stone tools do not fall readily into temporal groups, and absolute dates are especially few from the Jackson Lake sites. Therefore, studies of temporal change in stone tools rely on period placement by association with ceramics.

The 16 sites in the Jackson Lake community produced 27,794 pieces of chipped stone, weighing 474.1 kg (half a ton). By comparison, the 71,012 ceramics from the same proveniences weigh 433.3 kg. Site counts of chipped stone range from 6 to 14,049 pieces; at the eight sites where major excavations took place, the average per-site count is 3,340, but removing the huge count from LA 37592 reduces the average count to 1,810 for the other seven sites (Table 19.1). Although twice as many lithics were recovered from the Barker Arroyo segment of the project, counts from the Jackson Lake segment are comparable to the Chaco Project analysis, which contained 34,375 pieces (Cameron 1997). Other quantities of chipped stone from large projects include 15,856 from five communities on the Transwestern Pipeline (Winter 1994:308) and 5,861 items from 19 sites in the Bis sa'ani community (Simmons 1982:1001).

Although it is difficult to know how to compare these figures, the assemblage from Jackson Lake is a substantial one. Three-fourths of the material (by count) in the assemblage was recovered from proveniences that were screened, and 8.5 percent came from intensive surface collection. The remaining 15 percent was collected from backhoe trenching and deep structure fill removal without screening. The latter techniques, of course, lead to fewer small items being recovered. Due to right-of-way definition and expedient excavation techniques, no site could be considered fully excavated, so it follows that the collection does not contain all chipped stone present at a site. Floor proveniences and the artifact-laden midden in the upper fill of Pit Structure 1 at LA 37592, however, were fully excavated by hand

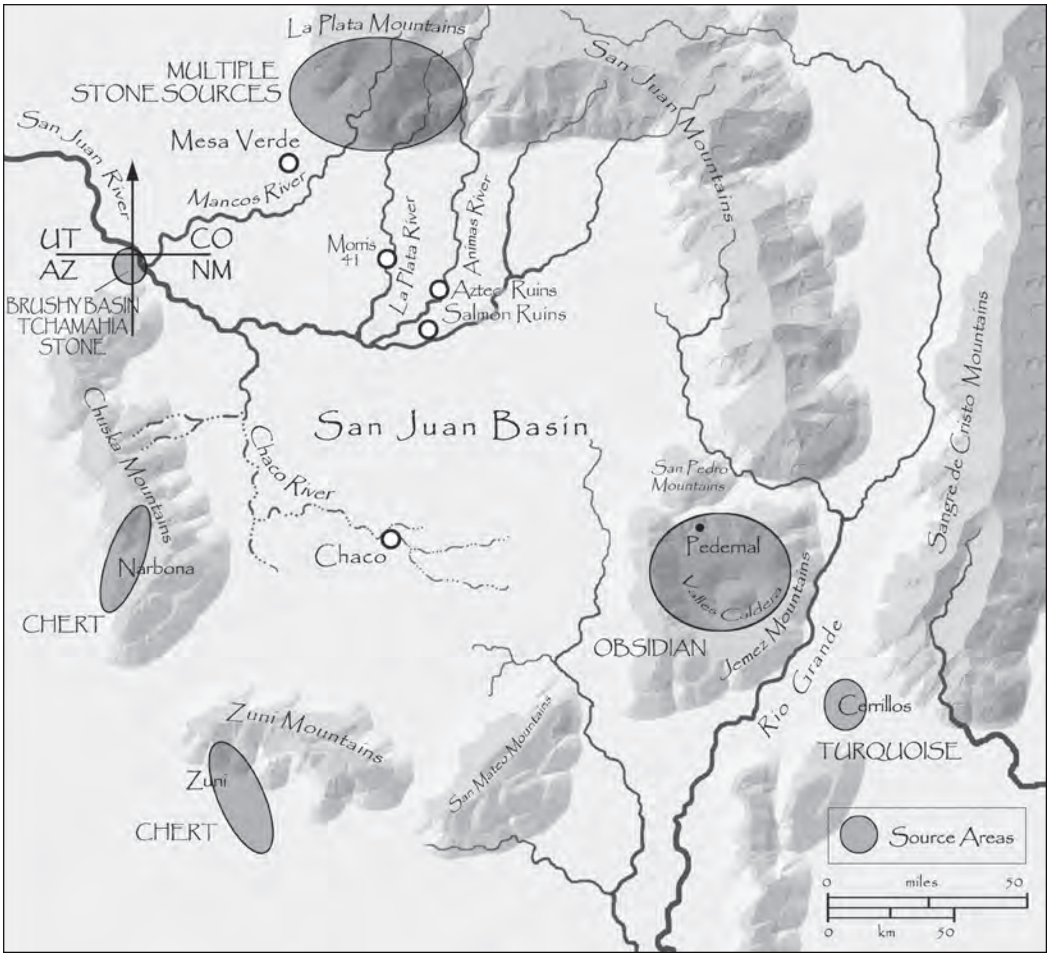


Figure 19.1. Locations of sources and sites mentioned (partially adapted from Cameron 1997:540).

Table 19.1. Chipped stone, totals by site; counts and weight (g), with percents.

Site	Count	Col. %	Weight (g)	Col. %
LA 37591	1755	6.3%	41,910.0	8.8%
LA 37592	14,049	50.5%	193,022.0	40.7%
LA 37593	3138	11.3%	53,991.0	11.4%
LA 37594	2985	10.7%	48,370.0	10.2%
LA 37595	1555	5.6%	44,147.0	9.3%
LA 37596	51	0.2%	1942.0	0.4%
LA 37597	83	0.3%	1222.0	0.3%
LA 37598	2126	7.6%	53726.0	11.3%
LA 60743	6	0.0%	173.0	0.0%
LA 60744	502	1.8%	5367.0	1.1%
LA 60745	41	0.1%	828.0	0.2%
LA 60747	116	0.4%	961.0	0.2%
LA 60749	567	2.0%	10,200.0	2.2%
LA 60751	544	2.0%	10,206.0	2.2%
LA 60752	80	0.3%	2601.0	0.5%
LA 60753	196	0.7%	5405.0	1.1%
Total	**27,794**	**100.0%**	**474,071.0**	**100.0%**

and screened. This midden deposit consistently accounts for a large percentage of the material in a number of categories.

Analysis Methodology and History

The Jackson Lake chipped stone material was analyzed under a recording system developed by Karen Wening and then by David Cushman. Although comparable to the Barker Arroyo recording system and the OAS standard system (OAS Staff 1994) in many respects, this system focused more heavily on material variability and edge use than these other systems. The system was applied in stages, first to material from the 1987 testing program (LA 60744 and LA 60753 in the Jackson Lake segment), and subsequently to the material from the excavated Jackson Lake sites. The great attention to color variation in material types and the focus on edge damage were eliminated when Signa Larralde assumed directorship for the analysis, and these attributes were not recorded for Barker Arroyo materials. When the data sets were transformed into a single usable data set, therefore, a number of variables from the original Jackson Lake analysis were abandoned. Raul Troxler and Eric Blinman devised the programs that standardized the data and were responsible for much of the data curation during establishment of the data sets. The standardized data set is the basis for most of this discussion of the Jackson Lake lithic artifacts, but, where useful, the original data have also been used. I subsequently took over the tasks of data curation, cleaning, and manipulation, and report preparation for the various lithic analyses.

The chipped stone recording was accomplished by a number of analysts, including Peter Bullock, Karen Wening, Adisa Willmer, Leslie Barnhart, and David Cushman. Each item was examined and described as a separate case on coding forms. The use of several analysts and the complexity of the material types naturally left room for variability in recording. Grouping the materials into the standardized material types eliminated most of this variability.

Although variables for dimension measurements are included in the Jackson Lake system, these data were recorded for only 181 of the 27,794 cases in the study. These data were recorded primarily at LA 60744 and LA 60753 early in the analysis stream. Thus, none of the major Jackson Lake site assemblage data sets have this information. The proxy for all measurement is weight: every item was weighed. Most of the data presented here are by count, although several tables present both count and weight (e.g., Tables 19.1, 19.2, 19.3). Counts have the problems that individual units represent different—sometimes very different—behaviors (see Shott 2000). Thus, a tool that involved many steps and much effort to manufacture counts the same as a single flake removed from that same tool or a large core. Enumeration problems are further compounded by the possibilities of post-production breakage. Some control for these discrepancies is gained by examining classes of forms and by controlling for completeness. Enumeration problems are both compounded and alleviated in expedient assemblages such as these. On the one hand, since it is often difficult to specify which items were actually used and for what, counting tools or portions of tools is more difficult than in assemblages where most tools were formal. On the other hand, if most items of a certain size were potentially tools, perhaps less distinction among items is necessary. Not that assemblages with more formal tools are necessarily easier to deal with: expedient tools are part of those assemblages, too, and must be accounted for; only if more formal tools means fewer expedient tools (not a secure assumption) would this be the case. Weights also have comparability problems as a means of quantification, since a single large core or hammerstone will count the same as numerous items representing many actions. Numbers are useful for comparison of tool occur-

Table 19.2. Chipped stone, totals by material type; counts and weight (g), with percents.

	Count	Col. %	Weight (g)	Col. %
Chert	13,741	49.4%	166,012.0	35.0%
Chalcedony	449	1.6%	1391.0	0.3%
Silicified wood	2728	9.8%	18,200.0	3.8%
Quartzite	1052	3.8%	30,697.0	6.5%
Quartzitic sandstone	1760	6.3%	43,522.0	9.2%
Obsidian	5	0.0%	5.0	0.0%
Igneous	103	0.4%	4082.0	0.9%
Rhyolite	73	0.3%	3502.0	0.7%
Sandstone	103	0.4%	4864.0	1.0%
Siltstone	7747	27.9%	200,049.0	42.2%
Other	33	0.1%	1347.0	0.3%
Total	**27,794**	**100.0%**	**474,071.0**	**100.0%**

Table 19.3. Chipped stone, totals by artifact type; counts and weight (g), with percents.

	Count	Col. %	Weight (g)	Col. %
Debitage	23,823	85.7%	190,401.0	40.2%
Core	949	3.4%	114,359.0	24.1%
Uniface	6	0.0%	91.0	0.0%
Biface	7	0.0%	33.0	0.0%
Utilized debitage, retouched	2195	7.9%	34,263.0	7.2%
Utilized core, retouched	108	0.4%	10,109.0	2.1%
Drill	26	0.1%	169.0	0.0%
Graver	9	0.0%	88.0	0.0%
Notch	62	0.2%	1376.0	0.3%
Denticulate	13	0.0%	187.0	0.0%
Bifacial knife/scraper	14	0.1%	164.0	0.0%
Projectile point	77	0.3%	173.0	0.0%
Hammerstone	361	1.3%	107,475.0	22.7%
Hammerstone flake	100	0.4%	4136.0	0.9%
Chopper/plane	41	0.1%	9078.0	1.9%
Axe	1	0.0%	499.0	0.1%
Hoe	2	0.0%	1470.0	0.3%
Total	**27,794**	**100.0%**	**474,071.0**	**100.0%**

rence between assemblages, while weights give better ideas of absolute quantities of raw materials occurring at different locations.

In addition to the analysis to which all recovered material was subjected, subsets of the assemblage were analyzed by more specific studies. Signa Larralde and Sarah Schlanger separated the projectile points for more detailed examination, as well as the "large hafted tools"—primarily axes, tchamahias, and mauls (and are thus mostly ground stone). Their report on the large hafted tools will be published in the synthesis volume (Vol. 6) of this report. I assumed responsibility for and modified their projectile point analysis, adding some artifacts and some variable states. This analysis contributes both to this report and to the overview. The overlap between the detailed projectile point and formal tool analysis is not perfect for several reasons: the assignment of tool names such as drill and knife to utilized flakes; the subdivision of categories, particularly projectile points, in the more detailed analysis; and reassessment of artifacts during more detailed analysis. This lack of correspondence is most serious in the category "drill," where the bulk analysis indicates 29 specimens and the detailed analysis only 3. The items in the formal tool analysis, then, are more conservatively identified based on morphology, as opposed to those in the general analysis, which rely more heavily on functional interpretation combined with shape.

Proveniences fall into several levels of temporal and functional reliability, from unmixed contexts—which are very likely to represent a short, well-defined time span—to contexts that are sufficiently mixed as to have little temporal meaning beyond the broadest parameters of a site's dates. All La Plata proveniences have been reviewed in terms of their ceramic content and the excavators' assessment of the integrity of the context. Those judged reliable have been assigned "component age" codes; only those contexts that have been assigned this code are used for analyses examining temporal questions. Data from chipped stone analyses have been linked with provenience data so that each line of lithic information also has information on context and date. Just over 40 percent of the lithic collection (by count) is from contexts allowing for temporal comparisons.

Material Types

Identifying the natural sources of chipped stone informs us on several levels. The presence of materials exotic to the La Plata Valley (as determined by raw material type) is a gauge of one type of interaction with populations in other areas or patterns of acquisition outside the area. Distributions of local materials can inform us about organization of production within the valley. In addition to spatial information about sources, different materials have different functional qualities, the importance of which we can examine by their use and properties.

The gravel terraces of the La Plata Valley would seem to provide an inexhaustible supply of siltstone and quartzite (Figs. 19.2, 19.3), as well as material for manos, axes, and architecture. Cherts and igneous materials (andesite/diorite and rhyolite) are present in the gravels, but are less abundant (Moore 1988a; Cushman 1991). Siltstone cobbles originate from glacial outwash from the La Plata Mountains in Colorado, while chert is more likely to have originated in the sandstone bedrock of the valley, added to the gravels during scouring of the valley bedrock (Wells and Enzel 1990; Cushman 1990). Probably for the same reason, gravels in the Animas Valley contain more cherts (Moore 1988a).

Materials can be placed in two broad "super categories," which tend to share morphological attributes. The first consists of fine-grained materials, which are more homogeneous; it includes chert, silicified wood, and chalcedony. The second group includes coarser materials: siltstone, quartzite, and quartzitic sandstone, and, less numerous, igneous rocks such as andesite and rhyolite. The finer materials tend to be smaller and more heavily worked.

Cushman (1990) conducted inventories of surface materials in eight locations around the project area. His samples from Piñon Mesa, just to the west of the Jackson Lake sites, and McDermott Arroyo (Fig. 19.2) contained silicified wood, which was absent from other surface and subsurface sample areas. The Piñon Mesa sample contained the highest density of silicified wood and chert. It was the only location that did *not* yield siltstone. This area is clearly outside the Pleistocene cobble zone, which supplied the siltstone to the valley residents. Chert pebbles are present in huge numbers in the conglomeratic sandstones (especially the Ojo Alamo) on Piñon Mesa, but cobbles of flakeable size are harder to find.

In spite of their location next to terraces ap-

Figure 19.2. View of the terrace slopes just west of sites LA 37591, LA 37592, LA 37593, LA 37594, and LA 37595, illustrating the huge numbers of cobbles on the terraces and talus.

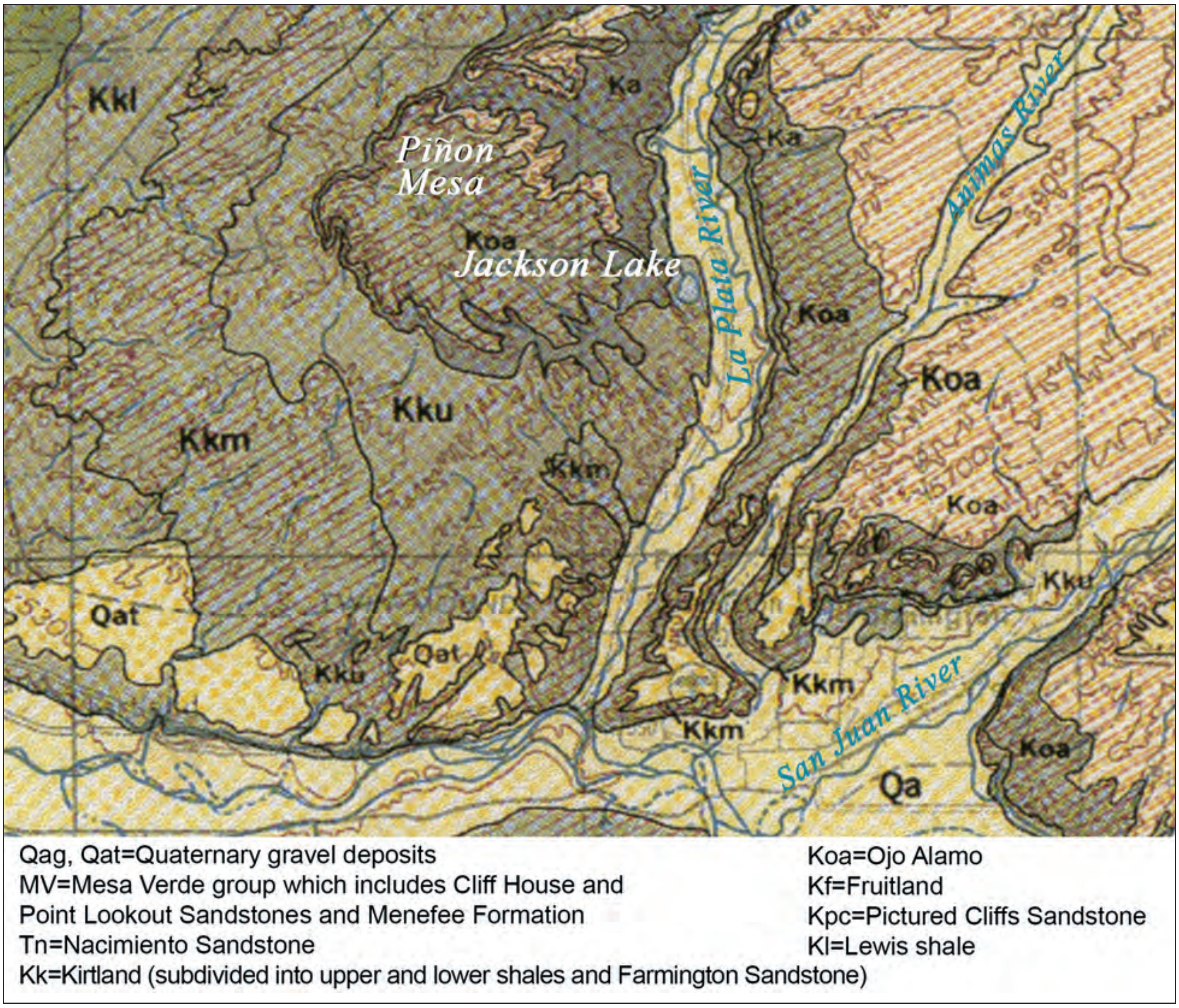


Figure 19.3. Formations in and surrounding the La Plata Valley. Note the large expanses of Quaternary gravel terrace along the main rivers to the north. Important sources of lithic materials also include the Ojo Alamo, Piñon Mesa, and other Ojo Alamo outcrops and terraces; the major drainages are lined by recent alluvium (figure adapted from Connor 1990, O'Sullivan and Beikman 1963, and Moore 1988b:12.)

parently similar to those a few km up the valley at Barker Arroyo, Jackson Lake material types are somewhat different from those at Barker Arroyo. Use of chert is considerably heavier at Jackson Lake, and use of siltstone is considerably less; these two materials are the most abundant at both locations, but their relative frequencies are different. Ojo Alamo, variously assigned to the Cretaceous, the Tertiary, and the boundary between the two, is described as "brown crossbedded sandstone containing spherical-pebble conglomerate composed of quartzite and chert clasts near [the] base. . . . [It] grades laterally into the lower part of the Animas Formation to the north and contains abundant petrified wood" (Manley et al. 1987).

This formation was an important source of material in Chaco Canyon as well (Cameron 1997), occurring in a northwest to southeast band north of Chaco; the farthest north outcrop is a small, isolated outcrop near LA 37607 (Condon 1990).

Cushman's samples from terraces north of Jackson Lake show that nearly all the material available there was siltstone, with small amounts of quartzitic sandstone, illuminating the superficially surprising differences between the Barker Arroyo and Jackson Lake communities. Quartzitic sandstone and silicified wood are also more common at Jackson Lake than at Barker Arroyo. All of these higher percentages at Jackson Lake stem in part from the extraordinary abundance of siltstone at Barker Arroyo. It may also be that the more direct access to the badlands (Kirtland-Fruitland formations) from the Jackson Lake area made obtaining raw cherts easier for residents of the Jackson Lake area. Ojo Alamo and Kirtland-Fruitland outcrops are reasonably close to both areas, however. The Nacimiento Formation is widely exposed in northwestern New Mexico, including much of the area south and east of the La Plata River (Fig. 19.2). Nacimiento gravels contain siltstones, andesite, diorite, and coarse-grained quartzites, as well as a few cherts (Moore 1988b:11).

Love (1997a:623–624) isolates the Nacimiento and Ojo Alamo Formations as two of the most likely sources of chipped stone material, especially silicified wood and jasper, in Chaco Canyon. The La Plata River cuts through these two formations at Jackson Lake, providing an important chipped stone material source in addition to the gravel terraces. Both are sources of chert and silicified wood.

In the process of pulling together materials from the entire project and striving to enhance replicability, the range of material types recorded was greatly condensed (compare Tables 19.2, 19.4). The original coding system was based on Helene Warren's material codes, which are widely used in the Southwest (Table 19.4). The majority of this discussion is based on the collapsed material categories, but the original codes retain information about material variability that I have used in the material discussions. Especially since the Warren codes are widely used, a listing of all the codes used grouped into the collapsed material categories by major form categories is found in Table 19.4. This listing of "types" of materials points up many of the difficulties facing lithic analysts. These difficulties stem from having to differentiate among categories that are either on continua with or between categories that share many attributes. For example, in this system large numbers of items were placed in yellow-brown chert (1070) and yellow-brown silicified wood (1150). These materials were recorded in approximately equal numbers (nearly a thousand of each), and there is little doubt that some of these items are the same material although coded differently. Moreover, there is little doubt that when heat treated this material turns a deep red brown and would then be coded 1122. Whether an item is coded as wood or as chert may rest on the visibility of dark streaks indicating wood structure. As those intimate with the Warren codes will understand, the analysts added even further codes for materials they did not feel were covered by that system, resulting in 285 material type codes. The listing in Table 19.4 gives additional perspective on the amount of material variety present in these lithics. The identifications were purely visual, with no use of chemical verifications, so identifications such as Flint Ridge Ohio (code 1450) should be evaluated accordingly.

In the course of the analysis, some additions of codes seem to be inconsistent with the basic system. An extreme example of this occurred with the 3200 to 3210 bracket of codes. The 3200 series should be igneous materials, including monzonite (3200) and monzonite altered (3201). However, codes 3202–3205 were used and labeled as siltstone (3202) and cherts (3203–3205) for 1159 items. Only two of the items in this series were called monzonite, an igneous material; the rest are cherts (n = 268) and siltstones (n = 885), common materials likely to be found in this assemblage. In translating these items into consolidated code groups, we used the labels rather than the type of material implied by the code group.

Another source of confusion both in classification and standardization is established terminology. For example, Narbona Pass "chert" is clearly a chalcedony; type 1091 is called "Pedernal chert, chalcedonic"; and 1644 is called "red quartzitic chert." Although we all have clear mental templates as to what constitutes a given material, there are items that seem a little granular to be chert but too cherty to be quartzite, waxy cherts that might be translucent if the piece were thinner, and so forth. These are fuzzy distinctions we must live with.

Chert

Chert is a durable, siliceous, conchoidally fracturing material available in abundance in the gravel deposits on terraces in the La Plata Valley and as nodules in many of the Cretaceous and Tertiary formations adjacent to and underlying the valley. Although it can contain a variety of inclusions and does vary in texture and quality, it is generally homogeneous. It comes in a wide variety of colors and

Table 19.4. Chipped stone, counts by material subtype (with associated Warren code) and major artifact type.

Warren Code	Detailed Material Type	Debi-tage	Util-ized Debi-tage	Small Tools	Large Tools	Total
	Cherts					
1011	fossiliferous, cream to light red	21	3	–	5	**29**
1013	cream, fossiliferous (crinoid stems), Cook's Peak; from limestone	2	–	–	1	**3**
1014	chalcedonic	3	1	–	–	**4**
1020	clastic with quartz grains	30	1	–	2	**33**
1021	clastic, tan, grades to sedimentary quartzite	19	7	1	1	**28**
1022	clastic, creamy white, grades to light green, Upper Morrison Formation	10	3	–	–	**13**
1023	clastic, gray	119	16	5	4	**144**
1024	clastic, yellow-brown, green, mottled	19	6	–	1	**26**
1025	clastic, green	1	–	–	–	**1**
1026	clastic, tan	18	–	–	1	**19**
1027	clastic, blue	–	–	–	1	**1**
1028	pink, black/white mottled	31	3	–	5	**39**
1029	black, fossiliferous	6	3	–	2	**11**
1030	black, undifferentiated	46	6	1	2	**55**
1031	black, chalcedonic, waxy luster; transparent on thin edges	1	2	1	–	**4**
1035	black, banded; dull luster; from Mancos Shale(?)	–	1	–	–	**1**
1040	green, glossy to dull luster; Brushy Basin (Upper Morrison Formation)	17	1	1	2	**21**
1041	mottled pink; Lukachuki, Arizona; San Juan Basin	81	9	–	2	**92**
1042	clayey, glossy luster, cf baked shales, San Juan Basin	4	1	–	1	**6**
1044	similar to 1040	6	–	–	–	**6**
1046	green, undifferentiated	39	1	–	2	**42**
1050	white, miscellaneous	1016	61	4	34	**1115**
1051	white, black glossy inclusions, miscellaneous	7	2	–	–	**9**
1060	dark red (jasper), miscellaneous	125	28	3	2	**158**
1062	dark red, Datil Formation	5	1	–	–	**6**
1063	dark red, crimson inclusions, Tecolote Chert in part	2	–	–	–	**2**
1070	yellow-brown, brown (jasper), miscellaneous	740	77	7	23	**847**
1071	yellow-brown, oolitic	6	1	–	–	**7**
1072	yellow-brown, black mossy inclusions; Chinle Chert	3	–	–	–	**3**
1074	light yellow-brown, chalcedonic, white inclusions	4	1	–	1	**6**
1075	dark brown, miscellaneous	7	1	–	–	**8**
1080	chalcedony and opal, pink to pinkish orange, Washington Pass Chert	16	7	5	–	**28**
1081	similar to 1080	5	–	–	–	**5**
1091	chalcedonic, Pedernal Chert	2	–	–	–	**2**
1092	Zuni, white with red-yellow inclusions, Bidahochi Formation	1	1	–	–	**2**
1098	chalcedonic, similar to 1091	17		2	1	**20**
1400	undifferentiated	46	8	3	1	**58**
1401	white and brown mottled	203	20	–	22	**245**
1402	dark green	13	1	–	–	**14**
1403	yellow-brown, red inclusions	22	6	–	1	**29**
1404	yellow-brown, fossiliferous	300	37	2	23	**362**
1405	cream with yellow-brown cortex	428	40	–	44	**512**
1406	light to dark with brown mottling	66	16	1	8	**91**
1407	gray, yellow-brown mottling	223	22	1	13	**259**
1408	pink, yellow-brown, fossiliferous	80	5	1	5	**91**
1409	black/white mottled	186	15	2	12	**215**
1410	Alibates	178	11	–	15	**204**
1412	banded as Alibates	6	3	–	–	**9**
1413	Similar to Alibates; black/white mottled, poor fracture	7	1	–	1	**9**

Table 19.4 (continued)

Warren Code	Detailed Material Type	Debi-tage	Util-ized Debi-tage	Small Tools	Large Tools	Total
1414	white, fossiliferous, oolitic	788	47	6	58	**899**
1415	light red to gray, dull to waxy luster; Santa Fe Formation	3	–	–	–	**3**
1416	yellow-brown and white, mottled	139	11	1	15	**166**
1417	yellow-brown grading to pink near cortex	31	3	–	3	**37**
1418	gray, fossiliferous (oolites and rods)	415	46	7	43	**511**
1419	yellow-brown and gray, fossiliferous (oolites)	31	4	–	5	**40**
1420	gray banded, Dona Ana County	3	2	–	–	**5**
1421	red fossiliferous, Dona Ana County	1	–	–	–	**1**
1422	mottled, red, buff; Fusselman Formation, Dona Ana County	1	–	–	–	**1**
1423	banded, red, gray, jasperoid, Lake Valley	4	2	–	–	**6**
1424	dark brown	48	9	1	1	**59**
1425	mottled, miscellaneous	346	40	–	32	**418**
1426	gray, poor fracture	18	1	–	–	**19**
1427	gray/brown mottled	56	2	–	4	**62**
1428	cream/tan, fossiliferous	510	31	4	24	**569**
1429	red/white mottled	25	5	–	1	**31**
1430	chalcedonic, Laguna, NM	1	1	–	–	**2**
1431	chalcedonic, mottled red/gray; Waldo, NM	1	1	–	–	**2**
1432	orange-red moss jasper; Morrison Formation, Baldy Hill, Union County	2	–	–	–	**2**
1433	red and gray, undifferentiated	15	2	–	–	**17**
1434	brown, poor fracture	9	2	–	–	**11**
1435	cream to orange and red, waxy	2	–	–	1	**3**
1436	pale green, yellow-brown cortex, fossiliferous	8	–	–	1	**9**
1437	brown	391	24	6	25	**446**
1439	cream, banded	25	6	–	2	**33**
1440	novaculite (Arkansas)	1	–	–	–	**1**
1442	tan with feldspar inclusions	–	1	–	–	**1**
1443	orange	76	4	1	2	**83**
1444	cream, yellow/brown, cortex fine	260	8	2	27	**297**
1445	poor, marginal fracture	–	1	–	–	**1**
1450	Flint Ridge Chert, Ohio	2	–	–	–	**2**
1550	oolitic	4	–	–	–	**4**
1600	light gray, miscellaneous	928	69	5	45	**1047**
1601	light gray to reddish-gray, Nambe area	6	–	–	1	**7**
1602	light gray to reddish-gray and dark gray (Tecolote Chert)	3	–	–	–	**3**
1603	gray, grading to limestone	4	–	–	–	**4**
1604	light/dark mottled gray	579	42	8	39	**668**
1605	light/dark gray banded	52	6	–	2	**60**
1610	dark gray miscellaneous	289	25	3	15	**332**
1612	white/gray mottled, fine	98	11	3	10	**122**
1613	light/dark gray mottled, fine	1	–	–	–	**1**
1615	dark gray, red inclusions, miscellaneous	10	2	–	–	**12**
1616	dark red/gray mottled	62	6	2	3	**73**
1620	light yellow	10	–	–	–	**10**
1630	cream	310	11	–	12	**333**
1640	light orange	6	2	–	–	**8**
1643	red green fossiliferous	77	6	–	4	**87**
1644	red quartzitic	4	–	–	–	**4**
1645	red	138	11	4	2	**155**
1649	not described	1	–	–	–	**1**
1650	olive green, olive gray miscellaneous	27	3	–	–	**30**
1651	olive gray, ranges to red and brown with quartz (Nambe area)	1	–	–	–	**1**
1652	red, poor fracture	16	1	–	–	**17**
1653	pink/white mottled	150	14	3	7	**174**

Table 19.4 (continued)

Warren Code	Detailed Material Type	Debi-tage	Util-ized Debi-tage	Small Tools	Large Tools	Total
1654	pink/white banded, poor fracture	8	–	–	–	**8**
1655	pink, poor fracture	38	2	–	2	**42**
1660	light tan or buff	922	66	6	40	**1034**
1661	mottled light brown, pebbles, Zuni area		1	–	–	**1**
1664	pink, fossiliferous	81	6	3	4	**94**
1665	pink and gray	105	10	1	6	**122**
1680	pink, miscellaneous	372	29	1	5	**407**
3203	gray, tan, crystalline inclusions	167	7	–	12	**186**
3204	red, crystalline inclusions	52	–	–	2	**54**
3205	black, red, crystalline inclusions	13	–	–	1	**14**
3206	black, tan, crystalline inclusions	7	1	–	–	**8**
3207	green, crystalline inclusions	2	–	–	–	**2**
Total		**11942**	**1013**	**107**	**694**	**13756**
	Chalcedonies					
1045	green	1	–	–	–	**1**
1052	clear, miscellaneous	9	–	1	–	**10**
1053	clear, black inclusions	1	–	–	–	**1**
1200	inclusions, miscellaneous white	134	23	6	3	**166**
1201	inclusions, miscellaneous white, red	1	–	–	–	**1**
1202	gray fossiliferous	7	–	–	–	**7**
1203	yellow, tan, fossiliferous	16	1	1	–	**18**
1210	mossy inclusions, miscellaneous	11	3	1	–	**15**
1213	banded, light	9	1	–	–	**10**
1215	clear and white, black inclusions	3	–	–	–	**3**
1220	clear colorless, yellow mossy inclusions, miscellaneous	2	–	–	–	**2**
1221	clear, abundant yellow mossy inclusions, miscellaneous	4	–	1	–	**5**
1230	clear, sparse red inclusions, miscellaneous	6	1	–	–	**7**
1231	clear, abundant red inclusions	–	1	1	–	**2**
1232	clear, scattered red and yellow inclusions	4	1	–	1	**6**
1234	clear, red inclusions and black	1	–	–	–	**1**
1235	clear, red-purplish inclusions	1	–	–	–	**1**
1240	clear, brown-purplish inclusions	7	–	–	–	**7**
1250	banded, miscellaneous	16	6	2	1	**25**
1251	colorless, white, yellowish banded, cf Apache Creek	5	1	–	–	**6**
1300	miscellaneous, clear, colored uniformly	30	1	–	–	**31**
1310	clear, uniform shades of yellow, miscellaneous	37	2	–	2	**41**
1315	clear, uniform shades of orange, miscellaneous	11	–	2	–	**13**
1320	clear, uniform shades of pink/red, miscellaneous	2	4	–	–	**6**
1330	clear, uniform shades of light gray, miscellaneous	9	1	–	–	**10**
1340	clear, uniform shades of light brown, miscellaneous	41	1	3	–	**45**
1345	clear, uniform shades of dark brown, miscellaneous	4	–	–	–	**4**
Total		**372**	**47**	**18**	**7**	**444**
	Silicified Woods					
1100	undifferentiated	6	2	1	1	**10**
1108	light, cherty	61	6	–	1	**68**
1109	light, splintery	103	9	–	2	**114**
1110	dark colors, grays, browns, undifferentiated, dull	317	48	3	19	**387**
1111	gray, brown, light rodlike inclusions; Nacimiento, Ojo Alamo, and San Jose Formations	2	–	–	1	**3**
1112	dark, waxy luster, conchoidal fracture, undifferentiated	41	15	2	3	**61**
1113	light, variegated; waxy luster, cherty; undifferentiated	39	17	–	1	**57**
1114	brown, poor fracture	113	21	1	8	**143**
1115	brown and white, good fracture	28	5	–	2	**35**

Table 19.4 (continued)

Warren Code	Detailed Material Type	Debi-tage	Util-ized Debi-tage	Small Tools	Large Tools	Total
1116	black and white, waxy luster, good fracture	16	11	–	3	**30**
1117	greenish-white, good fracture	4	1	2	1	**8**
1118	brown, good fracture	160	26	3	4	**193**
1119	shades of light and dark orange, good fracture	9	3	–	–	**12**
1120	shades of red, undifferentiated	34	3	2	–	**39**
1121	white, cherty	72	8	2	1	**83**
1122	dark red mottled, cherty	60	13	3	1	**77**
1130	vascular rays (palm wood), undifferentiated	9	1	–	–	**10**
1139	dark, chalcedonic	32	6	3	3	**44**
1140	light, white, chalcedonic, undifferentiated	140	31	5	3	**179**
1141	light, white, chalcedonic, black inclusions, undifferentiated	14	–	–	–	**14**
1142	light, variegated, chalcedonic, undifferentiated	41	11	1	–	**53**
1143	milky white/black opal, glossy luster; Tesuque Formation	1	–	–	–	**1**
1144	pinkish orange and gray, cherty, Triassic rocks south of Zuni	4	–	–	–	**6**
1150	yellow brown, brown (jasper), undifferentiated	674	201	26	35	**936**
1151	yellow brown, glossy luster, no wood structure, San Juan Basin	2	–	1	–	**3**
1160	light, variegated, chalcedonic, conchoidal fracture, Chinle Formation	5	2	–	1	**8**
1161	dark red (jasper), Chinle Formation, Zuni Mountains	39	11	2	2	**54**
1162	red-orange, Baldy Hill Formation, Union County	1	1	–	–	**2**
1170	opalized, undifferentiated	26	5	1	–	**32**
1171	yellow	54	4	–	1	**59**
Total		**2107**	**462**	**59**	**93**	**2721**
	Quartzites					
4000	undifferentiated	9	1	1	–	**11**
4001	white, coarsely crystalline, Rio Grande axial gravel (lightning stones)	13	–	–	–	**13**
4003	pink	225	10	–	24	**259**
4004	gray, purple/white banded	17	6	–	2	**25**
4005	miscellaneous cobbles	–	–	–	1	**1**
4007	gray, red/tan mottled	16	2	–	4	**22**
4008	purple	76	3	–	9	**88**
4009	green, poor fracture	45	8	1	2	**56**
4010	very fine-grained, silt-sized, undifferentiated	3	1	–	1	**5**
4011	gray	143	12	–	13	**168**
4012	brown, poor fracture	13	1	–	2	**16**
4013	black	41	7	–	7	**55**
4014	gray, fine-grained	45	3	–	4	**52**
4015	brown, good fracture	35	1	1	2	**39**
4019	not described	–	1	–	–	**1**
4021	tan, fine-grained	83	1	1	3	**88**
4022	tan, orange cortex	7	1	–	1	**9**
4023	translucent yellow	31	1	–	1	**33**
4024	white/clear	30	1	–	4	**35**
4025	red	23	4	1	3	**31**
4026	green, fine-grained	15	1	–	–	**16**
4050	micaceous, undifferentiated	2	–	–	–	**2**
4060	dark red, very fine-grained, conchoidal fracture, Chaco	1	–	–	–	**1**
4065	massive with inclusions	18	2	–	–	**20**
4071	not described	1	–	–	–	**1**
4114	not described	1	–	–	–	**1**
Total		**893**	**67**	**5**	**83**	**1048**
	Quartzitic Sandstones					
2200	miscellaneous	1	–	–	–	**1**
2204	red, dark, Spears Member, Datil Formation; and quartzitic siltstone	250	14	–	21	**285**

Table 19.4 (continued)

Warren Code	Detailed Material Type	Debi-tage	Util-ized Debi-tage	Small Tools	Large Tools	Total
2205	white to red, NE New Mexico	8	1	–	–	**9**
2207	green and yellow-brown mottled	3	–	–	–	**3**
2208	green	78	8	–	2	**88**
2209	brown	155	16	–	5	**176**
2210	gray to black	341	22	–	15	**378**
2211	white	44	–	1	3	**48**
2212	pink-orange	226	20	–	17	**263**
2213	quartzitic sandstone, purple	167	10	2	22	**201**
2214	quartzitic sandstone, fine-grained, purple	20	1	–	1	**22**
2215	coarse-grained, red	55	3	–	2	**60**
2220	coarse-grained, red, high gravel, Chaco area	8	–	–	–	**8**
2221	gray/tan mottled	4	–	–	–	**4**
2227	coarse-grained, gray/black	18	3	–	3	**24**
2231	tan	121	3	–	6	**130**
2232	white/yellow	20	1	–	–	**21**
2233	red/black mottled	1	–	–	–	**1**
2236	fine-grained red	27	2	–	4	**33**
2237	fine-grained green	4	–	–	1	**5**
Total		**1551**	**104**	**3**	**102**	**1760**
	Obsidians					
3500	undifferentiated	2	–	2	–	**4**
3530	probably Polvadera	–	–	1	–	**1**
Total		**2**	**–**	**3**	**–**	**5**
	Igneous					
3000	granitic-porphyry	26	–	–	2	**28**
3002	unidentified, black matrix, crystalline green mineral inclusions	1	1	–	1	**3**
3003	unidentified, green matrix, green inclusions	–	–	–	1	**1**
3004	unidentified	35	1	–	4	**40**
3010	light-colored, felsitic, aphanitic (rhyolite)	1	–	–	–	**1**
3100	granite, undifferentiated	12	–	–	1	**13**
3200	green, quartz crystals (monzonite?)	21	–	–	–	**21**
3201	monzonite, altered (seriticized)	2	–	–	–	**2**
3240	diorite, undifferentiated	9	–	–	1	**10**
3800	tuff, undifferentiated	1	–	–	–	**1**
3860	tuff, hybrid miscellaneous	1	–	–	–	**1**
4380	metabasalt	3	–	–	–	**3**
Total		**89**	**2**	**–**	**10**	**101**
	Rhyolites					
3150	undifferentiated	5	–	–	2	**7**
3730	vitrophyre, rhyolitic, gray, glassy, welded	50	8	1	4	**63**
3731	vitrophyre, rhyolitic, piperno with clear crystals, glassy, welded	2	–	–	1	**3**
Total		**57**	**8**	**1**	**7**	**73**
	Sandstones					
2000	undifferentiated	1	–	–	–	**1**
2010	fine indurated	3	–	–	–	**3**
2011	fine-grained silica	7	–	–	–	**7**
2015	very fine-grained, undifferentiated	81	2	–	5	**88**
2025	coarse micaceous	1	–	–	–	**1**
2045	very fine-grained, friable	2	–	–	–	**2**
2103	cobble	–	–	–	1	**1**
2913	concretion	1	–	–	–	**1**
Total		**96**	**2**	**–**	**6**	**104**

Table 19.4 (continued)

Warren Code	Detailed Material Type	Debitage	Utilized Debitage	Small Tools	Large Tools	Total
			Siltstones			
2216	green banded, grading to chert	8	–	1	2	**11**
2217	green banded, poor fracture	10	1	–	5	**16**
2218	green/red/yellow banded	4	–	–	–	**4**
2219	green, grading to chert	32	7	–	2	**41**
2222	green/black/red	17	2	–	3	**22**
2223	black, poor fracture	8	–	–	1	**9**
2224	gray, yellow/brown mottling	5	1	–	–	**6**
2225	green, poor fracture	5	–	–	–	**5**
2226	red/gray banded	11	4	1	–	**16**
2228	tan/buff	50	3	1	1	**55**
2229	green, red inclusions	10	3	–	1	**14**
2230	green, tan, cherty	4	–	–	–	**4**
2234	pink/green	10	4	–	2	**16**
2235	mudstone	9	5	–	–	**14**
2250	undifferentiated	2	–	–	–	**2**
2251	siltstone/sandstone, Datil	–	–	–	1	**1**
2252	silt/mud/sandstone	2	–	–	–	**2**
2253	green	809	61	1	64	**935**
2254	black	655	29	2	62	**748**
2256	red, green inclusions	10	–	–	2	**12**
2257	green, banded	76	7	1	16	**100**
2258	red	444	34	1	29	**508**
2259	red, poor fracture	6	–	–	1	**7**
2260	white, thin	4	–	–	–	**4**
2262	black, no banding	1398	115	2	116	**1631**
2263	black, banded	13	1	–	5	**19**
2264	black, green inclusions	15	2	–	–	**17**
2265	brown, green inclusions	6	1	–	1	**8**
2266	green and white mottled	1	–	–	–	**1**
2267	brown	396	35	1	32	**464**
2268	gray	1721	84	4	127	**1936**
2269	gray, banded	98	13	–	17	**128**
2270	black, grading to chert	83	10	–	8	**101**
2271	black/green/brown	4	–	–	–	**4**
2272	brown, poor fracture	8	–	–	–	**8**
2274	brown, grading to chert	9	1	–	1	**11**
2906	black, banded, poor fracture	1	–	–	–	**1**
3202	black, crystalline inclusions	722	62	2	59	**845**
Total		**6689**	**485**	**17**	**558**	**7749**
			Other			
2300	conglomerate, undifferentiated	19	3	3	1	**26**
2790	hematite	1	–	–	–	**1**
4381	fibrolite	1	–	–	–	**1**
4510	schist-hornblende	–	–	–	1	**1**
5040	gypsum	4	–	–	–	**4**
Total		**25**	**3**	**3**	**2**	**33**
		23,823	**2,193**	**216**	**1562**	**27,794**
% of Total		**85.7%**	**7.9%**	**0.8%**	**5.6%**	

is distinguished from chalcedony in large part by its opacity or lack of "diaphaneity" (Banks 1990:150).

With the exception of the small Early Basketmaker III sample, chert regularly makes up over half of the flaked stone material by count (Table 19.5). Most occurs as small flakes, although there are substantial numbers of flakes weighing more than 25 g (Figs. 19.4, 19.5, 19.6 [a–c]). In his survey of raw materials, Cushman (1990) found that chert occurs as smaller nodules than the metamorphic materials, which is clearly reflected in the mean sizes of whole flakes: whole chert flakes average only two-thirds the weight of siltstone flakes (Table 19.6). Further, since chert is more suitable for fine flaking, there is greater likelihood that it will be found as smaller flakes resulting from more complete reduction. Based on comparisons of surface versus subsurface occurrence of siltstone and chert and the apparent depletion of siltstone but not chert, Cushman (1990:21) suggests that cherts were primarily obtained from sources other than the terraces, probably Piñon Mesa. Chert was used to make most tool types (Tables 19.5, 19.7, 19.8, 19.9a). Although no chert axes are in the collections, chert hammerstones are abundant (Tables 19.5, 19.7, 19.8, 19.9a). It seems likely that chert is less amenable to the grinding phase of axe production than either siltstone or igneous materials.

Relative to occurrence, chert is much more likely to be used in small formal tools than is siltstone (Table 19.7, 19.9a, 19.9b), but less likely than either chalcedony or silicified wood. There are more chert projectile points than any other material, predictably including more form varieties.

The occurrence of cortex on chert, quartzite, and siltstone is quite similar, with around 60 percent of whole flakes having cortex on less than half the dorsal surface (Table 19.10). Flakes of these materials are also more likely to have half or more of their dorsal surfaces be cortex. In contrast to chalcedony and silicified wood, this pattern suggests acquisition in cobble form, in all likelihood from the terraces. Similar patterns were observed for all of these materials at the south end of the valley at LA 50337 (Vierra 1993a:188). The distribution of platform types among these three materials is also highly similar, although there is a slight preference for single-facet platforms in chert flakes and for cortical platforms in quartzite, quartzitic sandstone, and siltstone (Table 19.11).

With roughly 13,500 flakes and 122 possible chert variable states, the original coding state recorded a great variety of "types" of chert (Table 19.4). Remarkably, 114 of the categories were used, though many only have one or two examples. Over half of the chert items (52.3 percent) are accounted for by nine of the material groupings, each containing more than 500 items: white miscellaneous, light gray miscellaneous, light tan to buff, white oolitic, yellow-brown miscellaneous, light and dark gray mottled, cream to tan fossiliferous, gray oolitic, and cream with yellow cortex. The names of these abundant varieties make clear the ultimate origins of many of these materials in sedimentary, fossil-bearing deposits, probably limestones.

Roughly grouping the colors, gray cherts are the most abundant (23 percent), followed by white (18 percent), and yellow to orange (14 percent; see Table 19.4). Yellow brown and brown are also common chert colors, accounting for 11 and 13 percent, respectively. Materials with several colors, whether as inclusions, mottling, or other mixture, are also common, around 8 percent (many of the items included in this color count do have some color mixture as well). Colors present but less common include pink, red, green, and black, in decreasing order of abundance. The Jackson Lake system included a variable identifying heat treatment based on color, luster, crazing, and the presence of pot lids. Less than 6 percent of the cherts were deemed to have been heat-treated, mostly on the basis of increased luster. Since color often changes with heat treatment, it is not surprising that red and pink materials were more often coded as having been heat-treated.

Exotic cherts include: Narbona Pass chert (formerly Washington Pass chert) from the Chuska Mountains; Pedernal chert from near Abiquiu, New Mexico, and well into the San Juan Basin (Love 1997a:626; Vierra 1993b:161–162); and materials identified as originating near Zuni. Narbona Pass chert is a distinctive pink, high-quality chert from around 75 km to the south (Fig. 19.1; Love 1997a:626; Love 1997b:640; Cameron 2001). Contrary to its common name, it is often considered chalcedony. It is included with the cherts here for taxonomic consistency. This material is abundant in Chaco Canyon during Pueblo II and III (Cameron 1987, 1997, 2001). Only about 30 pieces of this chert were recovered from Jackson Lake sites. Over 200 pieces of chert

Table 19.5. Chipped stone tool types and material types, totals by time period and major tool group; counts and percents. Includes ranked material occurrence.

	Early BM III		Basketmaker III		Mid Pueblo II		Late Pueblo II		Early Pueblo III		Late Pueblo III		Total	
	Count	**Col. %**	**Count**	**Col. %**	**Count**	**Col. %**	**Count**	**Col. %**	**Count**	**Col. %**	**Count**	**Col. %**	**Count**	**Col. %**
All Artifact Types														
Debitage	57	81.4%	201	86.3%	1707	82.6%	1128	85.6%	991	87.9%	8581	88.4%	**12665**	**87.2%**
Core	1	1.4%	16	6.9%	105	5.1%	49	3.7%	53	4.7%	300	3.1%	**524**	**3.6%**
Uniface	–	–	–	–	1	0.0%	–	–	1	0.1%	1	0.0%	**3**	**0.0%**
Biface	–	–	–	–	–	–	–	–	–	–	2	0.0%	**2**	**0.0%**
Retouched utilized debitage	7	10.0%	8	3.4%	147	7.1%	95	7.2%	51	4.5%	611	6.3%	**919**	**6.3%**
Retouched utilized core	2	2.9%	–	–	10	0.5%	6	0.5%	3	0.3%	32	0.3%	**53**	**0.4%**
Drill	–	–	–	–	3	0.1%	–	–	2	0.2%	10	0.1%	**15**	**0.1%**
Graver	–	–	–	–	2	0.1%	1	0.1%	–	–	2	0.0%	**5**	**0.0%**
Notch	–	–	–	–	6	0.3%	–	–	1	0.1%	15	0.2%	**22**	**0.2%**
Denticulate	–	–	–	–	3	0.1%	–	–	2	0.2%	3	0.0%	**8**	**0.1%**
Bifacial knife, scraper	–	–	–	–	–	–	2	0.2%	–	–	6	0.1%	**8**	**0.1%**
Projectile point	–	–	5	2.1%	2	0.1%	6	0.5%	4	0.4%	26	0.3%	**43**	**0.3%**
Hammerstone	2	2.9%	3	1.3%	78	3.8%	29	2.2%	19	1.7%	106	1.1%	**237**	**1.6%**
Chopper, plane	1	1.4%	–	–	1	0.0%	1	0.1%	1	0.1%	13	0.1%	**17**	**0.1%**
Axe	–	–	–	–	1	0.0%	–	–	–	–	–	–	**1**	**0.0%**
Hoe	–	–	–	–	–	–	1	0.1%	–	–	–	–	**1**	**0.0%**
Total	**70**	**100.0%**	**233**	**100.0%**	**2066**	**100.0%**	**1318**	**100.0%**	**1128**	**100.0%**	**9708**	**100.0%**	**14523**	**100.0%**
% of Total	**0.5%**		**1.6%**		**14.2%**		**9.1%**		**7.8%**		**66.8%**			
Flakes and Utilized Flakes														
Chert	18	28.1%	114	54.5%	937	50.5%	555	45.4%	522	50.1%	4386	47.7%	**6982**	**51.4%**
Chalcedony	1	1.6%	8	3.8%	32	1.7%	15	1.2%	9	0.9%	149	1.6%	**214**	**1.6%**
Silicified wood	9	14.1%	23	11.0%	207	11.2%	249	20.4%	89	8.5%	578	6.3%	**1155**	**8.5%**
Quartzite	3	4.7%	3	1.4%	65	3.5%	61	5.0%	28	2.7%	306	3.3%	**466**	**3.4%**
Quartzitic sandstone	10	15.6%	9	4.3%	152	8.2%	63	5.2%	66	6.3%	551	6.0%	**851**	**6.3%**
Obsidian	–	–	–	–	–	–	–	–	–	–	2	0.0%	**2**	**0.0%**
Igneous	1	1.6%	1	0.5%	8	0.4%	5	0.4%	–	–	24	0.3%	**39**	**0.3%**
Rhyolite	–	–	–	–	3	0.2%	1	0.1%	8	0.8%	21	0.2%	**33**	**0.2%**
Sandstone	–	–	–	–	11	0.6%	5	0.4%	2	0.2%	31	0.3%	**40**	**0.3%**
Siltstone	22	34.4%	51	24.4%	437	23.6%	262	21.4%	318	30.5%	2692	29.3%	**3782**	**27.8%**
Other	–	–	–	–	2	0.1%	7	0.6%	–	–	2	0.0%	**11**	**0.1%**
Total	**64**	**100.0%**	**209**	**100.0%**	**1854**	**100.0%**	**1223**	**100.0%**	**1042**	**–**	**9192**	**100.0%**	**13584**	**100.0%**
Cores and Utilized Cores														
Chert	1	33.3%	9	56.3%	58	50.4%	28	50.9%	22	39.3%	191	57.5%	**309**	**53.6%**
Chalcedony	–	–	–	–	–	–	–	–	–	–	3	0.9%	**3**	**0.5%**
Silicified wood	–	–	1	6.3%	7	6.1%	8	14.5%	2	3.6%	20	6.0%	**38**	**6.6%**
Quartzite	–	–	1	6.3%	4	3.5%	1	1.8%	3	5.4%	8	2.4%	**17**	**2.9%**
Quartzitic sandstone	1	33.3%	–	–	6	5.2%	1	1.8%	3	5.4%	10	3.0%	**21**	**3.6%**
Igneous	–	–	–	–	1	0.9%	–	–	1	1.8%	–	–	**2**	**0.3%**
Rhyolite	–	–	–	–	1	0.9%	–	–	–	–	–	–	**1**	**0.2%**
Sandstone	–	–	–	–	1	0.9%	1	1.8%	–	–	–	–	**2**	**0.3%**
Siltstone	1	33.3%	5	31.3%	37	32.2%	16	29.1%	25	44.6%	100	30.1%	**184**	**31.9%**
Total	**3**	**100.0%**	**16**	**100.0%**	**115**	**100.0%**	**55**	**100.0%**	**56**	**100.0%**	**332**	**100.0%**	**577**	**100.0%**

Table 19.5 (continued)

	Early BM III		Basketmaker III		Mid Pueblo II		Late Pueblo II		Early Pueblo III		Late Pueblo III		Total	
	Count	**Col. %**	**Count**	**Col. %**	**Count**	**Col. %**	**Count**	**Col. %**	**Count**	**Col. %**	**Count**	**Col. %**	**Count**	**Col. %**
Flake:core ratio			13.1		16.1		22.2		18.6		27.7		23.5	
Hammerstones														
Chert	–	–	1	33.3%	26	33.3%	16	55.2%	5	26.3%	36	34.0%	**84**	**35.4%**
Chalcedony	–	–	–	–	–	–	–	–	–	–	2	1.9%	**2**	**0.8%**
Silicified wood	–	–	–	–	–	–	–	–	–	–	3	2.8%	**3**	**1.3%**
Quartzite	–	–	1	33.3%	13	16.7%	2	6.9%	3	15.8%	4	3.8%	**23**	**9.7%**
Quartzitic sandstone	–	–	1	33.3%	10	12.8%	2	6.9%	4	21.1%	9	8.5%	**26**	**11.0%**
Igneous	–	–	–	–	1	1.3%	–	–	1	5.3%	1	0.9%	**3**	**1.3%**
Rhyolite	–	–	–	–	1	1.3%	–	–	–	–	–	–	**1**	**0.4%**
Siltstone	2	100.0%		–	27	34.6%	9	31.0%	6	31.6%	51	48.1%	**95**	**40.1%**
Total	**2**	**100.0%**	**3**	**100.0%**	**78**	**100.0%**	**29**	**100.0%**	**19**	**100.0%**	**106**	**100.0%**	**237**	**100.0%**
Projectile Points														
Chert	–	–	4	80.0%	1	50.0%	2	33.3%	2	50.0%	10	38.5%	**19**	**44.2%**
Chalcedony	–	–	–	–	–	–	1	16.7%	2	50.0%	6	23.1%	**9**	**20.9%**
Silicified wood	–	–	–	–	–	–	3	50.0%	–	–	9	34.6%	**12**	**27.9%**
Quartzite	–	–	–	–	1	50.0%	–	–	–	–	–	–	**1**	**2.3%**
Quartzitic sandstone	–	–	1	20.0%	–	–	–	–	–	–	–	–	**1**	**2.3%**
Obsidian	–	–	–	–	–	–	–	–	–	–	1	3.8%	**1**	**2.3%**
Total	**–**	**–**	**5**	**100.0%**	**2**	**100.0%**	**6**	**100.0%**	**4**	**100.0%**	**26**	**100.0%**	**43**	**100.0%**
*** Ranked Material Occurrence by Flakes, Cores, Hammerstones, and Points (F, C, H, P)**														
	F, C, H, P		**F, C, H, P**		**F, C, H, P**		**F, C, H, P**		**F, C, H, P**		**F, C, H, P**		**F, C, H, P**	
Chert	2, 1, –, –		1, 1, 1, 1		1, 1, 2, 1		1, 1, 1, 2		1, 2, 2, 1		1, 1, 2, 2,		1, 1, 2, 1	
Chalcedony	6, –, –, –		5, –, –, –		6, –, –, –		6, –, –, 3		6, –, –, 1		6, 6, 5, 2		6, 6, 6, 3	
Silicified wood	4, –, –, –		3, 3, –, –		3, 3, 3, –		3, 3, –, 1		3, 5, –, 3		3, 3, 4, 1		3, 3, 5, 2	
Quartzite	5, –, –, –		6, 3, 1, –		5, 5, 3, –		5, 4, 3, –		5, 4, 4, –		5, 5, 5, –		5, 5, 4, –	
Quartzitic sandstone	3, 1, –, –		4, –, 1, 2		4, 4, 4, –		4, 4, 3, –		4, 4, 3, –		4, 4, 3, –		4, 4, 3, 4	
Siltstone	1, 1, 1, –		2, 2, –, 2		2, 2, 1, –		2, 2, 2, –		2, 1, 1, –		2, 2, 1, –		2, 2, 1, –	

* For each time period, “Ranked Material Occurrence“ is relative (where “1“ indicates the most numerous and “6“ the least) and is meant to be read vertically below the respective tool type abbreviation (F, C, H, P = Flakes, Cores, Hammerstones, and Points).

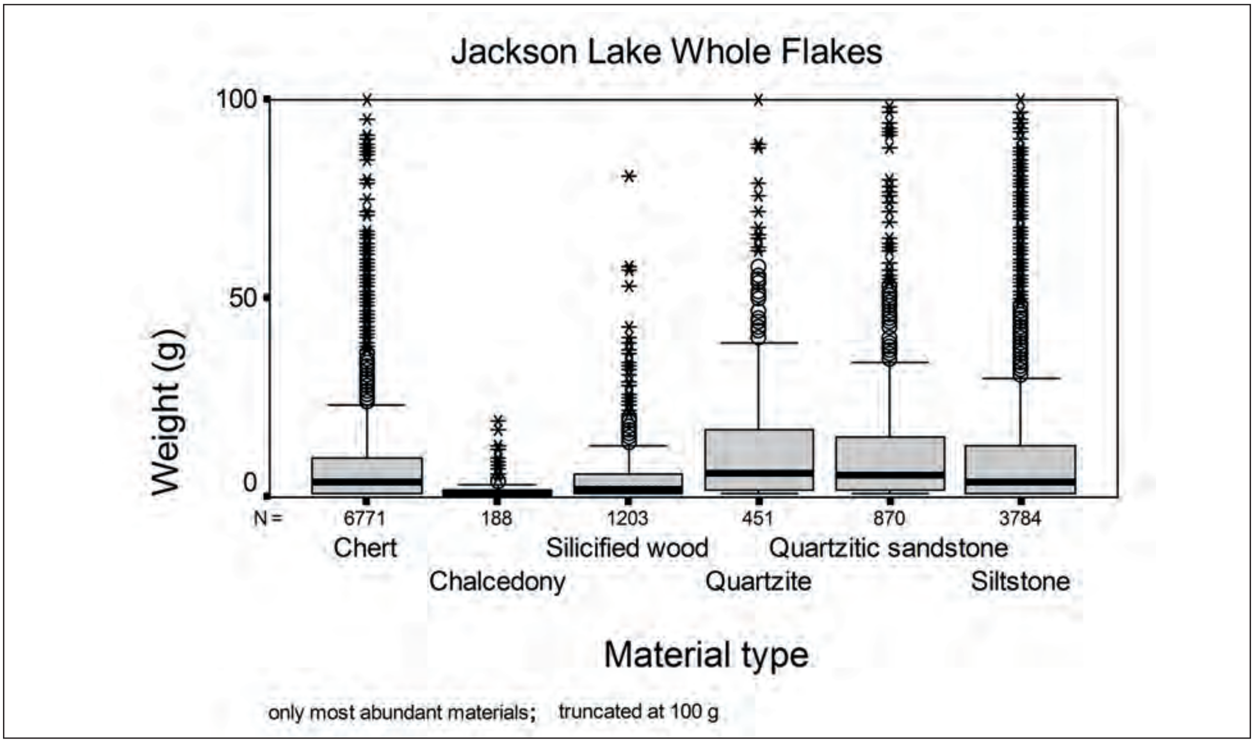


Figure 19.4. Box plot showing size distributions of whole flakes by material (flakes over 100 g not shown) for all Jackson Lake community sites; bar within box represents median weight within a material category.

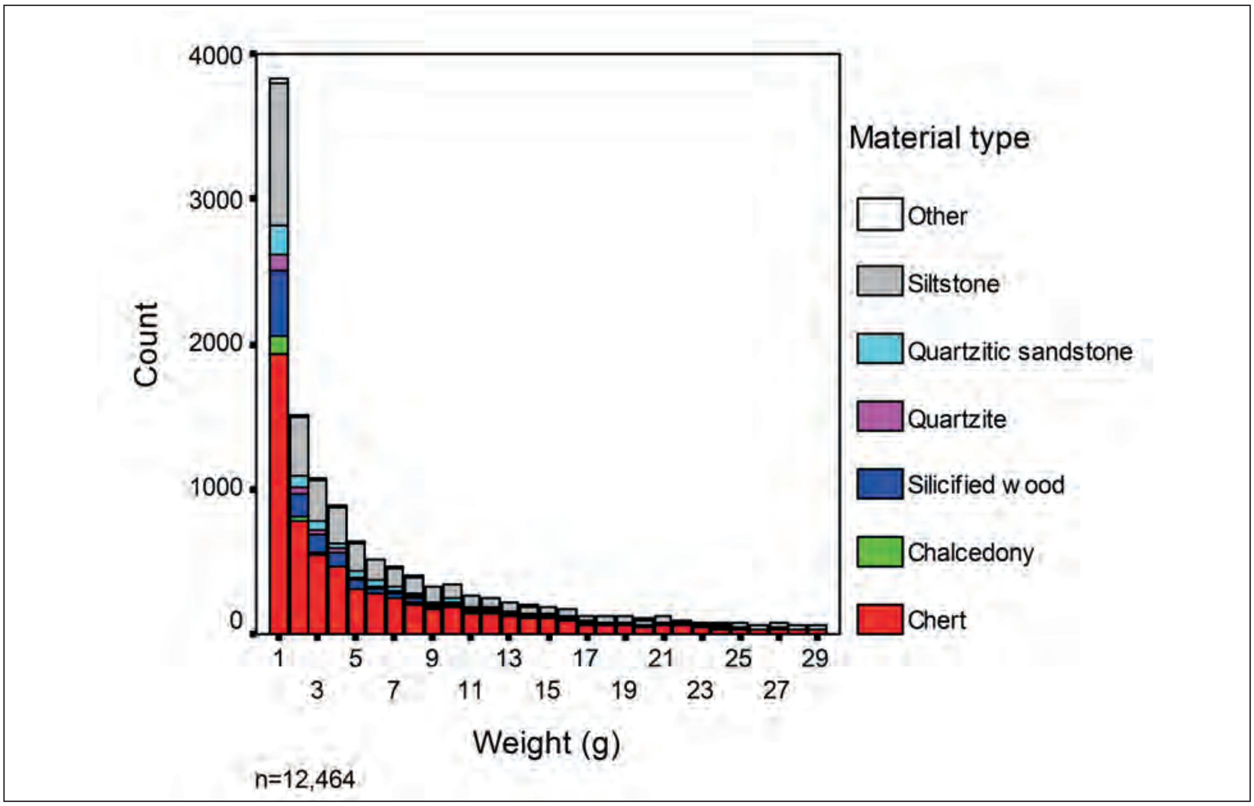


Figure 19.5. Weight distribution of whole flakes by material (only flakes weighing less than 30 g are shown) for all Jackson Lake community sites. "Other" includes all igneous materials and sandstone; 51.3 percent of items shown are less than or equal to 3 g.

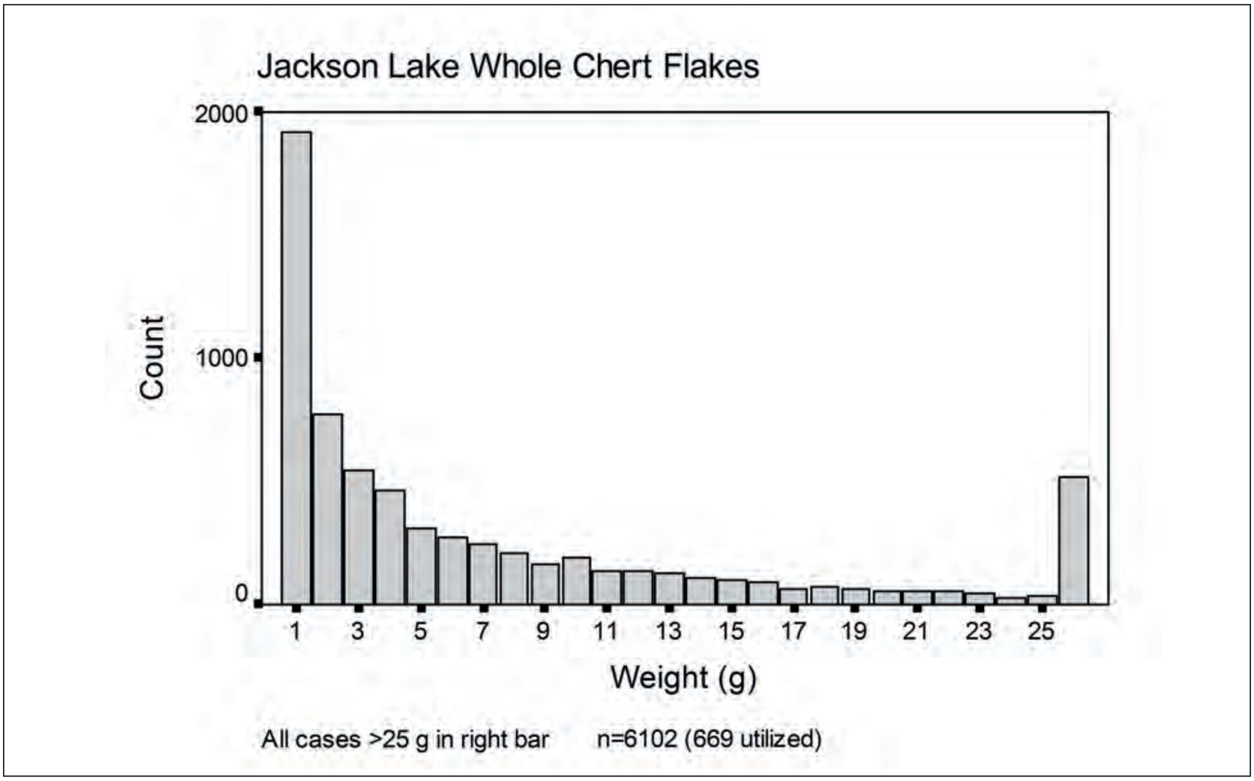


Figure 19.6 [a–c]. Chert flakes, bar chart: a. weight distribution of all whole chert flakes, with all cases greater than 25 g in far-right bar;

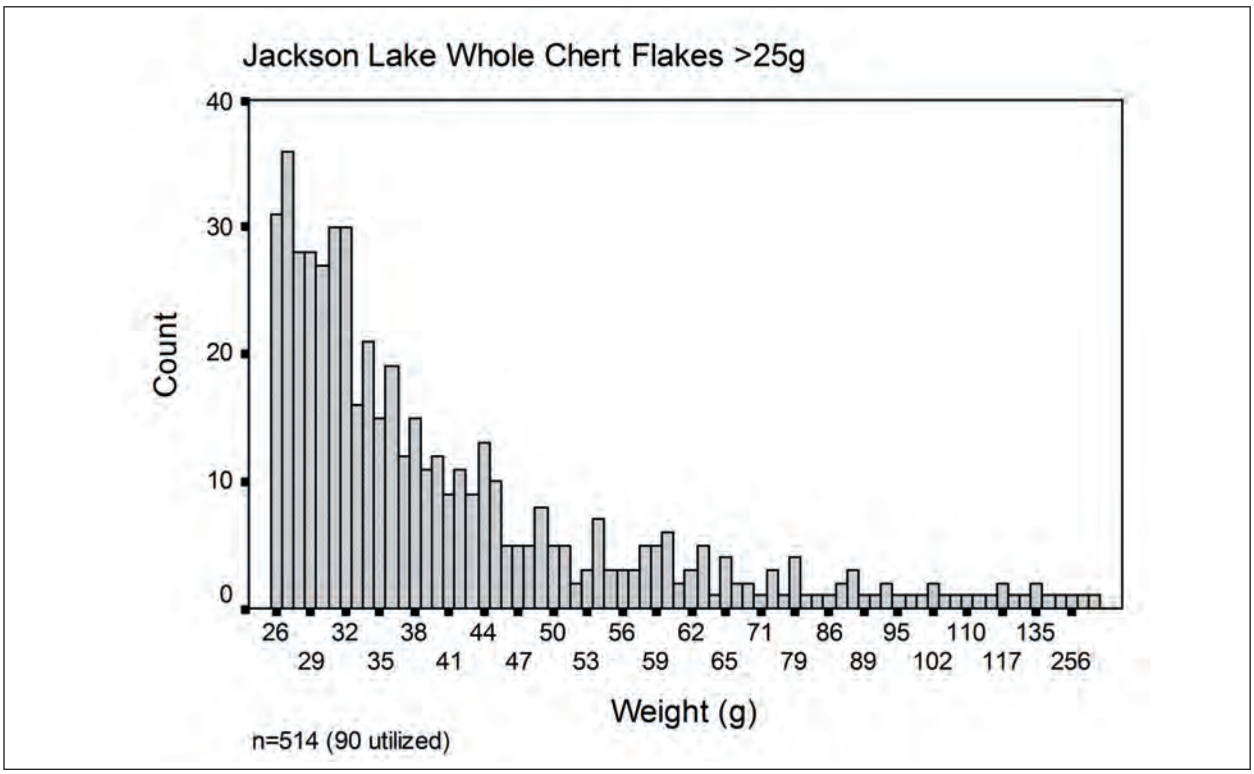


Figure 19.6 [a–c]. Chert flakes, bar chart: b. breakdown of weights of flakes weighing more than 25 g.

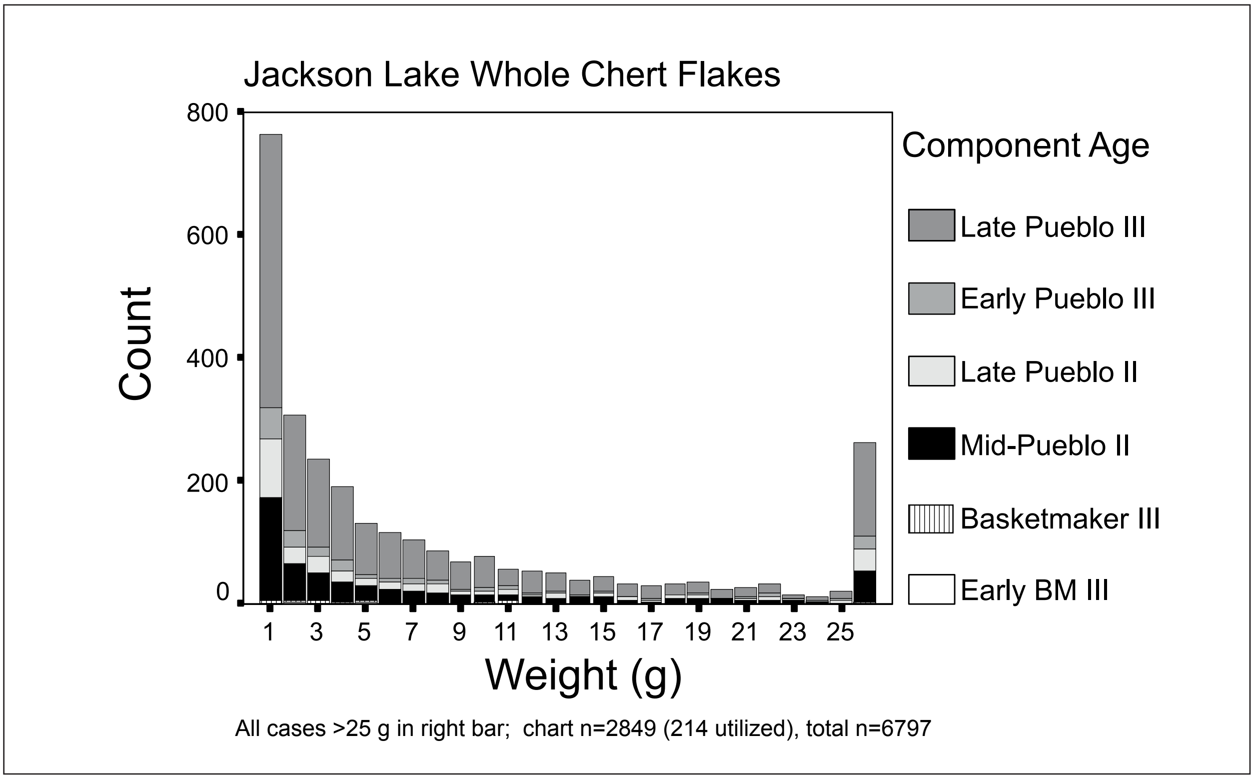


Figure 19.6 [a–c]. Chert flakes, bar chart: c. whole chert whole flake weights showing temporal distribution; the distribution is very similar to a., but only artifacts from well-dated proveniences are shown.

Table 19.6. Whole flake mean weight (g) by material type and utilization.

	Mean Weight (g)	Count	Standard Deviation	Minimum-Maximum	Median
Chert	8.58	6797	13.91	1-333	4.00
Chalcedony	2.17	188	2.69	1-19	1.00
Silicified wood	5.00	1205	7.13	1081	2.00
Quartzite	13.98	452	22.46	1-268	6.00
Quartzitic sandstone	14.06	870	23.41	1-203	5.50
Obsidian	1.00	2	0.00	1	–
Igneous	12.77	48	17.55	1-109	6.00
Rhyolite	25.06	34	66.57	1-387	7.50
Sandstone	10.54	68	15.22	1-72	4.50
Siltstone	12.15	3804	21.29	1-398	4.00
Other	7.46	13	12.05	1-42	2.00
Total	**9.78**	**13,481**	**17.41**	**1-398**	**4.00**
Debitage	9.07	12,095	15.92	1-333	3.00
Retouched utilized debitage	15.94	1386	26.33	1-398	8.50

Table 19.7. Chipped stone tool groups by material type; counts and percents.

	Small Formal		Flakes, Cores		Hammerstones		Large Formal		Total
	Count	Row %	Count	Row %	Count	Row %	Count	Row %	
Chert	78	0.6%	13,485	98.2%	160	1.2%	5	0.0%	**13,728**
Chalcedony	20	4.5%	424	95.1%	2	0.4%	–	–	**446**
Silicified wood	41	1.5%	2657	98.3%	6	0.2%	–	–	**2704**
Quartzite	1	0.1%	993	95.1%	46	4.4%	4	0.4%	**1044**
Quartzitic sandstone	2	0.1%	1699	96.6%	53	3.0%	4	0.2%	**1758**
Obsidian	3	60.0%	2	40.0%	–	–	–	–	**5**
Igneous	–	–	95	94.1%	6	5.9%	–	–	**101**
Rhyolite	1	1.4%	69	94.5%	2	2.7%	1	1.4%	**73**
Sandstone	–	–	102	98.1%	2	1.9%	–	–	**104**
Siltstone	5	0.1%	7521	97.2%	181	2.3%	29	0.4%	**7736**
Other	1	3.2%	28	90.3%	1	3.2%	1	3.2%	**31**
Total	**152**	**0.5%**	**27,075**	**97.6%**	**459**	**1.7%**	**44**	**0.2%**	**27,730**

were labeled as Alibates chert, a distinctive material type from Texas. Colleagues who are familiar with Alibates materials (R. N. Wiseman, J. L. Moore, S. L. Larralde) are of the firm opinion that this La Plata material is not Alibates chert. The material in question is a creamy yellow, with some phenocrysts, and a much darker yellow-brown cortex; it is likely that most or all of this material was obtained locally. The "Alibates" cases have been excluded from tables showing nonlocal materials (*see* "Nonlocal Materials" discussion and associated Tables 19.20 and 19.21 later in this chapter).

Chalcedony

Chalcedony is distinguished from chert, its close relative, primarily by its translucence and texture. It is a cryptocrystalline material with a waxier texture than chert. The Jackson Lake detailed material categories recorded 28 varieties of chalcedony among 446 artifacts. The majority of the varieties are "miscellaneous" color groups. Most of the chalcedony varieties contain inclusions of some form, ranging from fossils to "mossy," to inclusions specified only by color. White chalcedony with miscellaneous inclusions accounts for over a third of the chalcedony. Another quarter of the chalcedony is variations on clear with inclusions. In the comparative collection used to identify these varieties, there is tremendous variability within types. For example, "chalcedony, clear uniform shades of dark brown (1345)" specimens are overall dark brown in appearance with some small, nearly clear areas; "chalcedony, colorless, white, yellowish banded, Apache Creek area (1251)" contains pieces that are pure white with bands, many with no yellow.

Of the common materials, chalcedony is the least abundant, occurs rarely as hammerstones and cores (Tables 19.5, 19.7, 19.8, 19.9a), and frequently as tools relative to its overall occurrence. Chalcedony follows the pattern of smaller flakes with less cortex (and, of course, fewer cortical platforms) seen in silicified wood (Tables 19.6, 19.10, 19.11). The average size of chalcedony flakes is the smallest for all reasonably abundant material types (Fig. 19.7; Table 19.6). This pattern, common to the two materials, suggests that chalcedony came from a similar, or perhaps the same, source as silicified wood. Flake attributes in chalcedony tend to be quite different from materials other than silicified wood and slightly more extreme than silicified wood. Thus, chalcedony and silicified wood flakes are small, but chalcedony flakes have the smallest average. The two materials have the lowest frequency of cortical platforms, but chalcedony has the lowest. Conversely, the two have more single-facet platforms (40–45 percent), and chalcedony has the most. Among abundant, conchoidally fracturing materials, chalcedony has the most instances of collapsed platforms, considerably more than silicified wood (13.5 vs. 9.5 percent). Given its fracture properties, chalcedony surprisingly contains the highest percentage of all materials occurring as angular debris (18.1 percent), but silicified wood is close (17.1); still, 78 percent of the chalcedony is in the form of core flakes (Tables 19.10, 19.11, 19.12, 19.13). Signa Larralde (personal communication, 2003)

Table 19.8. Chipped stone tool type by material type; counts and percents.

	Debitage		Core		Retouched/ Utilized Debitage		Hammerstone		Formal Tools		Drills/Gravers		Large Tools		Total
	Count	Row %	Count	Row %	Count	Row %	Count	Row %	Count	Row %	Count	Row %	Count	Row %	
Chert	11,942	86.8%	529	3.8%	1013	7.4%	160	1.2%	42	0.3%	65	0.5%	5	0.0%	**13,756**
Chalcedony	372	83.8%	5	1.1%	47	10.6%	2	0.5%	15	3.4%	3	0.7%	–	–	**444**
Silicified wood	2107	77.4%	87	3.2%	464	17.1%	6	0.2%	35	1.3%	22	0.8%	–	–	**2721**
Quartzite	893	85.2%	33	3.1%	67	6.4%	46	4.4%	3	0.3%	2	0.2%	4	0.4%	**1048**
Quartzitic sandstone	1551	88.1%	44	2.5%	104	5.9%	54	3.1%	2	0.1%	1	0.1%	4	0.2%	**1760**
Obsidian	2	40.0%	–	–	–	–	–	–	3	60.0%	–	–	–	–	**5**
Igneous	91	88.3%	3	2.9%	2	1.9%	7	6.8%	–	–	–	–	–	–	**103**
Rhyolite	57	78.1%	4	5.5%	8	11.0%	2	2.7%	–	–	1	1.4%	1	1.4%	**73**
Sandstone	96	92.3%	4	3.8%	2	1.9%	2	1.9%	–	–	–	–	–	–	**104**
Siltstone	6687	86.3%	348	4.5%	485	6.3%	181	2.3%	2	0.0%	15	0.2%	29	0.4%	**7747**
Total	**23,798**	**85.7%**	**1057**	**3.8%**	**2192**	**7.9%**	**460**	**1.7%**	**102**	**0.4%**	**109**	**0.4%**	**43**	**0.2%**	**27,761**

points out that as a raw material chalcedony is often highly fractured, which yields substantial amounts of debris during reduction.

Other than obsidian, a higher percentage of chalcedony was found as formal tools than in any other material (Table 19.7). Fifteen of these tools are projectile points, over half of which are side-notched. The distribution of point types within the chalcedony group is similar to the overall distribution of point types.

Silicified Wood

Silicified wood is another conchoidally fracturing material. Its most likely sources are the Ojo Alamo, Fruitland, and Nacimiento Formations on either side of the La Plata Valley (Fig. 19.2), although it is available and was used throughout the San Juan Basin. Silicified wood ranges in texture from that retaining some splintery qualities from its ultimate origin, to homogeneous, tractable stone-working material. For the most part, the silicified wood that was brought to sites appears to have good working qualities, although some splintery pieces are in the assemblage. The terms "cherty" and "chalcedonic" are both attached to descriptions of silicified wood varieties, and it is inevitable that flakes from the same source or even nodule wind up getting called chert or chalcedony in addition to silicified wood. Such confusion has little significance in terms of acquisition area or working qualities. Further variability is also indicated by the presence of modifiers including dull, glossy, waxy, and opalized. The Jackson Lake lithics recording format recognizes 30 varieties of silicified wood (Table 19.4). Over a third of the varieties are yellow, and another 17 percent are brown, followed by white (10 percent) and reds and oranges (7 percent). A substantial number of varieties are described only as dark (18 percent of total silicified wood) or light (11 percent), rather than by color.

Silicified wood occurs mostly as small pieces in all assemblages (Fig. 19.8 [a–b]), indicating that large nodules were probably scarce. Most (55 percent) silicified wood flakes have no cortex, and nearly all (97 percent) have cortex on less than half of the dorsal surface. This material type contains the highest percentage of utilized pieces (Tables 19.8, 19.9a), and after chert was the material most often used for formal tools (Table 19.7, 19.9a). Roger Moore (1988a:1072) reports low frequencies of silicified

Table 19.9a. Chipped stone tool types by material, subtotals for chert, chalcedony, and silicified wood; counts and percents.

	Chert		Chalcedony		Silicified Wood		Total	
	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %
Debitage	11,943	86.8%	372	83.6%	2106	77.5%	**14,421**	**85.2%**
Core	480	3.5%	5	1.1%	72	2.6%	**557**	**3.3%**
Uniface	3	0.0%	–	–	1	0.0%	**4**	**0.0%**
Biface	3	0.0%	1	0.2%	3	0.1%	**7**	**0.0%**
Retouched, utilized debitage	1013	7.4%	47	10.6%	464	17.1%	**1524**	**9.0%**
Retouched, utilized core	49	0.4%	–	–	15	0.6%	**64**	**0.4%**
Drill	15	0.1%	3	0.7%	8	0.3%	**26**	**0.2%**
Graver	7	0.1%	–	–	1	0.0%	**8**	**0.0%**
Notch	34	0.2%	–	–	11	0.4%	**45**	**0.3%**
Denticulate	9	0.1%	–	–	2	0.1%	**11**	**0.1%**
Bifacial knife, scraper	4	0.0%	1	0.2%	6	0.2%	**11**	**0.1%**
Projectile point	33	0.2%	14	3.1%	23	0.8%	**70**	**0.4%**
Hammerstone	160	1.2%	2	0.4%	6	0.2%	**168**	**1.0%**
Chopper, plane	5	0.0%	–	–	–	–	**5**	**0.0%**
Total	**13,758**	**100.0%**	**445**	**100.0%**	**2718**	**100.0%**	**16,921**	**100.0%**

Table 19.9b. Chipped stone tool types by material, subtotals for quartzite, quartzitic sandstone, sandstone, and siltstone; counts and percents.

	Quartzite		Quartzitic Sandstone		Sandstone		Siltstone		Total	
	N	Col. %	N	Col. %	N	Col. %	N	Col. %	N	Col. %
Debitage	893	85.2%	1551	88.1%	96	92.3%	6688	86.3%	**9228**	**86.6%**
Core	26	2.5%	40	2.3%	4	3.8%	315	4.1%	**385**	**3.6%**
Uniface	–	–	1	0.1%	–	–	1	0.0%	**2**	**0.0%**
Retouched, utilized debitage	67	6.4%	104	5.9%	2	1.9%	485	6.3%	**658**	**6.2%**
Retouched, utilized core	7	0.7%	4	0.2%	–	–	33	0.4%	**44**	**0.4%**
Drill	–	–	–	–	–	–	1	0.0%	**1**	**0.0%**
Notch	2	0.2%	1	0.1%	–	–	12	0.2%	**15**	**0.1%**
Denticulate	–	–	–	–	–	–	2	0.0%	**2**	**0.0%**
Bifacial knife, scraper	1	0.1%	–	–	–	–	1	0.0%	**2**	**0.0%**
Projectile point	2	0.2%	1	0.1%	–	–	–	–	**3**	**0.0%**
Hammerstone	46	4.4%	54	3.1%	2	1.9%	181	2.3%	**283**	**2.7%**
Chopper, plane	4	0.4%	4	0.2%	–	–	27	0.3%	**35**	**0.3%**
Axe	–	–	–	–	–	–	1	0.0%	**1**	**0.0%**
Hoe	–	–	–	–	–	–	1	0.0%	**1**	**0.0%**
Total	**1048**	**100.0%**	**1760**	**100.0%**	**104**	**100.0%**	**7748**	**100.0%**	**10,660**	**100.0%**

N = count

wood at sites east of the river and north of Jackson Lake excavated during the La Plata Mine project. He attributes this material to Piñon Mesa, which is much closer to the Jackson Lake community, accounting for the higher frequencies of silicified wood in these collections. He also says that this material is available as "non-redeposited . . . chunks of silicified wood" (Moore 1988b:14). This form means that the location and perhaps means of acquiring silicified wood was different from those materials available in gravel deposits. Cushman (1990) found silicified wood to be most abundant on Piñon Mesa but also reported sizable pieces from McDermott Arroyo, east of the river and farther to the north. The distinctive yellow-brown silicified wood may originate in the Animas Formation but is also found in the Fruitland Formation and as drift (Banks 1990:66; see also Vierra 1993b:159). This same va-

Table 19.10. *Whole flakes, presence of cortex by material type; counts and percents.*

Material	No Cortex		1–50% Cortex		51–99% Cortex		100% Cortex		Total
	Count	Row %	Count	Row %	Count	Row %	Count	Row %	
Chert	1685	24.8%	4032	59.4%	929	13.7%	144	2.1%	**6790**
Chalcedony	114	60.6%	62	33.0%	10	5.3%	2	1.1%	**188**
Silicified wood	663	55.1%	477	39.6%	61	5.1%	3	0.2%	**1204**
Quartzite	88	19.6%	278	62.1%	69	15.4%	13	2.9%	**448**
Quartzitic sandstone	201	23.2%	533	61.4%	118	13.6%	16	1.8%	**868**
Obsidian	2	100.0%	–	–	–	–	–	–	**2**
Igneous	8	16.7%	29	60.4%	6	12.5%	5	10.4%	**48**
Rhyolite	14	41.2%	14	41.2%	6	17.6%	–	–	**34**
Sandstone	23	27.4%	43	61.5%	1	10.2%	1	0.9%	**68**
Siltstone	1043	27.4%	2340	61.5%	388	10.2%	33	0.9%	**3804**
Other	6	46.2%	1	7.7%	6	46.2%	–	–	**13**
Total	**3847**	**28.6%**	**7809**	**58.0%**	**1594**	**11.8%**	**217**	**1.6%**	**13,467**

13 flakes coded not applicable for cortex.

riety of silicified wood—which they called silicified wood yellow—was defined and recorded separately by the CGP project south of the San Juan from the La Plata Valley. They identified the source as lag gravels on terraces near the north edge of the CGP lease (Chapman 1977:429, 440).

Tabulating the five most abundant varieties of silicified wood from the six largest site collections shows that the varieties have significant associations with sites ($X^2 = 163.1$, $p = .000$, $n = 1,727$, $C = .294$). Particular contributors to the chi-square value are more than expected dark dull silicified wood at LA 37591 and poor brown at LA 37592, and less dark dull at LA 37594 and yellow brown at LA 37592. Since clustering is to be expected if core reduction took place at a site, site-variety associations are not surprising, and the proximity of the sites means that these associations probably reveal little about material source differences. Splintery silicified wood (n = 114) occurs primarily at LA 37592 and LA 37593, the sites with the largest collections, but it is present at most of the other Jackson Lake sites, as well. Over a quarter of it occurs as angular debris, predictably more than in more evenly fracturing materials. Though the majority form remains core flakes, there are no formal tools made of splintery wood.

Silicified wood and chalcedony were clearly favored for projectile point manufacture (Tables 19.9a, 19.9b). Silicified wood is by far the most abundant material used for points, greatly outstripping its occurrence in the overall sample (in the whole sample silicified wood is 41 percent of points, 10 percent of the total lithic assemblage; Table 19.9a), as does much scarcer chalcedony (17 percent of points, 2 percent of total). This preference crosscuts most point styles. This is especially notable since intuitively chert would be almost as useful for points and was far more available, but was used surprisingly little (42 percent of points, 50 percent of total).

The use of yellow-brown (10YR 4–5/4–6) silicified wood is notable at LA 37592. This material was used throughout the valley but is more abundant in Jackson Lake sites. Numerous tools were made from this material and recovered especially from the Pit Structure 1 midden. Many of the formal tools from that context are projectile points made on flakes. The workmanship on most of these items is expedient, with many flake attributes still visible (Fig. 19.9 [a–g]). This material appears to turn a deep red when heat treated (Fig. 19.9 [f] [356-1]) but is still recognizable by the dark streaks in both colors. Although many of these points are sufficiently similar in workmanship and style to have been produced by the same knapper, others are very different, indicating use of this material by many craftsmen, probably over a considerable span of time (Figs. 19.8, 19.9). There is a possible Bajada (or San Jose?) point of this material from LA 65030 (Barker Arroyo), surely an heirloom or a collected find, but likely to have originally been made before 2000 BC. Materials from the La Plata Mine project also show consistent use of this material in tool manufacture (Moore 1988a:1072–1073, 1077). In contrast to the frequent and preferential use of

Table 19.11. Debitage flake platform type by material type; counts and percents.

Material	Cortical		Single Facet		Multifaceted		Retouched		Collapsed		Absent		Other		Total
	Count	Row %	Count	Row %	Count	Row %	Count	Row %	Count	Row %	Count	Row %	Count	Row %	
Chert	3356	29.6%	3981	35.1%	802	7.1%	14	0.1%	1064	9.4%	2025	17.9%	92	0.8%	**11,340**
Chalcedony	42	12.3%	154	45.0%	23	6.7%	2	0.6%	46	13.5%	72	21.1%	3	0.9%	**342**
Silicified wood	284	13.4%	847	40.0%	252	11.9%	7	0.3%	201	9.5%	519	24.5%	10	0.5%	**2120**
Quartzite	288	33.6%	240	28.0%	66	7.7%	2	0.2%	99	11.6%	158	18.5%	3	0.4%	**856**
Quartzitic sandstone	509	34.3%	487	32.8%	79	5.3%	4	0.3%	171	11.5%	226	15.2%	10	0.7%	**1486**
Obsidian	–	–	–	–	–	–	–	–	1	50.0%	1	50.0%	–	–	**2**
Igneous	27	34.2%	24	30.4%	3	3.8%	1	1.3%	10	12.7%	14	17.7%	–	–	**79**
Rhyolite	14	23.7%	22	37.3%	7	11.9%	–	–	9	15.3%	7	11.9%	–	–	**59**
Sandstone	23	28.4%	44	54.3%	1	1.2%	–	–	8	9.9%	5	6.2%	–	–	**81**
Siltstone	2078	33.9%	1965	32.1%	382	6.2%	3	0.0%	590	9.6%	1020	16.6%	92	1.5%	**6130**
Other	6	24.0%	8	32.0%	1	4.0%	–	–	2	8.0%	8	32.0%	–	–	**25**
Total	**6627**	**29.4%**	**7772**	**34.5%**	**1616**	**7.2%**	**33***	**–**	**2201**	**9.8%**	**4055**	**18.0%**	**210**	**0.9%**	**22,520**

* 12 are abraded; 6 chert flakes with modified platforms not shown.

yellow-brown silicified wood in these assemblages, however, Vierra (1993b:354) says, "There is very little of the yellow-brown silicified wood in either the Archaic or Pueblo assemblages" of the pipeline study in the San Juan and upper Puerco Rivers.

The "nice" tools from yellow-brown silicified wood show that it can be worked carefully, but there seems to be a tendency to use it in very expedient, not to say crude, ways (Fig. 19.9). It may be that it renders very thin, nearly ready-to-use flakes. Interestingly, it seems that there is a pattern in which smaller tools such as projectile points made from this popular material are as expedient as possible, but larger tools, mostly probably knives, are well made with careful, regular flaking and symmetrical tool outlines (Figs. 19.10 [a–d], 19.11 [a–e]). A comparison of the four most common materials used for projectile points (chert, chalcedony, this silicified wood, and undifferentiated silicified wood) shows that there is not a statistically significant association of subjectively evaluated workmanship with material within points, but that the occurrence of crude and expedient points is greater than expected within yellow-brown silicified wood. Chapman (1977:450–451) found that this material was preferentially used for tool manufacture in the Chuska Valley.

Quartzite

Quartzite is metamorphosed or indurated sandstone that breaks through (rather than around) the constituent sand grains. Depending on the degree of metamorphosis the original grains become indistinct from the cement. The material retains a sugary appearance as light is reflected from a fractured surface. Grains in some specimens have a very shiny, liquid appearance.

Quartzite and quartzitic sandstone are rarely used for formal tools, though five points and two well-made knives show that it could be worked into formal tools (Fig. 19.10 [a, b]; Table 19.14). These materials, however, are commonly used for hammerstones (Tables 19.5, 19.9b). Quartzite flakes tend to be larger than other flakes, especially the utilized ones (Tables 19.6, 19.16, 19.17). Far fewer quartzite and quartzitic sandstone flakes have no dorsal cortex, though more have less than half cortex than those that have more than half (Table 19.10). This indicates that it was uncommon for quartzite cores to be heavily reduced and suggests that quartzite tools were even more expedient than more siliceous ma-

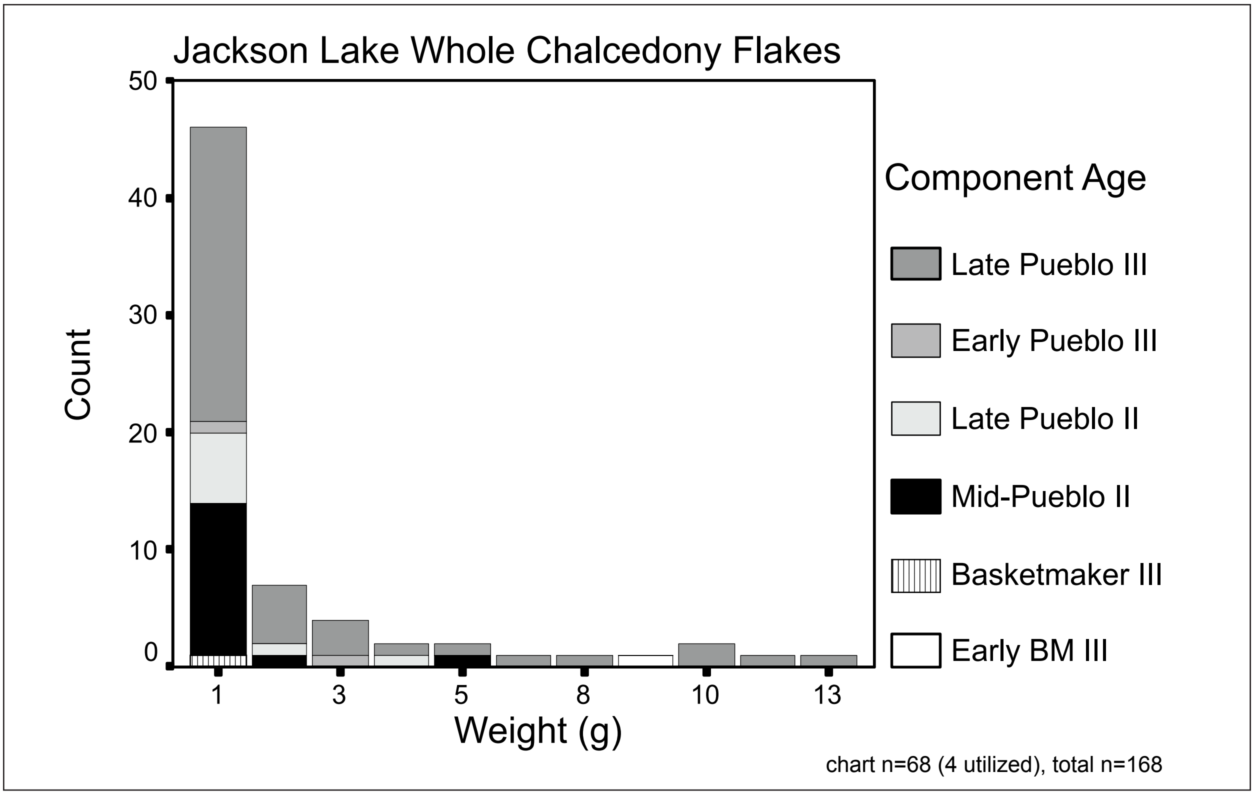


Figure 19.7. Chalcedony flakes, bar chart: temporal distribution of weights of whole chalcedony flakes.

Table 19.12. Debitage flake portion by material type; counts and percents.

	Indeterminate		Whole		Proximal		Medial Fragment		Distal		Lateral Fragment		Total
Material	**N**	**Row %**	**N**	**Row %**	**N**	**Row %**	**N**	**Row %**	**N**	**Row %**	**N**	**Row %**	
Chert	174	1.5%	6797	59.8%	1685	14.8%	410	3.6%	1199	10.5%	1104	9.7%	**11,369**
Chalcedony	6	1.7%	188	54.8%	68	19.8%	14	4.1%	36	10.5%	31	9.0%	**343**
Silicified wood	56	2.6%	1205	56.8%	287	13.5%	142	6.7%	260	12.3%	171	8.1%	**2121**
Quartzite	25	2.9%	452	52.1%	176	20.3%	34	3.9%	79	9.1%	102	11.8%	**868**
Quartzitic sandstone	16	1.1%	870	57.8%	234	15.5%	52	3.5%	123	8.2%	211	14.0%	**1506**
Obsidian	–	–	2	100.0%	–	–	–	–	–	–	–	–	**2**
Igneous	3	3.8%	48	60.8%	8	10.1%	4	5.1%	7	8.9%	9	11.4%	**79**
Rhyolite	–	–	34	55.7%	12	19.7%	1	1.6%	5	8.2%	9	14.8%	**61**
Sandstone	1	1.2%	68	84.0%	7	8.6%	–	–	3	3.7%	2	2.5%	**81**
Siltstone	87	1.4%	3804	61.8%	776	12.6%	222	3.6%	570	9.3%	698	11.3%	**6157**
Other	3	11.5%	13	50.0%	4	15.4%	–	–	4	15.4%	2	7.7%	**26**
Total	**371**	**1.6%**	**13,481**	**59.6%**	**3257**	**14.4%**	**879**	**3.9%**	**2286**	**10.1%**	**2339**	**10.3%**	**22,613**

N = count

Table 19.13. Reduction morphology by material (all debitage); counts and percents.

Material	Angular Debris		Core Flake		Biface Flake		Blade		Resharpening		Hammerstone		Ground Stone		Total
	Count	Row %	Count	Row %	Count	Row %	Count	Row %	Count	Row %	Count	Row %	Count	Row %	
Chert	1582	12.2%	10,912	84.2%	11	0.1%	10	0.1%	9	0.1%	20	0.2%	410	3.2%	**12,956**
Chalcedony	76	18.1%	326	77.8%	1	0.2%	–	–	–	–	–	–	16	3.8%	**419**
Silicified wood	446	17.4%	2062	80.2%	9*	17.4%	5	0.2%	2	0.1%	1	0.0%	45	1.8%	**2570**
Quartzite	92	9.6%	795	82.8%	4	0.4%	–	–	–	–	14	1.5%	55	5.7%	**960**
Quartzitic sandstone	149	9.0%	1436	86.8%	–	–	1	0.1%	1	0.1%	7	0.4%	61	3.7%	**1655**
Obsidian	–	–	1	50.0%	1	50.0%	–	–	–	–	–	–	–	–	**2**
Igneous	13	14.1%	78	84.8%	–	–	–	–	–	–	–	–	1	1.1%	**92**
Rhyolite	4	6.2%	58	89.2%	–	–	–	–	–	–	–	–	3	4.6%	**65**
Sandstone	17	17.3%	81	82.7%	–	–	–	–	–	–	–	–	–	–	**98**
Siltstone	1016	14.2%	5907	82.4%	3	0.0%	5	0.1%	5	0.1%	21	0.3%	215	3.0%	**7173**
Other	3	10.7%	24	85.7%	–	–	–	–	–	–	1	3.6%	–	–	**28**
Total	**3398**	**13.1%**	**21,680**	**83.3%**	**29***	**13.1%**	**21**	**0.1%**	**17**	**0.1%**	**64**	**0.2%**	**806**	**3.1%**	**26,015**

* Includes one early stage and one late stage biface flake

One chert and one siltstone bipolar flake, and one chert not applicable, are not shown.

terials. Consistent with the presence of more cortex is a higher frequency of cortical platforms (Tables 19.10, 19.11).

Where color was specified the quartzites recorded in the analysis were red and pink (27.9 percent of total), gray (21.0 percent), tan (9.2 percent), purple (8.5 percent), white (6.6 percent), black (5.3 percent), brown (5.2 percent), and yellow (3.2 percent) (Table 19.4). The high frequency of red, pink, and purple suggests the presence of considerable iron in the material, and, further, that at least some of the material may have been heat treated. The analysts recorded very little heat treating in quartzite, but these colors are suggestive of such treatment. Heat treatment is likely to be much more evident in quartzite color than in texture (Toll 1978).

Quartzitic Sandstone

Quarzitic sandstone is on a continuum with quartzite and is essentially equivalent to it (Banks 1990:155). It is more granular than quartzite but is indurated and fractures conchoidally. In the La Plata area this material is generally from sandstones that were originally fine grained, so it is more difficult to determine whether the fracture is through or around grains. At Jackson Lake, this material was recorded about twice as often as quartzite, but at Barker Arroyo, quartzite was used far more often than quartzitic sandstone. With the exception of nonlocal quartzites such as that from the Brushy Basin member of the Morrison Formation, distinction between quartzitic materials (i.e., quartzite and quartzitic sandstone) has little archaeological importance. Colors recorded within this material type in this analysis were red, pink, and orange (37.0 percent); gray and black (22.8 percent); purple (12.7 percent); brown (10.0 percent); tan (7.4 percent); green (5.5 percent); and white (2.7 percent).

Cushman's (1990) material survey recorded quartzitic sandstone as the second most common material in gravel terrace samples. It was, however, far less common than siltstone, as is also the case in the archaeological assemblages.

In a broader sense, quartzite and quartzitic sandstone are both quartzite, and the Barker Arroyo analysis seems likely to have called most material by that inclusive name. The colors recorded for the "two" materials follow similar patterns, with reds most abundant. These similarities are borne out by the forms these two materials take in the

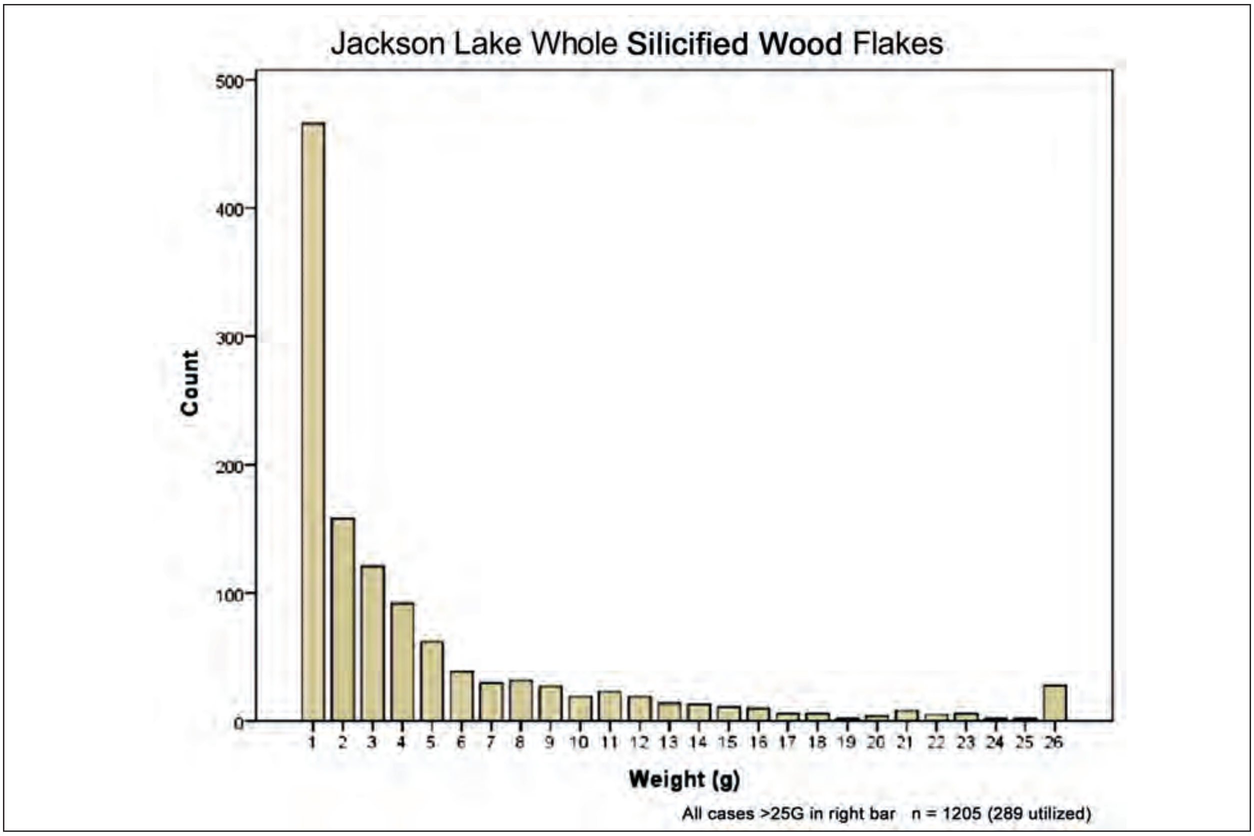


Figure 19.8 [a–b]. Silicified wood flakes, bar chart: a. weight distribution of all whole silicified wood flakes.

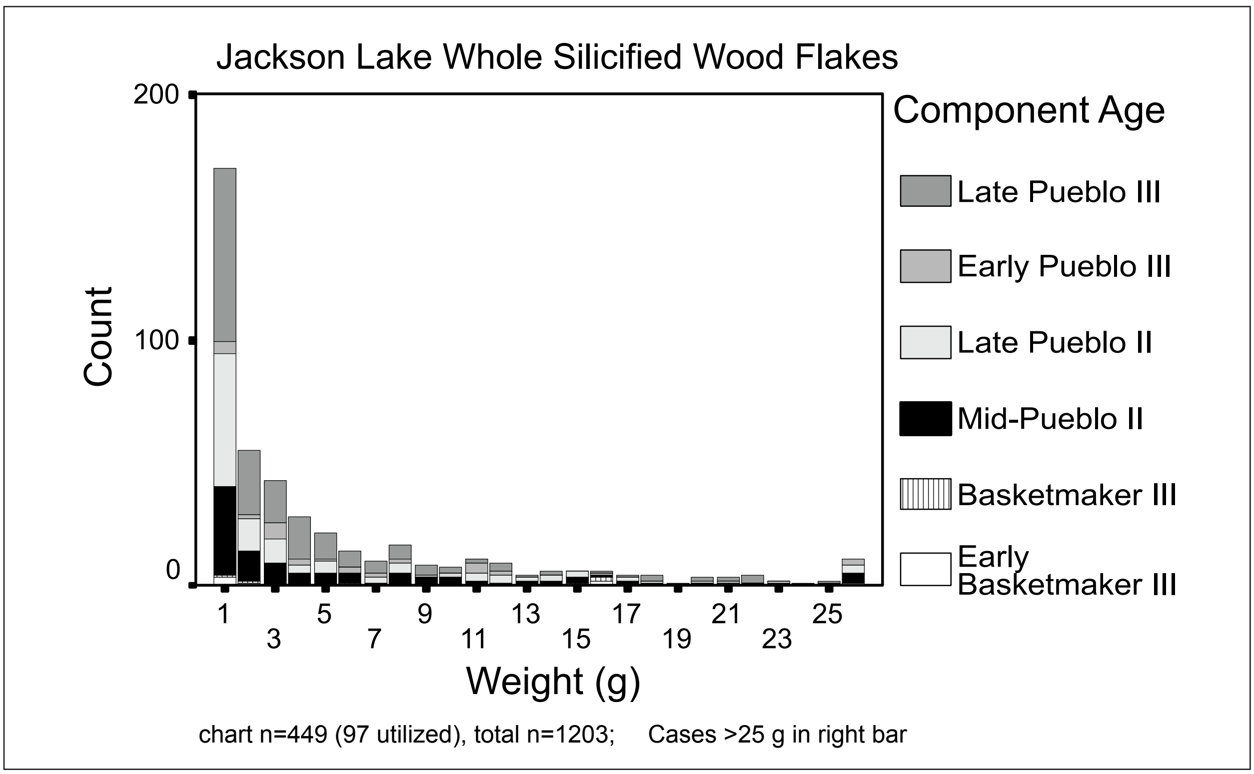


Figure 19.8 [a–b]. Silicified wood flakes, bar chart: b. temporal distribution of weights of whole silicified wood flakes.

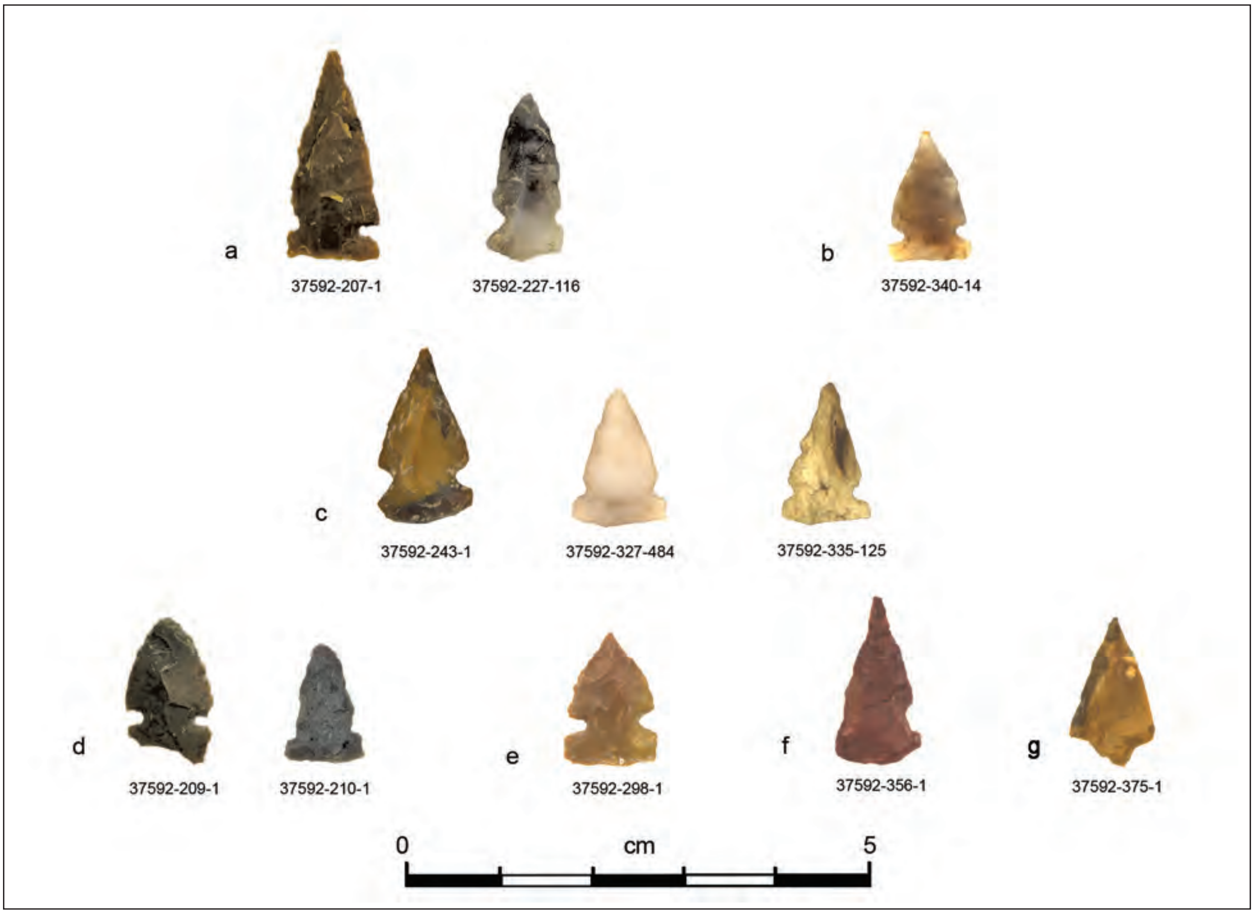


Figure 19.9 [a–g]. Expedient points from LA 37592, Pit Structure 1, midden: a. Layer 1; b. Layer 2; c. Layer 3; d. Layer 4; e. Layer 5; f. Layer 6; g. Layer 28. Eight of these points are made of yellow-brown silicified wood; f. is heat-treated.

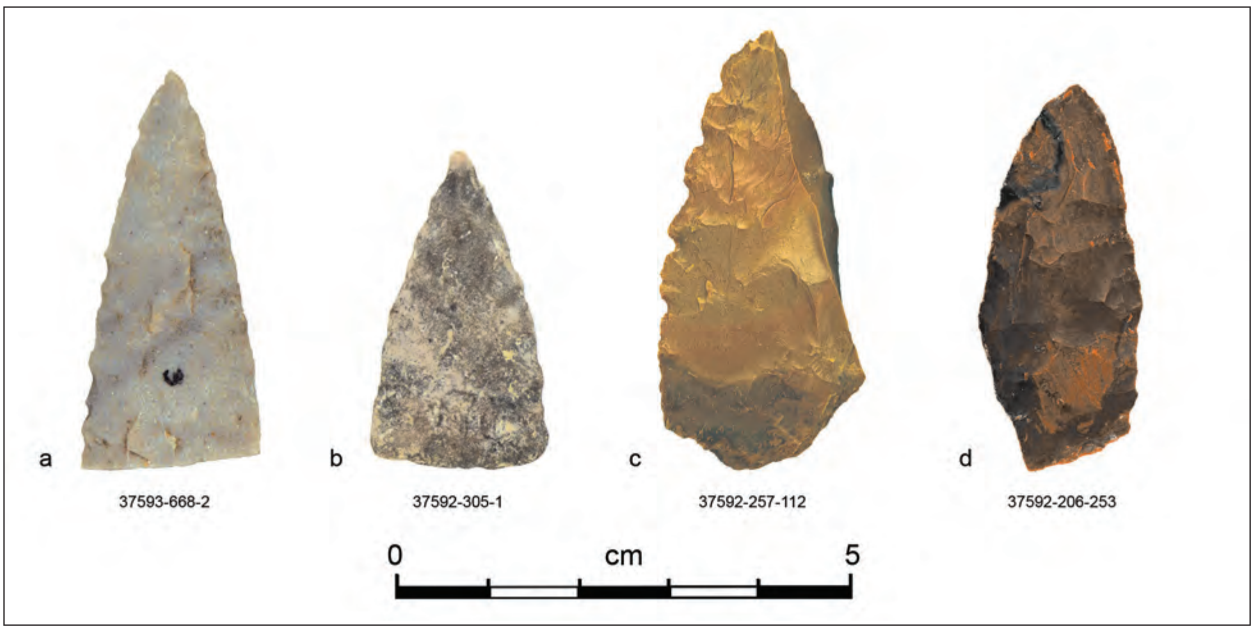


Figure 19.10 [a–d]. Four well-made bifaces from LA 37393 and LA 37592: a., b.: quartzite; c., d.: yellow-brown silicified wood. While c. is classified as a denticulate, the others are knives.

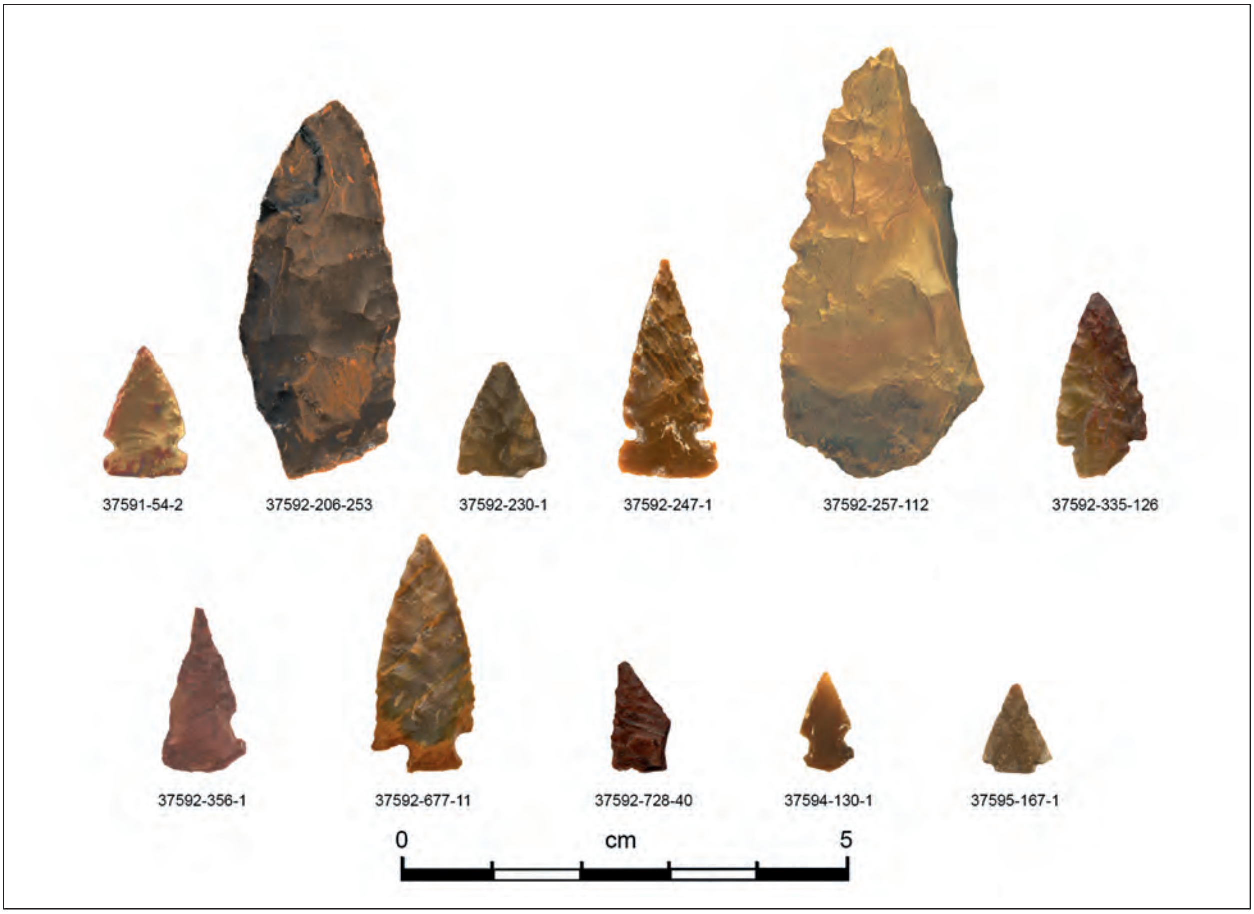


Figure 19.11. Tools made of yellow-brown silicified wood: LA 37591 (1, top left); LA 37592, (5, top right; 3, bottom left; 356-1 is heat treated; 677-11 and 728-40 are from non-midden locations); and tiny points from LA 37594 (bottom, 2nd from right, "hummingbird point") and LA 37595 (far right).

assemblage. There is a slightly greater tendency for quartzite to be found as tools or for fine work and therefore to be found as smaller flakes, but reduction morphology, artifact type, edge damage, and flake portion are all similarly distributed across variables (Tables 19.9b, 19.10, 19.11, 19.12, 19.13, 19.16). An especially striking occurrence in both materials is edge battering, clearly resulting directly from the tendency for these materials to be used as hammerstones, since this form of damage does not occur on whole flakes in this assemblage (compare Tables 19.18, 19.19). Distinctions between quartzite and quartzitic sandstone aside, this class of materials is much more common in the Jackson Lake assemblage than in the Barker Arroyo assemblage (10.1 percent of count, 15.7 percent of weight, in contrast to 5.4 percent of count and 8.6 percent of weight). It appears that quartzitic materials were used to fill the role often filled by siltstone at Barker Arroyo sites. This is probably primarily a function of availability, although preferences may also have been at work.

Quartzite (including quartzitic sandstone) was generically a popular material for hammerstones, attesting to its toughness and tensile qualities (Tables 19.5, 19.7, 19.9b).

Sandstone

Unmetamorphosed sandstone is an uncommon flaked stone material, but it does occur, mostly as debitage (Table 19.9b). Because of difficulties in interpreting sandstone fragments and the consequent collection bias, much sandstone debris goes uncollected. Some of the sandstone debitage that is collected could be by-products from shaping ground stone tools—sandstone is the material for over 70 percent of ground stone tools—although some was probably used for cutting edges and hammers as

Table 19.14. Projectile points and formal tools, counts by material type.

	Chert	Pedernal	Narbona Pass	Chal-cedony	Silicified Wood	Yellow-brown Silicified Wood	Obsidian	Quartzite	Total
Indeterminate	1	–	–	1	–	–	1	–	**3**
Stemmed	–	–	–	–	–	–	–	1	**1**
Basal notch	–	–	–	1	–	–	–	–	**1**
Eccentric	1	–	–	–	–	–	–	–	**1**
Unidentified point	–	–	1	1	1	–	–	–	**3**
Unidentified small	–	–	–	3	1	1	1	–	**6**
Unidentified corner-notched	2	–	–	1	–	1	–	–	**4**
Unidentified side-notched	–	–	–	1	1	3	1	–	**6**
Large side-notched	–	–	–	1	1	–	–	–	**2**
Jay point	1	–	–	–	–	–	–	–	**1**
En Medio point	–	1	–	–	1	–	–	–	**2**
Unnotched	–	–	1	1	–	–	–	–	**2**
Stemmed, long tangs	–	–	–	1	1	1	–	–	**3**
Corner-notched squat	–	–	–	–	–	1	–	–	**1**
Corner-notched, length>width	2	–	–	–	–	–	–	2	**4**
Corner-notched convex	–	–	–	–	–	1	–	–	**1**
Side-notched convex	–	–	1	2	3	4	–	–	**10**
Side-notched straight	3	–	1	2	4	6	–	2	**18**
Side-notched concave	2	–	–	2	–	–	–	–	**4**
Knife	–	–	–	–	–	1	–	2	**3**
Serrated knife	–	–	–	–	–	1	–	–	**1**
Straight-sided drill	–	–	1	–	–	1	–	–	**2**
Total	**12**	**1**	**5**	**17**	**13**	**21**	**3**	**7**	**79**

well. Sandstone was available from outcrops on both sides of the valley, though at some distance on the west side. It is likely that sandstone was more difficult to obtain than cobbles from the terraces, since sandstone probably did not usually survive glacial transport. In spite of the huge potential variability in sandstone, nearly all of the items in the chipped stone analysis are fine grained, and, essential for being identifiable as chipped stone, hard and well consolidated. Although sandstone varieties were potentially recorded in the Jackson Lake analysis, 88 of the 104 pieces were termed very fine grained, undifferentiated (Table 19.4).

Siltstone

Through time and over space, siltstone is one of the most abundant materials in La Plata Valley assemblages (Table 19.5). It was the material encountered most often in Cushman's raw material survey, dominating all terrace sources, but absent from Piñon Mesa. It occurs in a range of colors, from deep, pure black (it is sometimes confused with basalt in analyses of valley lithics; see Vierra 1993a:186), through gray, into gray green and green, with some browns and reds. In the "splitter" classification initially used to record this collection, 39 varieties of this material were recorded, including a number of varieties of "black rock." Of these many categories, 10

Table 19.16. Chipped stone material type by utilization (all flakes); counts and percents.

	Debitage		Retouched/ Utilized Debitage		Total	% Utilized	% of Total Utilized
Material	**Count**	**Col. %**	**Count**	**Col. %**	**Count**	**Col. %**	**Row %**
Chert	11,943	50.1%	1013	46.2%	**12,956**	49.8%	**7.8%**
Chalcedony	372	1.6%	47	2.1%	**419**	1.6%	**11.2%**
Silicified wood	2106	8.8%	464	21.1%	**2570**	9.9%	**18.1%**
Quartzite	893	3.7%	67	3.1%	**960**	3.7%	**7.0%**
Quartzitic sandstone	1551	6.5%	104	4.7%	**1655**	6.4%	**6.3%**
Obsidian	2	0.0%	–	0.0%	**2**	0.0%	**0.0%**
Igneous	90	0.4%	2	0.1%	**92**	0.4%	**2.2%**
Rhyolite	57	0.2%	8	0.4%	**65**	0.2%	**12.3%**
Sandstone	96	0.4%	2	0.1%	**98**	0.4%	**2.0%**
Siltstone	6688	28.1%	485	22.1%	**7173**	27.6%	**6.8%**
Other	25	0.1%	3	0.1%	**28**	0.1%	**10.7%**
Total	**23,823**	**100.0%**	**2195**	**100.0%**	**26,018**	**100.0%**	**8.4%**

Table 19.17. Large hafted tools, ground and chipped stone combined; counts by tool and material type.

	Igneous	Granite	Sandstone	Siltstone	Shale	Metamorphic	Quartzitic Sandstone	Other	Total
Notched maul	1	2	–	1	–	–	1	–	**5**
Grooved maul	–	2	1	1	–	–	–	–	**4**
Weight	1	–	–	–	–	–	–	–	**1**
Axe	–	–	1	3	–	–	–	–	**4**
One-notch axe	1	–	–	–	–	–	–	–	**1**
Two-notch axe	5	3	3	12	–	1	–	–	**24**
Three-fourths grooved axe	1	–	–	–	–	–	–	–	**1**
Full-grooved axe	2	–	–	2	–	–	–	–	**4**
Hoe	–	–	–	–	–	–	–	1	**1**
Notched hoe	–	1	–	–	–	–	–	–	**1**
Tchamahia	–	–	2	10	2	–	–	–	**14**
Total	**11**	**8**	**7**	**29**	**2**	**1**	**1**	**1**	**60**

Table 19.18. Utilized and unutilized whole flakes by material type; mean weight (g) and counts.

	Whole Utilized Flakes			Whole Unutilized Flakes		
	Weight (g)	**Standard Deviation**	**Count**	**Weight (g)**	**Standard Deviation**	**Count**
Chert	13.39	18.14	672	8.06	13.25	6125
Chalcedony	3.15	5.18	20	2.05	2.22	168
Silicified wood	6.71	8.61	289	4.47	6.51	916
Quartzite	28.43	34.27	43	12.50	20.37	410
Quartzitic sandstone	36.74	40.16	66	12.20	20.41	804
Igneous	30.0	–	1	12.54	17.39	48
Rhyolite	135.67	217.85	3	14.35	19.21	31
Sandstone	15.5	12.02	2	10.39	15.36	66
Siltstone	24.03	34.38	288	11.17	19.53	3515
Other	26.0	14	3	1.90	1.10	10
Total	**15.94**	**26.33**	**1386**	**9.07**	**15.92**	**12,095**

Table 19.19. Chipped stone tool type by igneous material types; counts and percents.

	Obsidian		Igneous		Rhyolite		Total	
	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %
Debitage	2	40.0%	90	88.2%	57	78.1%	**149**	**82.8%**
Core	–	–	3	2.9%	4	5.5%	**7**	**3.9%**
Retouched, utilized	–	–	2	2.0%	8	11.0%	**10**	**5.6%**
Drill	–	–	–	–	1	1.4%	**1**	**0.6%**
Projectile point	3	60.0%	–	–	–	–	**3**	**1.7%**
Hammerstone	–	–	7	6.9%	2	2.7%	**9**	**5.0%**
Chopper, plane	–	–	–	–	1	1.4%	**1**	**0.6%**
Total	**5**	**100.0%**	**102**	**100.0%**	**73**	**100.0%**	**180**	**100.0%**

constitute 93 percent of the items. Black is the most common color (around 43 percent), followed by gray (27 percent), green (14 percent), red (7 percent), and brown (6 percent), with various mixtures of these colors present (Table 19.4). In cobble form, siltstone of various colors often has a tan cortex.

The material used for tool manufacture is virtually all metamorphosed (Cushman and others refer to it as "meta-siltstone"). This material fractures conchoidally, with no evidence of the bedding planes one might expect from an unmetamorphosed sedimentary rock. "Typical" siltstone has a slightly grainy "macrocrystalline" texture, but there is a range of textures, as well, and some very fine specimens are difficult to distinguish from chert. Siltstone can contain crystalline inclusions, but in keeping with the name "silt" does not usually have visible grains. Clearly, it is abundant on the terraces of the valley and was often used for expedient tools, but rarely for formal chipped stone tools, though it was often selected for tools involving significant grinding in their production, such as axes and tchamahias (Tables 19.9b, 19.17), and occasionally for grinding tools. Among chipped stone items, siltstone artifacts regularly have the greatest average weight, because there are so often very large pieces. It was a common hammerstone material (Table 19.5). In his survey of raw materials, Cushman found that siltstone was the majority material by weight in all of his sample units on the terraces. By the time his survey reached the higher elevations of Piñon Mesa, siltstone was not present, reflecting its glacial source.

In spite of the greater average weight of siltstone artifacts (Tables 19.6, 19.18), the majority of siltstone whole flakes weigh only 1 g. Still, 14 percent of whole siltstone flakes weigh more than 25 g, as opposed to only 8.4 percent of whole chert flakes. Except for the presence of more very large flakes, the weight distribution of siltstone flakes is remarkably similar to that of chert flakes (Figs. 19.4, 19.5, 19.12 [a–c]). In spite of the fact that siltstone is so immediately available in large pieces, the occurrence of cortex on whole flakes is very similar to that of other abundant materials. Were siltstone actually being acquired on site, a higher percentage of flakes with more than half or all cortex would be likely. The occurrence of larger cobbles at the tops of terraces and the occurrence of cortex suggest that some testing and core reduction took place on the terrace tops before siltstone intended for use and further reduction was brought to the sites. Perhaps as a testimony to its durability, siltstone is slightly more likely to be recovered as whole flakes than are other common materials (Table 19.12).

Igneous Materials

Igneous materials do not occur with great frequency in the chipped stone assemblage (Table 19.4 indicates some of the variety present). The grouped coding retains both obsidian and rhyolite as distinct materials, although they, too, are relatively infrequent. Andesite-diorite cobbles, abundant in valley gravels, were the primary source of ceramic temper. Temper sources were probably heavily weathered, but unweathered diorite would probably be suitable for hammerstones, although it was seldom so used.

Obsidian, very rare in these collections and very distinctive in both source and characteristics, is discussed below as a nonlocal material. The use profiles of local igneous materials are similar to those of siltstones and quartzites (Tables 19.5, 19.8, 19.9b, 19.19):

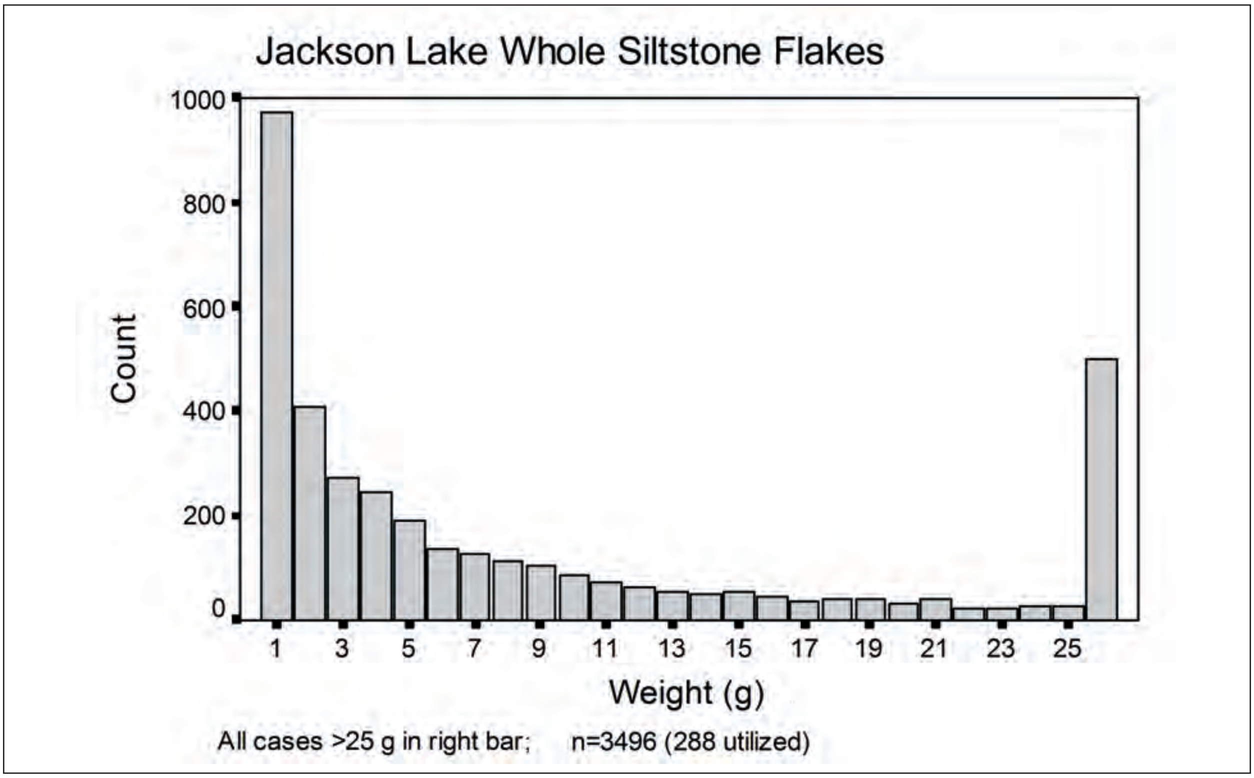


Figure 19.12 [a–c]. Whole siltstone flakes: a. weight distribution of all whole siltstone flakes, with all cases greater than 25 g in far-right bar.

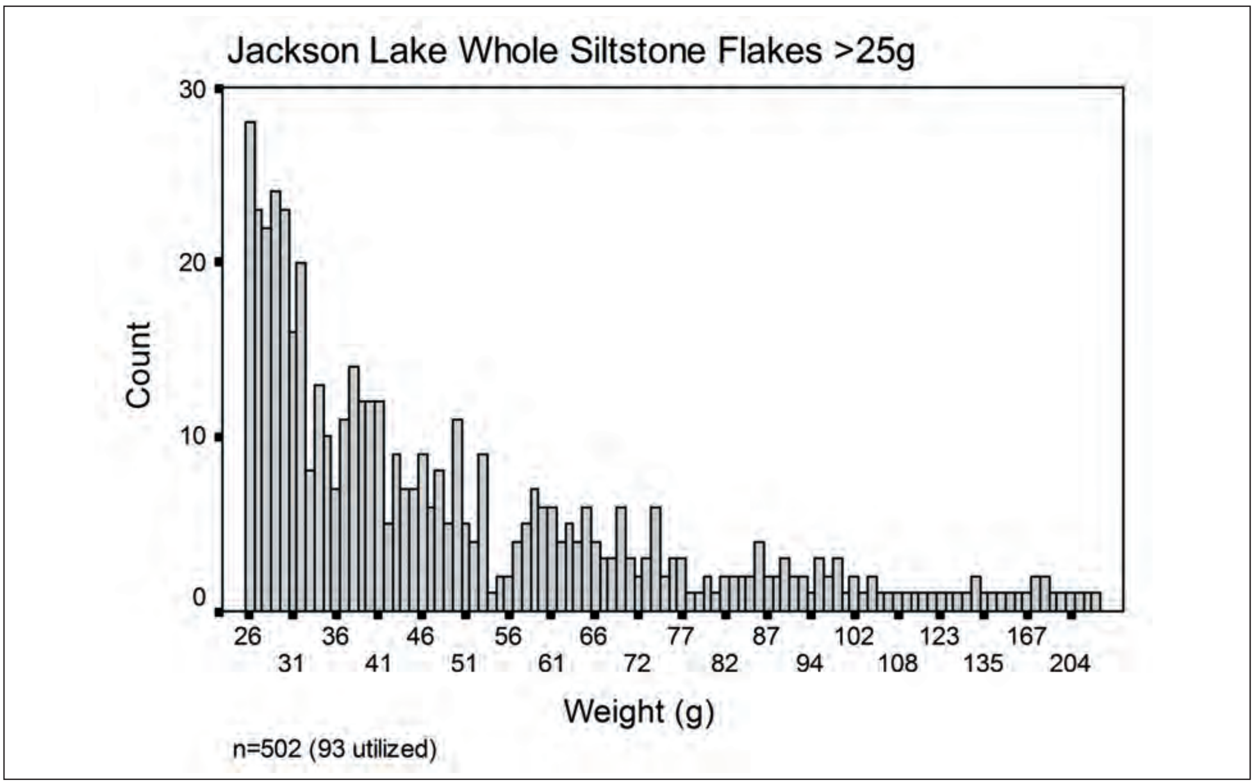


Figure 19.12 [a–c]. Whole siltstone flakes: b. Breakdown of weights of flakes weighing more than 25 g.

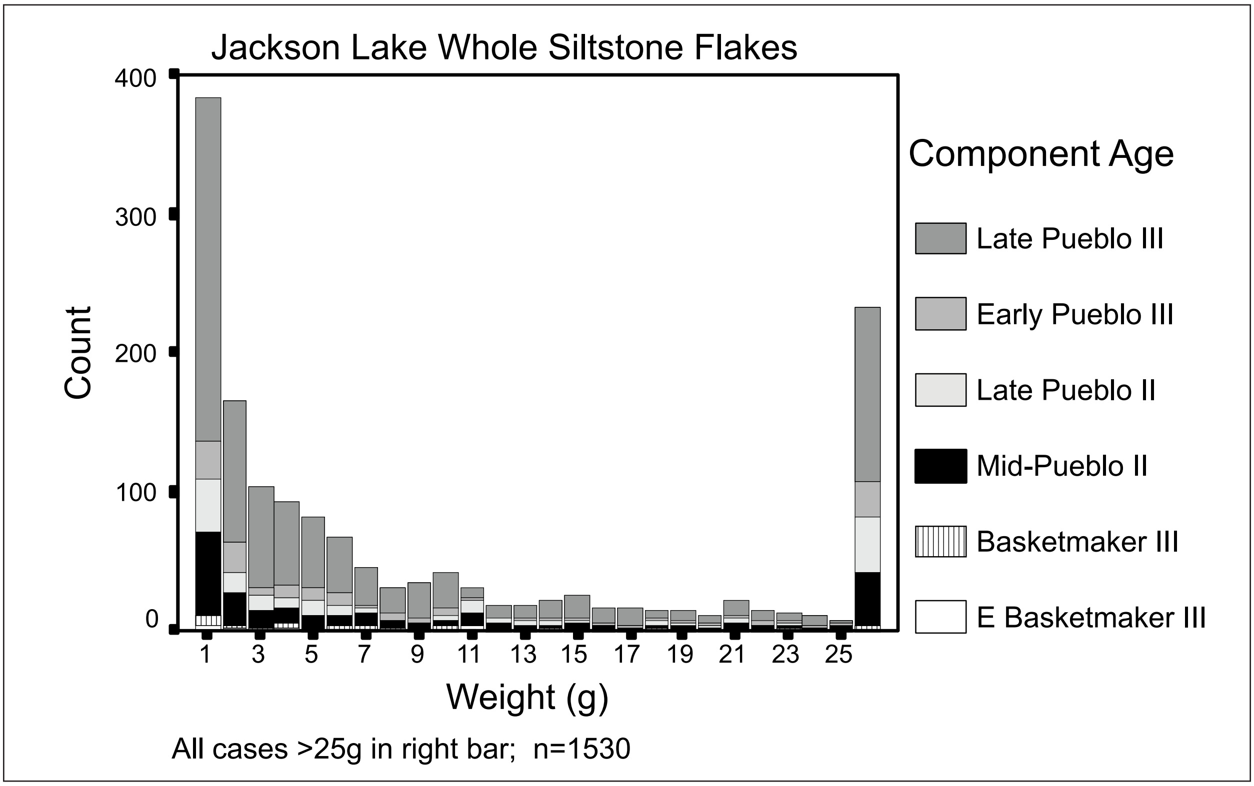


Figure 19.12 [a–c]. Whole siltstone flakes: c. weights showing temporal distribution; the distribution is very similar to a., but only artifacts from well-dated proveniences are shown.

predominantly debitage, a few utilized pieces, and a significant number of hammerstones. Because of its finer, aphanitic texture, rhyolite is probably more easily controlled in flaking and saw more use and retouch than the andesites and diorites.

As noted under siltstone, some counts from sites in the valley show substantial quantities of basalt (Vierra 1993a:185–188; Lancaster 1983:18). Although this identification cannot be refuted without reexamination of the material, it is quite likely that this material is black siltstone rather than basalt, though Moore (1988a:1072, 1083) identifies both basalt and siltstone from some periods at the La Plata Mine project.

Nonlocal Materials

With the variety of appearance of lithic materials, there are two problems in identifying exotic materials: failure to recognize nonlocal materials that look like some local variety, and, conversely, identifying a piece as a nonlocal type that is really just an uncommon variant of a local material. The lithic material type catalogue assembled by Helene Warren and used widely in lithic analysis in New Mexico and as a basis for material identification for the Jackson Lake materials includes many types with associated place names (Table 19.4). Selecting those names from the list that are putatively not local to the La Plata Valley and using those identified as not local to Chaco Canyon (Cameron 1997), there are only 133 items that have been identified as nonlocal out of the sample of 27,000 (Tables 19.20, 19.21). All of the obsidian is from the Jemez Mountains; there are only five pieces, all from LA 37592. Two varieties of silicified wood thought to derive from the Chinle Formation are relatively abundant and are probably not local, although these materials may also occur as reworked deposits in the Ojo Alamo and Nacimiento Formations, which are local (Love 1997a:626–628). We can be reasonably confident that materials identified as Narbona Pass chert are nonlocal; there are 26 pieces identified as such and another 5 as similar, possibly from that source (counted here as Narbona Pass). After Narbona Pass chert, the most common nonlocal material is Brushy Basin chert from the widespread Morrison Formation. Other possibly

Table 19.20. Exotic chipped stone material types, counts by site.

	LA Number										Total
	37591	37592	37593	37594	37595	37598	60744	60749	60751	60753	
Pedernal	–	–	–	–	2	–	–	–	–	–	**2**
Narbona	–	15	9	3	1	3	–	1	1	1	**34**
Brushy Basin	1	8	6	–	5	–	1	–	–	–	**21**
Zuni Cherts	–	3	–	–	–	2	–	–	–	–	**5**
Laguna, Waldo Cherts	–	2	–	–	–	–	2	–	–	–	**4**
Chinle Woods	–	20	13	8	5	14	–	–	2	–	**62**
Obsidian	–	5	–	–	–	–	–	–	–	–	**5**
Total exotics	**1**	**53**	**28**	**11**	**13**	**19**	**3**	**1**	**3**	**1**	**133**
Exotic percents	**0.8**	**39.8**	**21.1**	**8.3**	**9.8**	**6.8**	**2.3**	**0.8**	**2.3**	**0.8**	**92.8**
Total samples	**1755**	**14,049**	**3137**	**2985**	**1556**	**2126**	**502**	**567**	**544**	**196**	**27,417**
Total percents	**6.4**	**51.2**	**11.4**	**10.9**	**5.7**	**7.8**	**1.8**	**2.1**	**2.0**	**0.7**	**100.0**

No specimens of these materials were recovered from LA 37596, LA 37597, LA 60743, LA 60745, or LA 60747.

nonlocal materials occur in very low frequencies and include provenances such as Waldo, south of Santa Fe; Laguna, south of Chaco; and even Flint Ridge, Ohio, all of which seem only remotely possible as actual sources.

Most of the nonlocal materials occur as core flakes, and the distribution by form is surprisingly close to the overall distribution of morphologies, although there is a greater tendency to have visible use or alteration (Table 19.21). The six exotic material projectile points, though again a small number, are more than would be expected on the basis of projectile point distribution within all materials (Fig. 19.13 [a–c]. Use of Narbona Pass chert is especially high in the Jackson Lake collection: 64.5 percent were used in some way, and four are formal tools. Three projectile points are made from this material, including one from LA 37593 that is an exceptional piece of flintknapping—long and delicate, with very fine flaking (43 mm long, 11.5 mm wide, 2 mm thick; Fig. 19.13 [b]). Narbona Pass chert seems to have had special significance in Chaco Canyon (Cameron 2001), and items such as the point from LA 37593 may have been especially valued. The paucity of this material in La Plata assemblages, however, suggests several things about the nature of the valley occupants' relationship to Chaco Canyon and the Chuska Valley. Whereas Chaco and the Chuska Valley were tightly linked, as evident from lithics, ceramics, and timber supply, the La Plata Valley was outside all of these bonds. The La Plata was unquestionably part of the big picture, but the material assemblage clearly demonstrates that that picture was a complex one containing many levels of relationship among its parts. It is likely that there was a Totah sphere that maintained contact with Chaco Canyon but operated independently in many ways. Obtaining Narbona Pass chert for the La Plata Valley would not have been physically difficult. Its scarcity suggests that it did not have particular significance for valley residents, or perhaps that its acquisition was controlled. Since it is not entirely absent, it probably did not have the same significance in the La Plata Valley that it did in Chaco. This in turn suggests different sets of values in the two areas, which elaborates the tapestry as we understand it.

Tools and Function

By both count and weight, debitage constitutes the vast majority of the chipped stone assemblage: 95 percent by count, and 47 percent by weight (Table 19.3). Formal tools make up a very small fraction of the total chipped stone assemblage. Eliminating all debitage, cores, and hammerstones leaves only 255 pieces out of 27,000, or less than 1 percent of the total collection.

Material Type and Use

Percentages of material groups that were used display interesting patterning. Including all categories of use, around 10 percent of the three main material categories—chert, siltstone, and quartzite

Table 19.21. Exotic chipped stone material types, counts by reduction morphology.

	Angular Debris	Core Flake	Biface Flake	Tested Cobble	Unidirectional Core	Multidirectional Core	Uniface	Early Stage Biface	Late Stage Biface	Total
Pedernal	–	2	–	–	–	–	–	–	–	**2**
Narbona	2	26	–	–	–	–	1	1	4	**34**
Brushy Basin	4	15	–	–	1	1	–	–	–	**21**
Zuni Cherts	–	5	–	–	–	–	–	–	–	**5**
Laguna, Waldo Cherts	–	4	–	–	–	–	–	–	–	**4**
Chinle Woods	14	42	1	1	1	1	–	1	1	**62**
Obsidian	–	1	1	–	–	–	–	–	3	**5**
Total exotic	**20**	**95**	**2**	**1**	**2**	**2**	**1**	**2**	**8**	**133**
Percent of exotic	**15.0**	**71.4**	**1.5**	**0.8**	**1.5**	**1.5**	**0.8**	**1.5**	**6.0**	**100.0**
Whole sample counts	**3423**	**22,618**	**36**	**161**	**263**	**562**	**6**	**24**	**73**	**27,166**
Percent of total	**12.3**	**81.4**	**0.1**	**0.6**	**0.9**	**2.0**	**0.0**	**0.1**	**0.3**	**97.7**

Reduction morphologies not present in exotic materials

	Count	Percent of Total Sample
Not Applicable	1	.0
Cobble, chunk	20	.1
Blade	18	.1
Bipolar flake	2	.0
Resharpening flake	19	.1
Hammerstone flake	90	.3
Core	381	1.4
Unidirectional core	263	.9
Pyramidal core	9	.0
Biface	4	.0
Early stage biface	24	.1
Late stage biface	73	.3
Total count	**27,794**	**100.0**

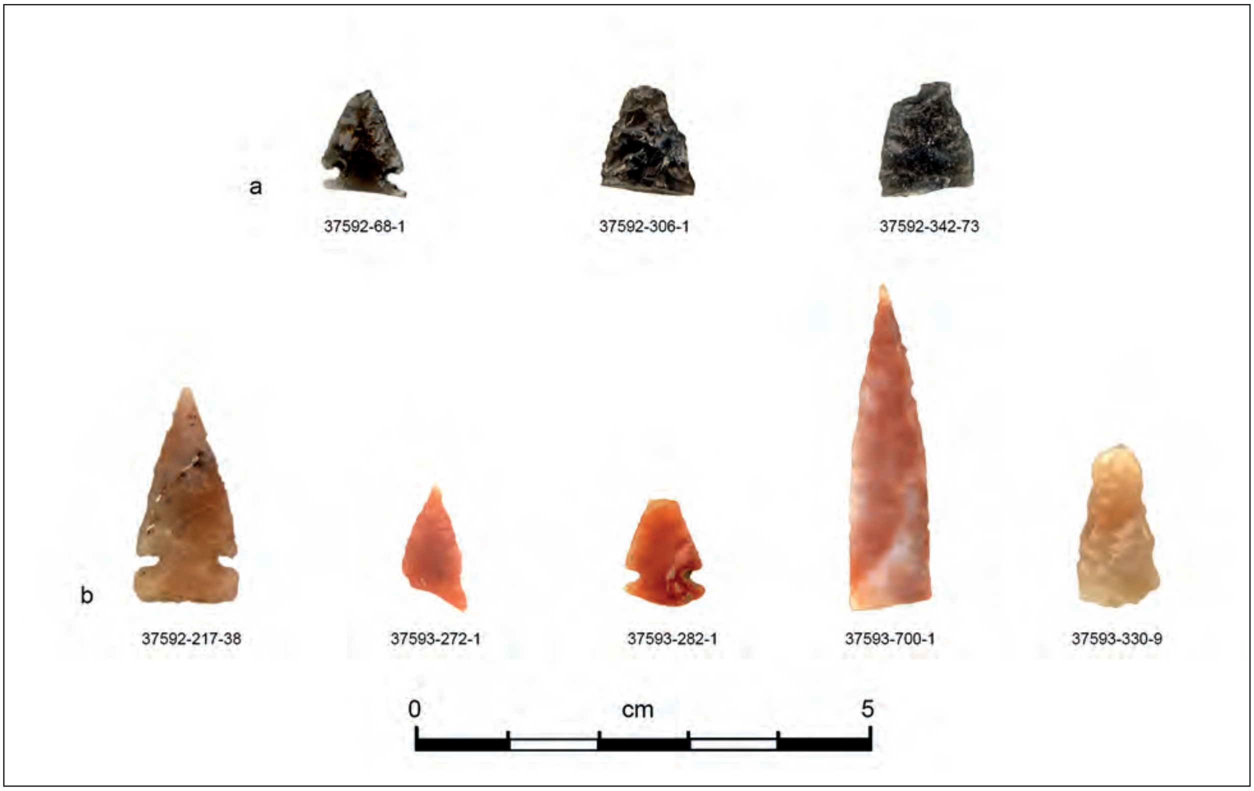


Figure 19.13 [a–b]. Points from exotic material: a. obsidian, LA 37592 (3); b. Narbona Pass chert, LA 37592 (1, left), LA 37593 (3, center), LA 37593 (1, right; drill).

—shows use. Chalcedonies and silicified woods display use at 15 and 20 percent rates, and extraordinary materials such as Narbona Pass chert and obsidian are 40 and 60 percent utilized. The profiles of major material groups across major functional categories are instructive (Figs. 19.14, 19.15; Tables 19.5, 19.7, 19.8, 19.9a, 19.9b, 19.22, 19.23). Debitage and core composition should be similar and are, but the preference for silicified wood for tools and utilization is clear, as is the preference for quartzitic hammerstones, and a tendency to use siltstone for large tools.

A total of 3,469 damaged edges were recorded on 2,978 items. Eighty-five percent of specimens with damaged edges have only one used edge, and of all these tools, only one has five edges recorded, though 450 have two edges. The clear preference for quartzite and siltstone for hammerstones can be seen in the high frequencies of battering on edges of those materials. Likewise, unidirectional wear, probably from scraping and cutting, is more common in cherts, silicified woods, and chalcedonies. Perhaps less predictably, rounding of edges is more common in siltstone and quartzite than in the more siliceous materials (Table 19.19). This could result from the way in which the materials wear, from the types of jobs for which they were used, or both. That is, scarring is more visible on the glassier materials and may have been recorded as facial or retouch rather than rounding. Activities that could cause rounding of edges from these tough materials include processing durable plant materials and hides.

The Jackson Lake coding system assigned tool types based on assessment of wear rather than morphology. Thus, an otherwise unmodified flake with a used edge would be coded as a knife. When the data sets were standardized, the morphology of the tool was controlled through the flake-core-biface variable. Most utilized flakes coded as knives, for example, were placed into the standardized category "utilized or retouched debitage." Examination of such cases showed this to be the correct method, restricting the definition for knife to items characterized by retouch and intentional shaping. The majority of tools are utilized, retouched flakes (Table 19.24).

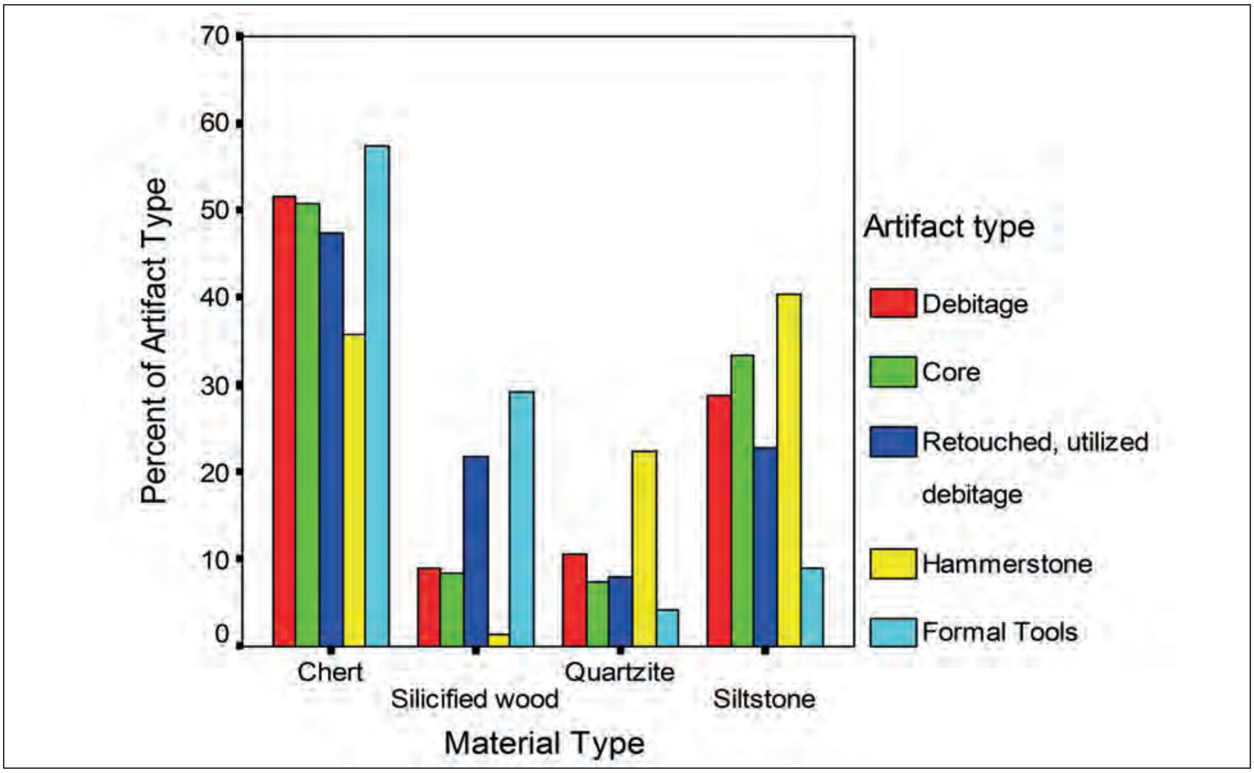


Figure 19.14. Four major lithic materials, percent by artifact-type category (total n = 26,990); all small tools are grouped as "formal," and quartzitic sandstone and quartzite are combined. (Example: 51% of debitage is chert.)

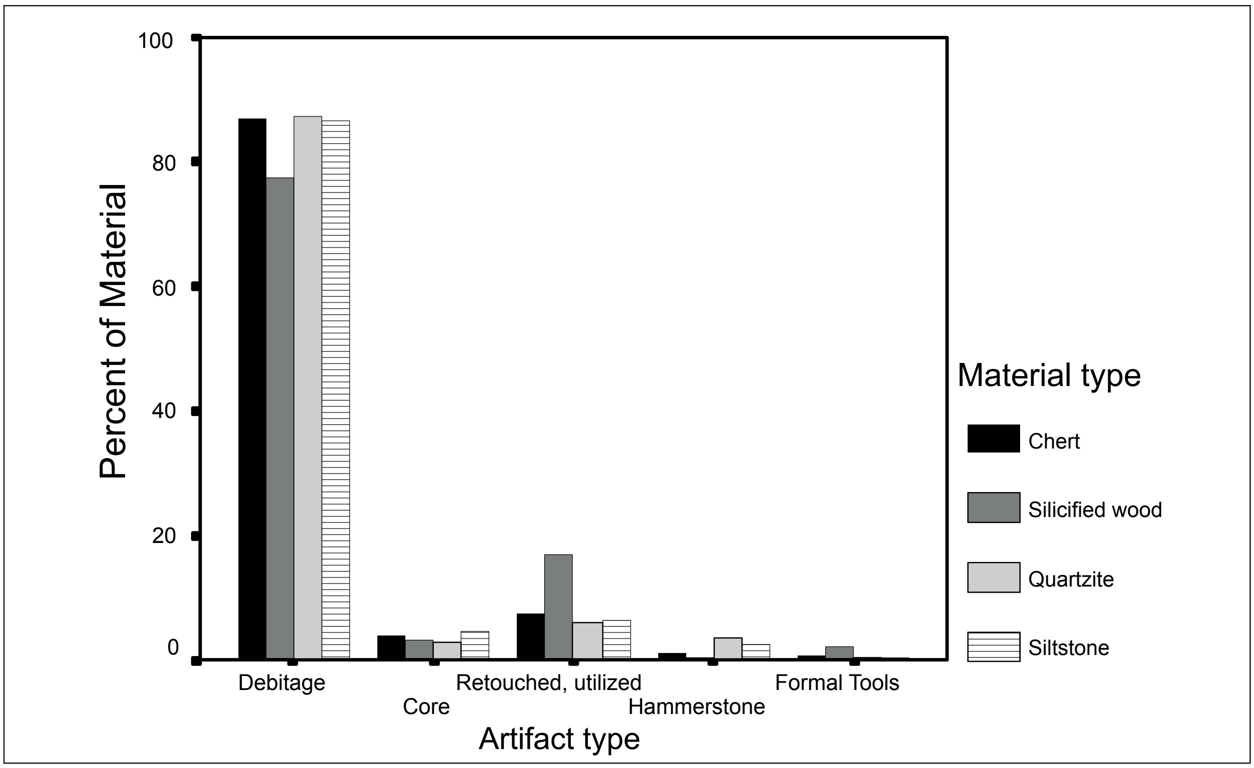


Figure 19.15. Percentages of grouped tool types by largest material-type groups (total n = 26,990); quartzitic sandstone and quartzite are combined. (Example: 87% of chert is debitage.)

Table 19.22. Chipped stone damage and percent of damaged edges by primary material type.

Damage	Chert	Chalcedony	Silicified Wood	Quartzite	Siltstone	Total
Unidirectional	37.9	33.3	43.2	21.2	24.1	**1171**
Bidirectional	7.5	12.5	14.3	4.2	6.3	**289**
Retouch	5.9	15.3	5.9	2.5	3.6	**176**
Rounding	20.2	18.1	18.4	26.9	29.6	**798**
Battering	12	2.8	0.9	31.4	22.6	**490**
Multiple	9.5	11.1	13.3	3.4	4.2	**299**
Other	7	6.9	3.9	9.6	9.4	**242**
Total damaged edges	**1307**	**60**	**528**	**295**	**871**	**2967**
Total piece count	**13,756**	**444**	**2721**	**2808**	**7747**	**27,794**
Total percent	**49.5%**	**1.6%**	**9.8%**	**10.1%**	**27.9%**	**–**
Percent material with damage	**9.5%**	**13.5%**	**19.4%**	**10.5%**	**11.2%**	**10.7%**
Percent of damaged edges	**44.1%**	**2.0%**	**17.8%**	**9.9%**	**29.4%**	**–**

Quartzite combines quartzitic sandstone and quartzite; 35 cases not shown.
Rounding, retouch, and multiple combine several variable states.

Technology and Reduction

The lithic technology of the valley can be described in three words: expedient, expedience, and expediency. The simplicity—or consistency—of the chipped stone industry is evident in the small variety of states that account for most of the assemblage. Ninety-six percent of all items are either core flakes or angular debris. Seventy percent of whole flakes retain at least some cortex (Table 19.10). Of 56 platform and morphology states possible, four account for 93 percent of the whole collection (Tables 19.11, 19.13, 19.25). Only 98 of 28,000 items were recorded as having abraded or prepared platforms, nearly all on flakes, distributed proportionally to overall occurrence across material types. Formalized cores are less than 1 percent of cores that have morphology identified (Table 19.26). Even fewer pieces were coded as "blades," although that code was utilized more often than in the Barker Arroyo analysis. These artifacts are not blades in the strictest sense—items struck from prismatic cores—but rather in the sense of flakes twice as long as wide with parallel edges and a dorsal ridge. To some degree these flakes may be fortuitous, but the term has been retained because of its descriptive value (Fig. 19.16 [d]). The criterion of length twice width is a significant hurdle, and many parallel-sided flakes that initially look like they could be blades are eliminated by this requirement. There is a concentration of this flake form in the trash strata of Pit Structure 1 at LA 37592.

Debitage

In keeping with the expediency of the industry, the vast majority of items in the assemblage is unmodified flakes. Combining utilized and unutilized pieces, chipped stone flakes make up over 90 percent of the Jackson Lake assemblage by count and nearly 50 percent by weight (Table 19.1). Of these, 51.9 percent are whole flakes. This huge category of material ranges from 1 to 420 g, though the majority weigh only 1 g (mean 8 g, median 3 g) (Figs. 19.4, 19.17; Tables 19.6, 19.27).

Whole flakes are the most nearly comparable unit across material types and time periods, since vagaries of depositional context are eliminated by not considering fragments. Clearly, the fragments also have meaning, however, since they contain information on material fracture, types of lithic manufacture, and use. Six categories of flake portion were recorded, from whole to various portions of the flake (such as proximal fragment or distal fragment). Each of the five main material types has a similar profile of flake portion, and over half of each material is represented by whole flakes (from 52.1 percent of quartzite flakes to 61.8 percent of siltstone flakes; see Fig. 19.18 and Table 19.12). Even though the profiles look similar, the count is sufficiently large and the distribution sufficiently different that the five by six contingency table tests as significantly different. As can be seen in Figure 19.18, deviations occur in whole siltstone flakes, medial and distal fragments in silicified wood,

Table 19.23. Use and retouch on utilized flakes by material type, first edge only; counts and percents.

	Chert		Chalcedony		Silicified Wood		Quartzite		Igneous		Siltstone		Other		Total	
	N	Col. %	N	Col. %	N	Col. %	N	Col. %	N	Col. %	N	Col. %	N	Col. %	**N**	**Col. %**
Not applicable	2	0.2%	2	4.3%	1	0.2%	–	–	–	–	3	0.6%	–	–	**8**	**0.4%**
Unidirectional utilization	462	45.6%	20	42.6%	214	46.1%	59	34.5%	5	50.0%	154	31.8%	1	20.0%	**915**	**41.7%**
Bidirectional utilization	88	8.7%	4	8.5%	65	14.0%	11	6.4%	–	–	33	6.8%	–	–	**201**	**9.2%**
Unidirectional retouch	52	5.1%	5	10.6%	17	3.7%	7	4.1%	–	–	21	4.3%	–	–	**102**	**4.6%**
Bidirectional retouch	15	1.5%	1	2.1%	4	0.9%	–	–	–	–	3	0.6%	–	–	**23**	**1.0%**
Rounding	39	3.8%	2	4.3%	16	3.4%	13	7.6%	1	10.0%	49	10.1%	–	–	**120**	**5.5%**
Rounding, unidirectional utilization	121	11.9%	4	8.5%	46	9.9%	31	18.1%	2	20.0%	110	22.7%	2	40.0%	**316**	**14.4%**
Rounding, bidirectional utilization	35	3.5%	–	–	19	4.1%	8	4.7%	–	–	14	2.9%	–	–	**76**	**3.5%**
Rounding, unidirectional retouch	10	1.0%	1	2.1%	2	0.4%	2	1.2%	1	10.0%	4	0.8%	–	–	**20**	**0.9%**
Rounding, bidirectional retouch	3	0.3%	–	–	2	0.4%	–	–	–	–	–	–	–	–	**5**	**0.2%**
Battering	1	0.1%	–	–	1	0.2%	3	1.8%	–	–	6	1.2%	–	–	**11**	**0.5%**
Unidirectional utilization, retouch	98	9.7%	2	4.3%	45	9.7%	7	4.1%	–	–	24	4.9%	–	–	**176**	**8.0%**
Bidirectional utilization, retouch	4	0.4%	1	2.1%	11	2.4%	–	–	–	–	–	–	–	–	**16**	**0.7%**
Other	84	8.3%	5	10.6%	21	4.5%	30	17.5%	1	10.0%	64	13.2%	2	40.0%	**207**	**9.4%**
Total	**1014**	**100.0%**	**47**	**100.0%**	**464**	**100.0%**	**171**	**100.0%**	**10**	**100.0%**	**485**	**100.0%**	**5**	**100.0%**	**2196**	**100.0%**

N = count
Quartzite and quartzitic sandstone, rhyolite and igneous, and other and sandstone combined.

proximal fragments in quartzite, and lateral fragments in quartzitic sandstone.

Considering flakes in 1 g groups (rounded to the nearest gram), 65 percent of all debitage weighs 5 g each or less, and 34.1 percent weighs 1 g, by count. Even among whole flakes, artifacts weighing 1 g are far more numerous than any other 1 g group (28.4 percent of the count weigh 1 g). Whole flakes are somewhat more evenly spread among smaller weights, but the distribution is very similar to the distribution of all flakes. There are 154 flakes that weigh more than 100 g (78 whole flakes), and 90 percent of all flakes weigh 21 g or less. In both whole and all flakes, there is nearly monotonic decline of frequency by weight—that is, the higher the weight class, the fewer items, with no important exceptions (Figs. 19.5, 19.6 [a–c], 19.7, 19.8, 19.12 [a–c], 19.19 [a–c]). By weight whole flakes are more evenly spread among lower weight groups: 52 percent by weight weigh 25 g or less. Pieces weighing 1 g are so abundant that that group accounts for the largest percentage of any group (2.9 percent).

Utilized Flakes

As a group, whole utilized flakes are considerably larger than whole unutilized debitage: the average weight for utilized flakes is 16 g, compared to 9 g for unutilized (medians are 8.5 and 3 g, respectively; Tables 19.18, 19.27). Vierra (1993b:206) found utilized flakes to be larger in the Enron samples, as well. As with unutilized flakes, size relates to material: quartzites and siltstones run much larger than cryptocrystalline materials (Tables 19.6, 19.18). The total number of utilized flakes is 2,191, with a mean weight of 15.6 g; the mean weight of the 1,386 whole utilized flakes is 15.9 g. This similarity in mean weight suggests that size was a more important criterion in selection for use.

Chalcedony and especially silicified wood show higher percentages of utilized items than do the other materials. Some of this greater frequency probably results from the greater visibility of use on these glassier materials, but some must also relate to their greater workability. Although intuitively one might expect chert to have been used in frequencies similar to chalcedony and silicified wood, it in fact shows a utilization percentage similar to those of quartzite and siltstone (Tables 19.16–19.19, 19.22, 19.23). Perhaps this can be explained by the similar availability of chert, siltstone, and quartzite,

Table 19.24. Breakdown of functions assigned by original analysis within utilized cores and flakes; counts and percents.

	Utilized Debitage		Utilized Core		Bifacial		Total	
	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %
Shaver	1194	54.4%	26	24.1%	3	18.8%	**1223**	**52.8%**
Knife	310	14.1%	9	8.3%	5	31.3%	**324**	**14.0%**
Burin	2	0.1%	–	–	–	–	**2**	**0.1%**
Indeterminate tool	17	0.8%	–	–	1	6.3%	**18**	**0.8%**
Scraper	627	28.6%	73	67.6%	4	25.0%	**704**	**30.4%**
Indeterminate, retouched	43	2.0%	–	–	3	18.8%	**46**	**2.0%**
Total	**2193**	**100.0%**	**108**	**100.0%**	**16**	**100.0%**	**2317**	**100.0%**

and/or to greater amounts of waste due to defects in raw material. If it were necessary to transport chalcedony and silicified wood some distance, core testing and initial reduction probably took place at the source, resulting in greater percentages of utilized flakes at the sites that were the loci of use.

The Jackson Lake analysis included some use and retouch attributes not recorded for Barker Arroyo and hence not in the standardized database. Both the number of utilized edges and the number of retouched edges give an idea of the extent of use on individual items (Table 19.28). Among core flakes only, 90 percent show neither use nor retouch, while only 1.6 percent have both use and retouch, and only 0.4 percent have multiple used and retouched edges (see core flakes in Table 19.28).

Within the context of small counts, the numbers of utilized items vary dramatically by site. At LA 37594, for example, 16 items of a total sample of 2,986 (0.5 percent) have at least two used and retouched edges, while at LA 37595 there is only one from a sample of 1,556 (0.06 percent). The greater relative frequency of used edges at LA 37594 may stem from the fact that more surface room area was excavated at this site than at other Jackson Lake sites. Formal tools, on the other hand, are few at 37594: midden deposits seem to produce far more formal tools than do probable use contexts.

Tasks

Although the processes of obtaining material and working it to produce implements are important and archaeologically observable, the most important aspect of chipped stone is how it was used. Especially given the expedient nature of the majority of the artifacts, ascertaining function is highly inferential—and frustrating! The standardized analysis refrained from functional labels, but the original analysis implied functional assignments through the use of tool type names for utilized debitage. Four-fifths of the functions assigned involved shaving or scraping, closely related activities differentiated by the steepness of the tool edge and a tendency for use-retouch to be on one face (Table 19.24). Cutting, or "knife," is 14 percent of flake use and 10 percent overall. The same functions were assigned to utilized cores, but with more identified as scrapers. There is a small group of artifacts coded as denticulates, applied here to tools with exaggerated serration through chipping notches into an edge (Figs. 19.10, 19.18). This artifact class has an unusual distribution across sites in that there is only one recorded from the large LA 37592 sample, but four from LA 37593 and five from the small LA 37595 sample, which also stands apart in the occurrence of notches and scarcity of formal tools.

The types of wear reflect these vague functional assignments. Cutting results in rounding or dulling of the edge, and when use-retouch is present, it is bifacial, on acute edges. Tougher, less glassy materials such as quartzite and siltstone are more likely to exhibit wear as rounding than as use-retouch flakes, which indicate the direction of use. Perforating and scoring were effected by projections from pieces of chipped stone, subdivided into drills and gravers. These implements range from extremely rare formal drills—none were found at Jackson Lake sites—to expedient projections from flakes (Fig. 19.20a [a]) to constricted tips of projectile points (Fig. 19.20a [b]). Drills and gravers tend to be on chert and silicified wood (90 out of 109 Jackson cases; Table 19.8), since manufacture of a small sharp point is more feasible on these more controllable materials. Unfortunately, all but two of these objects are in fill contexts, giving

Table 19.25. Reduction morphology of whole flakes by platform type; counts and percents.

Platform Type	Core Flake		Biface Flake		Blade		Bipolar Flake		Resharpening Flake		Hammerstone Flake		Ground Stone Tool Flake		Total	
	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %
Cortical	4459	34.2%	1	5.9%	6	46.2%	1	50.0%	1	14.3%	14	20.9%	181	47.5%	**4663**	**34.5%**
Single facet	5732	43.9%	2	11.8%	4	30.8%	1	50.0%	–	–	21	31.3%	118	31.0%	**5878**	**43.4%**
Multifacet	1025	7.9%	8	47.1%	–	–	–	–	1	14.3%	16	23.9%	32	8.4%	**1082**	**8.0%**
Retouched	6	0.0%	3	17.6%	–	–	–	–	2	28.6%	1	1.5%	2	0.5%	**14**	**0.1%**
Collapsed/crushed	1411	10.8%	1	5.9%	3	23.1%	–	–	1	14.3%	14	20.9%	38	10.0%	**1468**	**10.8%**
Absent	265	2.0%	2	11.8%	–	–	–	–	2	28.6%	–	–	7	1.8%	**276**	**2.0%**
Modified	1	0.0%	–	–	–	–	–	–	–	–	–	–	2	0.5%	**3**	**0.0%**
Other	145	1.1%	–	–	–	–	–	–	–	–	1	1.5%	1	0.3%	**147**	**1.1%**
Total	**13,044**	**100.0%**	**17**	**100.0%**	**13**	**100.0%**	**2**	**100.0%**	**7**	**100.0%**	**67**	**100.0%**	**381**	**100.0%**	**13,531**	**100.0%**

little indication of location or type of use. Pounding to shape masonry and tools was performed with a wide variety of implement sizes, as discussed below.

The tool type "notch" was coded as the primary tool type for 62 items, 32 of which were whole, and as a secondary function on 6 more. The majority of these tools are chert (55 percent), with substantial numbers of siltstone and silicified wood, as well (Tables 19.9a, 19.9b). These tools are largely unmodified flakes with a concave curved edge that shows some use. Presumably they would have been useful for smoothing shafts; most of the notches seem of a size more useful for items the size of digging sticks rather than arrow shafts, but they could have served for either (Fig. 19.16 [a]). Though there are a few larger specimens, most are of a size (13 g) that could be held easily with the thumb and first two fingers (Table 19.27).

Uses of chipped stone for weapons and in symbolic contexts—categories that are likely to have considerable overlap—were probably principally formal tools, including projectile points, knives, axes, and tchamahias. Projectile points and their association with war and hunting today have connotations of power. There are only a few suggestive contexts in the Jackson Lake assemblage; Floor 2 of Room 103 at LA 37593 has an unusual assemblage of materials, including a nonlocal bowl; turquoise and azurite; a quartzite knife; and several projectile points, one of which is a basally notched style unique in the project collections (Fig. 19.20b [g]), and another, an elegant Narbona Pass specimen (Fig. 19.13 [b]). In the same room, an effigy vessel was found below a subfloor corrugated pot, further setting the assemblage apart. Combined with some tantalizing suggestions of unusual features in the adjacent room outside the right-of-way, this group of tools seems likely to have had some ritual use.

The floor assemblage of Pit Structure 1, LA 60751, is discussed further below. The presence of points from four different styles spanning hundreds of years—Jay, Armijo, En Medio, and early Pueblo corner-notched—shows at the least an appreciation there for stylistic variation, and suggests objects with symbolic importance (Fig. 19.20b [a–d]).

In examining chipped stone from floor and floor fill contexts, items with use or function identified were recovered mainly from pit structures, with just a few from extramural contexts and one assemblage from a surface room. With one exception, chipped

Table 19.26. Use of cores (including hammerstones) with reduction morphology coded as core; counts and percents.

	Undifferentiated Core		Tested Cobble		Unidirectional Core		Bidirectional Core		Multidirectional Core		Pyramidal Core		Total	
Edge Damage	**Count**	**Col. %**	**Count**	**Col. %**	**Count**	**Col. %**	**Count**	**Col. %**	**Count**	**Col. %**	**Count**	**Col. %**	**Count**	**Col. %**
Undirectional, utilized	9	6.2%	2	3.5%	6	10.2%	2	7.4%	22	11.5%	–	–	**41**	**8.5%**
Bidirectional, utilized	1	0.7%	–	–	2	3.4%	–	–	2	1.0%	–	–	**5**	**1.0%**
Unidirectional, retouched	1	0.7%	1	1.8%	–	–	–	–	1	0.5%	–	–	**3**	**0.6%**
Bidirectional, retouched	–	–	–	–	–	–	–	–	1	0.5%	–	–	**1**	**0.2%**
Rounding	2	1.4%	1	1.8%	–	–	1	3.7%	5	2.6%	–	–	**9**	**1.9%**
Rounding + unidirectional, utilized	10	6.9%	5	8.8%	6	10.2%	4	14.8%	14	7.3%	–	–	**39**	**8.1%**
Rounding + bidirectional, utilized	1	0.7%	–	–	2	3.4%	–	–	–	–	–	–	**3**	**0.6%**
Rounding + unidirectional, retouched	–	–	–	–	–	–	–	–	1	0.5%	–	–	**1**	**0.2%**
Rounding + bidirectional, retouched	–	–	–	–	1	1.7%	–	–	–	–	–	–	**1**	**0.2%**
Battering	112	77.2%	42	73.7%	38	64.4%	18	66.7%	139	72.4%	–	–	**349**	**72.6%**
Unidirectional, utilized + retouched	4	2.8%	3	5.3%	2	3.4%	1	3.7%	3	1.6%	1	100.0%	**14**	**2.9%**
Bidirectional, utilized + retouched	–	–	–	–	1	1.7%	–	–	–	–	–	–	**1**	**0.2%**
Other	5	3.4%	3	5.3%	1	1.7%	1	3.7%	4	2.1%	–	–	**14**	**2.9%**
Total	**145**	**100.0%**	**57**	**100.0%**	**59**	**100.0%**	**27**	**100.0%**	**192**	**100.0%**	**1**	**100.0%**	**481**	**100.0%**

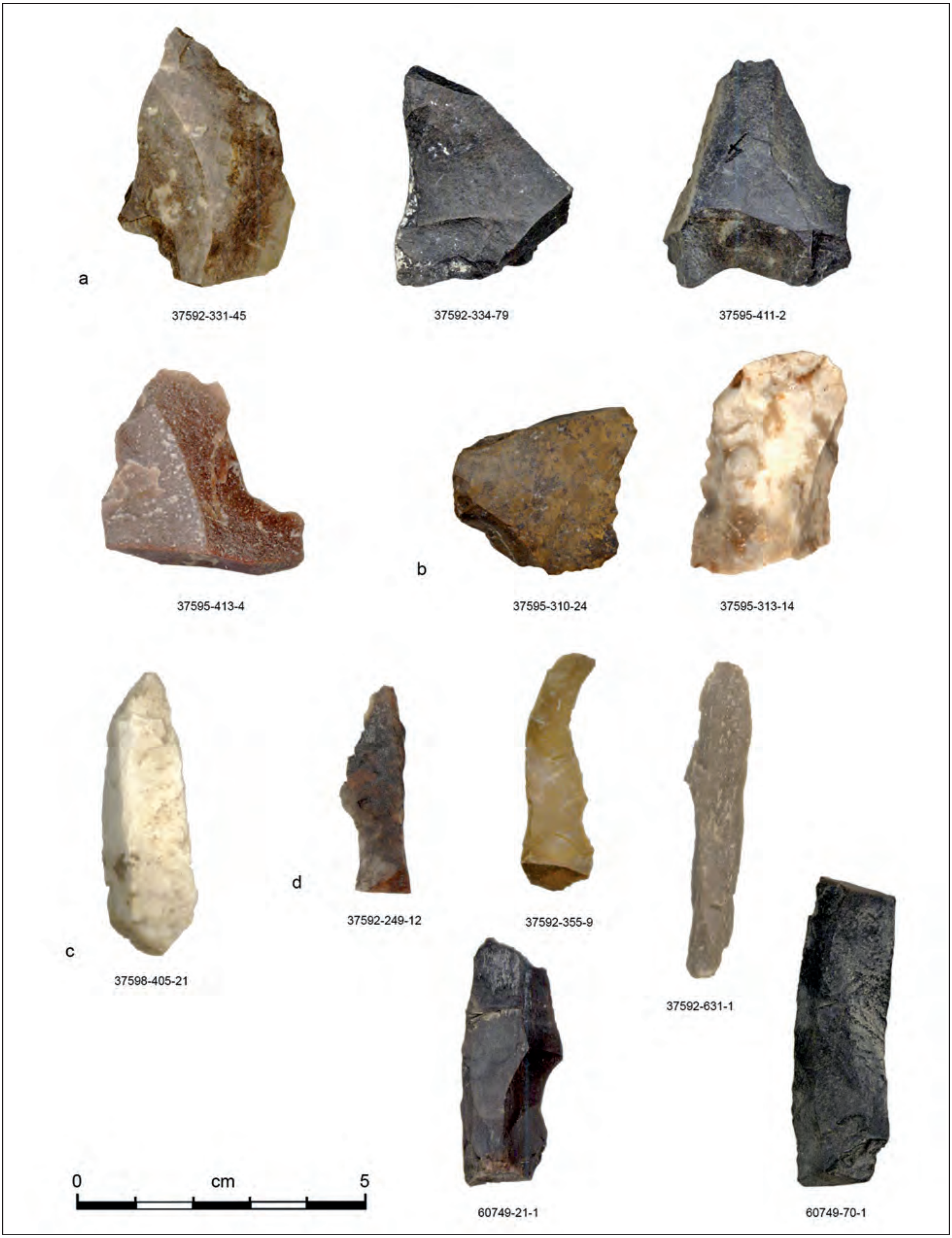


Figure 19.16 [a–d]. Other tool types: a., b. notches, LA 37592 (2; top left and center), LA 37595 (2; top right and middle row left); b. denticulates, LA 37595 (2; middle row center and right); c. bifacial use, LA 37598 (1; third row left); d. "blades," LA 37592 (3; third row right), LA 60749 (2; bottom right).

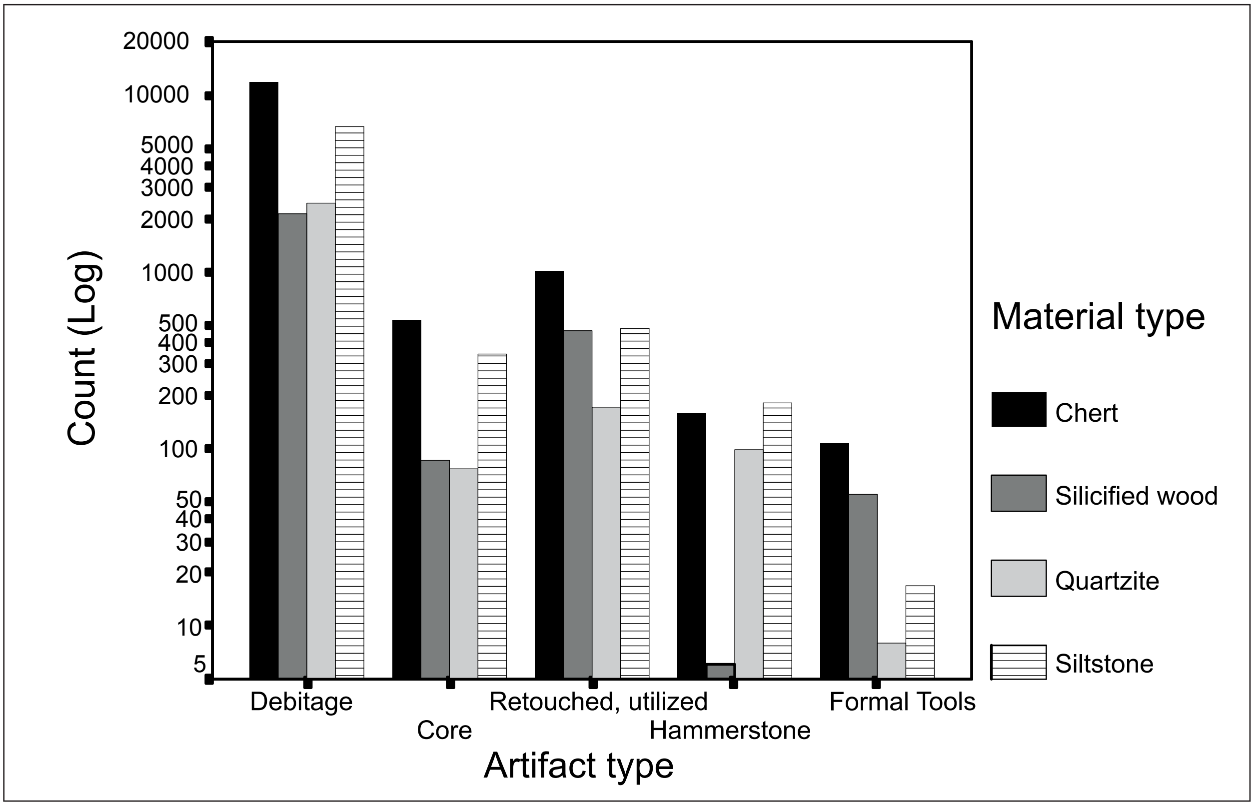


Figure 19.17. Counts of grouped tool types by major material type; logarithmic shows distributions in small formal tool and hammerstone samples. (Example: there are 11,941 chert flakes and 6 silicified wood hammerstones.)

Table 19.27. Chipped stone tool types (all), average weights (g) and counts by type.

Artifact Type	Mean	Count	Standard Deviation	Median	Minimum	Maximum
Debitage	7.96	23761	15.763	3	1	420
Core	120.5	949	157.034	75	1	2270
Uniface	15.17	6	23.198	3.5	1	60
Biface	4.71	7	4.424	3	1	13
Utilized debitage	15.58	2191	26.472	7	1	398
Utilized core	93.6	108	95.086	65.5	1	555
Drill	5.86	29	10.298	3	1	55
Graver	9.78	9	15.904	4	1	51
Notch	22.19	62	37.39	13	1	267
Denticulate	14.38	13	10.202	11	3	32
Bifacial knife, scraper	11.31	16	20.587	4	1	76
Projectile point	2.22	74	3.539	1	1	19
Hammerstone	298.13	358	234.657	239	93	2450
Hammerstone flake	37.35	167	42.915	26	1	431
Chopper, plane	221.41	41	172.34	197	1	693
Axe	499	1	–	499	499	499
Hoe	735	2	397.394	735	454	1016
Total	**17.06**	**27,794**	**59.169**	**3**	**1**	**2450**

Hammerstone cases less than 90 g and all cases with reduction morphology of hammerstone are placed in hammerstone flake artifact type.

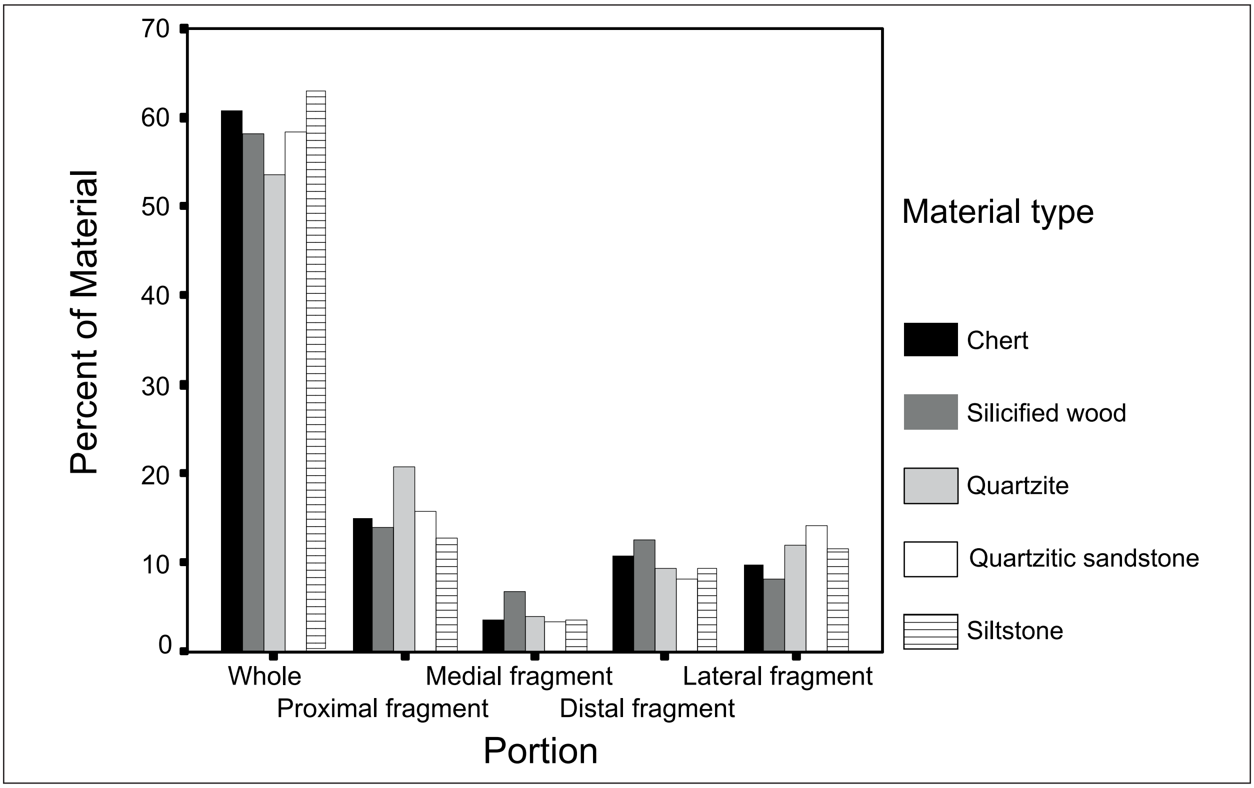


Figure 19.18. Percents of flake portions in major material groups (total n = 21,663); counts available in Table 19.12.

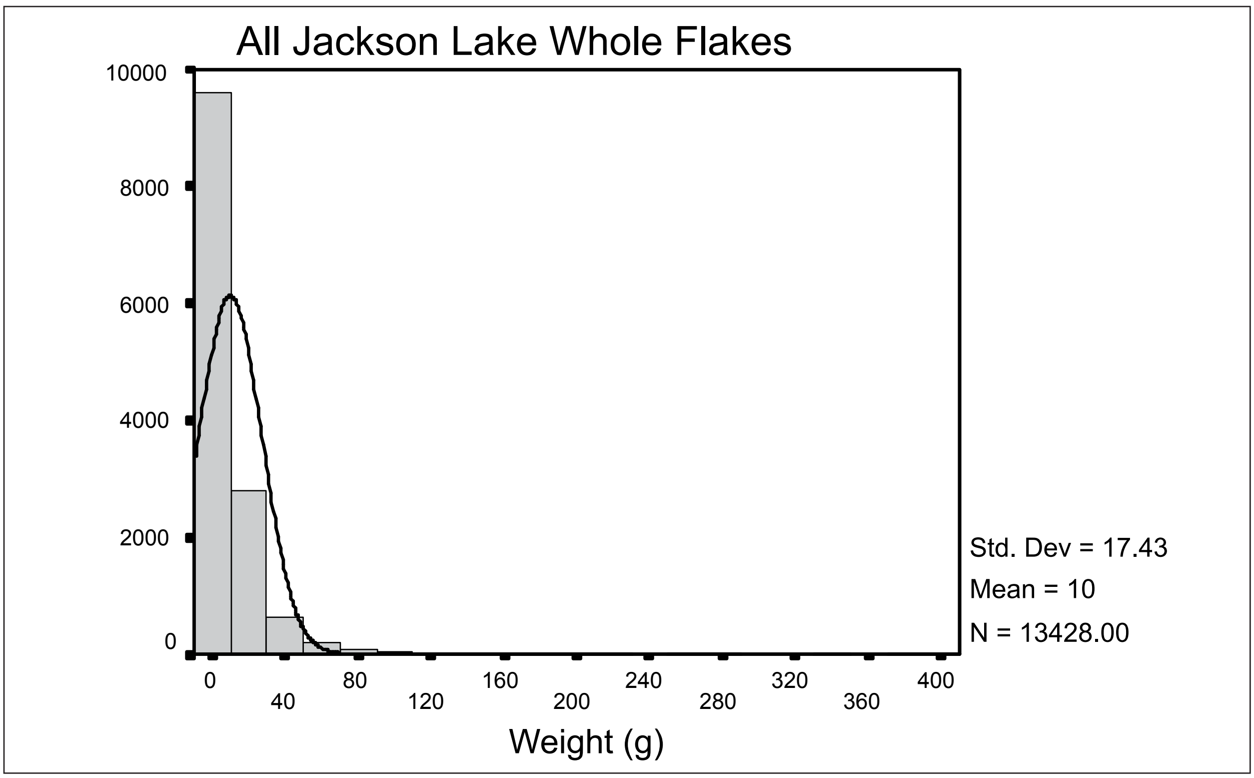


Figure 19.19 [a–c]. Breakdowns of whole flake weights of all materials: a. all flakes.

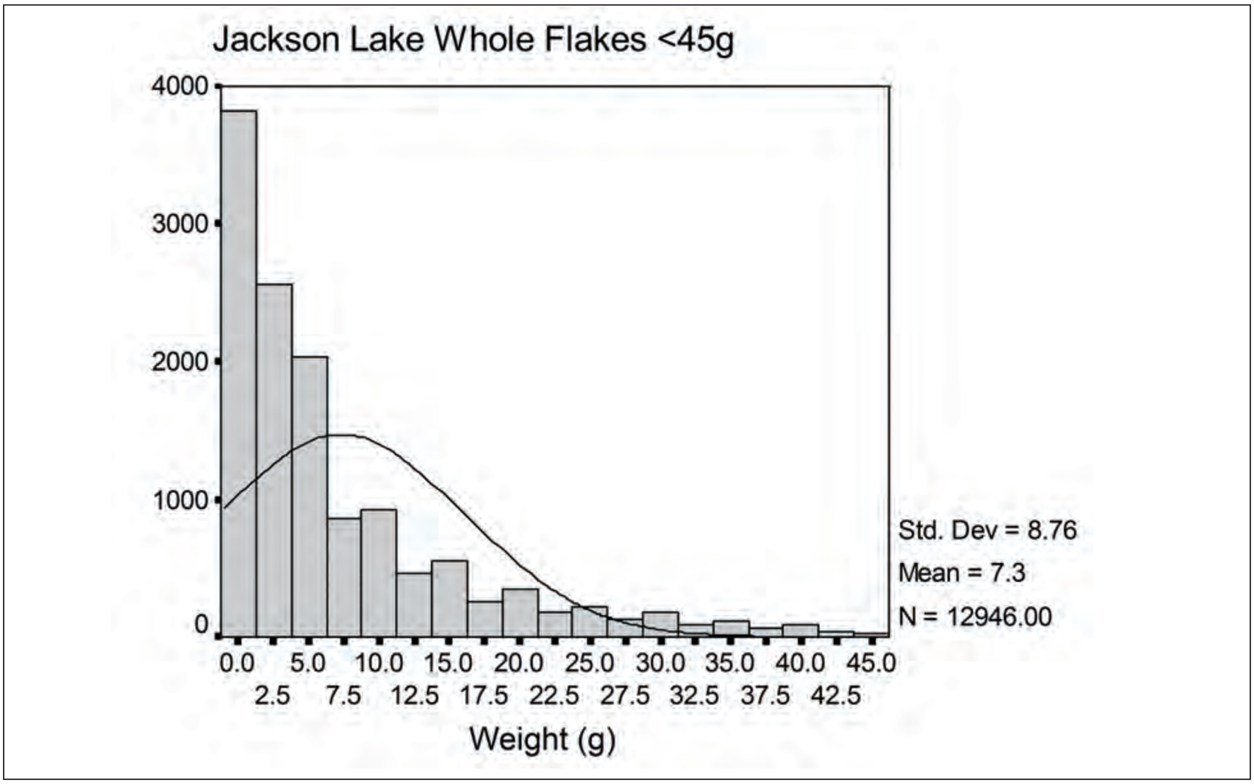


Figure 19.19 [a–c].Breakdowns of whole flake weights of all materials: b. flakes 45 grams or less.

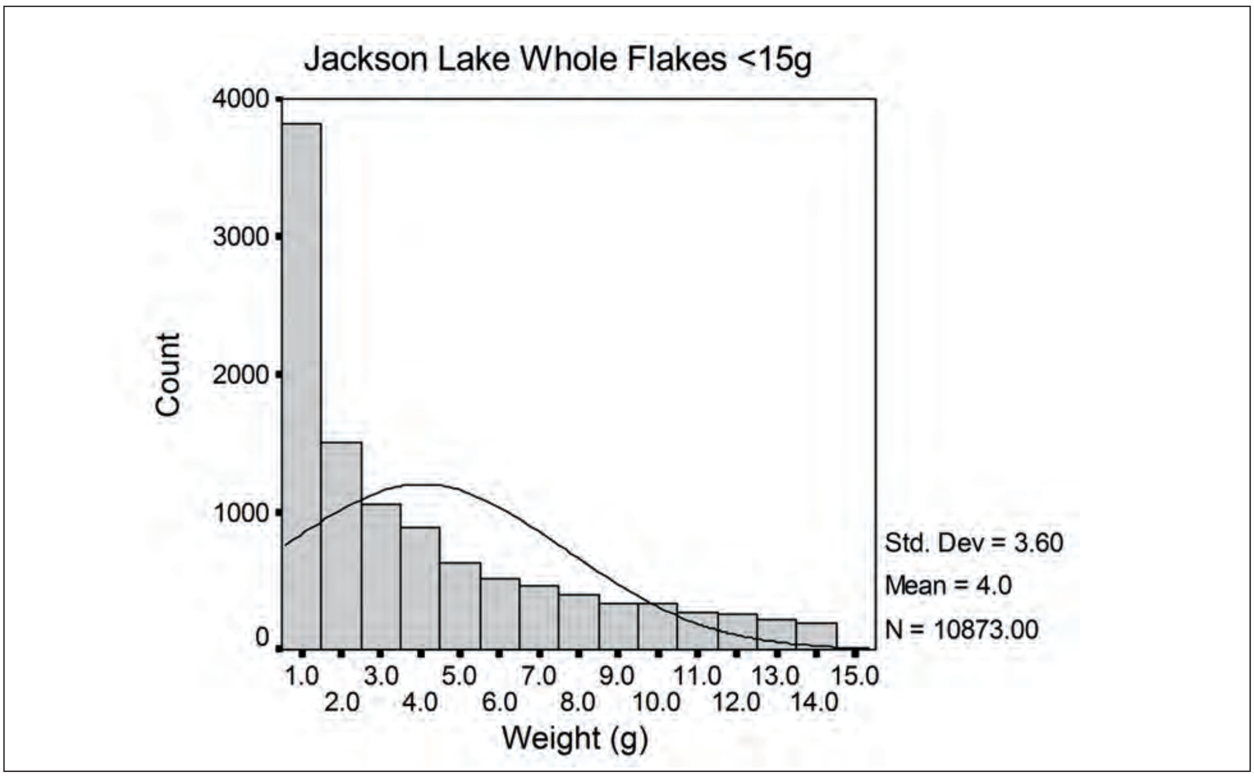


Figure 19.19 [a–c].Breakdowns of whole flake weights of all materials: c. flakes 15 grams or less.

Table 19.28. Edge retouch, counts by flake type and number of edges utilized.

All Forms - Number of Retouched Edges						
	0	1	2	3	4	Total
Number of Utilized Edges						
0	24,778	135	27	3	–	**24,943**
1	2038	377	10	–	–	**2425**
2	253	50	51	1	1	**356**
3	36	10	7	2	–	**55**
4	10	3	1	–	–	**14**
5	1	–	–	–	–	**1**
	27,116	575	96	6	1	**27,794**
All Core Flakes - Number of Retouched Edges						
	0	1	2	3	4	Total
Number of Utilized Edges						
0	19,354	93	9	1	–	**19,457**
1	1410	256	5	–	–	**1671**
2	177	37	32	–	1	**247**
3	22	6	6	2	–	**36**
4	6	3	1	–	–	**10**
	20,969	395	53	3	1	**21,421**
Whole Core Flakes - Number of Retouched Edges						
	0	1	2	3	–	Total
Number of Utilized Edges						
0	11,681	51	6	–	–	**11,738**
1	983	156	4	–	–	**1143**
2	124	22	19	–	–	**165**
3	16	3	5	1	–	**25**
4	4	2	1	–	–	**7**
	12,808	234	35	1	–	**13,078**

stone from presumed use contexts in rooms is in the form of debitage. Granted, the chipped stone from room floors is limited in the Jackson Lake sample, but this occurrence does suggest less stone tool use in the rooms (Table 19.29). There is a strong association between hammerstones and debitage on the floor of the mealing room, Pit Structure 2 at LA 37595; two utilized flakes are also present in this context.

Formal Tools

Among the mass of expedient tools there is a small and refreshingly recognizable group of formal tools. The majority of these are projectile points, which are accompanied by a few examples of knives and drills.

The category "projectile points" covers a great deal of variability—from barely retouched flakes to exquisitely worked symmetrical tools, and from tiny points to large, early styles over 10 cm long. Since the majority of points come from Pueblo II–III contexts, the stylistic variability is not great within the points, although there are variations on base shape and notching in addition to the variation in execution.

The term "knife" has been reserved for large bifacially worked tools. Using this term in this way (rather than, "If it cut something, it's a knife," as in the original analysis) means that only four knives are present in the Jackson assemblage (Fig. 19.10 [a–d]). Two of these tools are yellow-brown silicified wood, and two are quartzite. As noted, the workmanship on the silicified wood specimens is far more careful than it is on the majority of tools from this material, and the same can be said of the quartzite knives. This careful workmanship not only shows what is possible with these materials, but suggests a special connotation for this class of tool. Unfortunately, context of recovery does not suggest what the use or significance might have been: three are from midden contexts, though the fine example from Room 103, LA 37593, is associated with other remarkable tools.

"Drills" are also considered here to be formally shaped tools consisting of a pointed shaft with various types of base. Although there are 56 artifacts that have projections classified as drills or gravers, there are only three pieces of fully retouched drill shafts (Fig. 19.20a [a]). As is true of 11 points from Jackson Lake, the tips of projectile points are sometimes constricted, probably to make a hafted drill (Fig. 19.20a [c]). The occurrence of this type of tool is especially high at LA 37592, again from its midden; this occurrence may relate to the relatively large amount of red-dog shale debris at this site, further suggesting ornament production. Many projectile points have a constricted tip, some of which do not have rotary wear or rounding, suggesting that such tips may also have helped penetration.

Projectile point form is discussed further in the chronological trends section, below.

Cores

Cores are defined in the lithic analysis manual

Figure 19.20a [a–c]. Drills: a. retouched drill shafts, LA 37593 (2; top left), LA 37595 (1; top center); b. utilized flake with drill point, LA37592 (1; top right); c. projectile points with drill tips, LA 37591 (1; bottom far left), LA 37592 (3; bottom center), LA 37598 (1; bottom right).

as items lacking a bulb of percussion and having at least three negative flake scars. This definition allows for some very small objects to be called cores—too small, it would seem, to produce flakes of usable sizes (Fig. 19.21; Table 19.30). Items lacking bulbs of percussion below some size are probably "angular debris" rather than cores (J. L. Moore, personal communication, 1999). That is, they are pieces of worked stone (hence the negative flake scars) but were not the source of flakes for use or further modification. Angular debris was a form recorded for 12 percent of Jackson Lake materials. The same recording system documented 77 percent debitage. Angular debris was also recorded in the Barker Arroyo analysis, but clearly under different criteriaC there, debris was 4 percent of the sample, and core flakes were 85 percent. The concurrence of 89 percent indicates that technology and analysis were the same, but that the definition and use of "angular debris" differed. The extent to which this is due to actual differences as opposed to changes in recording procedure is unknown.

There is overlap between two analytical categories, cores and hammerstones, since many cores were used as hammerstones. The category "utilized core" does not include hammerstone use, only other types of edge use. Among hammerstones, however, there are 204 items whose reduction morphology is one of three core types. Combining the two groups raises the total number of cores to 1,430, of which 481 (34 percent) are utilized. In this group most of the utilization is battering (Table 19.26).

Most of the cores from Jackson Lake sites are multidirectional or unidirectional when a reduction morphology other than undifferentiated core was specified (Tables 19.31, 19.32). These forms of core fit with the expedient approach to lithic production that characterizes Anasazi material.

In spite of the presence of over 400 chalcedony flakes, there are only five chalcedony cores; they are all small and appear to be from late contexts (Table 19.33). This suggests that chalcedony was obtained elsewhere and minimally worked at the site. Chalcedony and silicified wood cores are the most heavily reduced, 80 percent having no or less than half cortex (Tables 19.30, 19.32). The degree of reduction of chert and siltstone cores is similar, with the majority of each with less than half of the

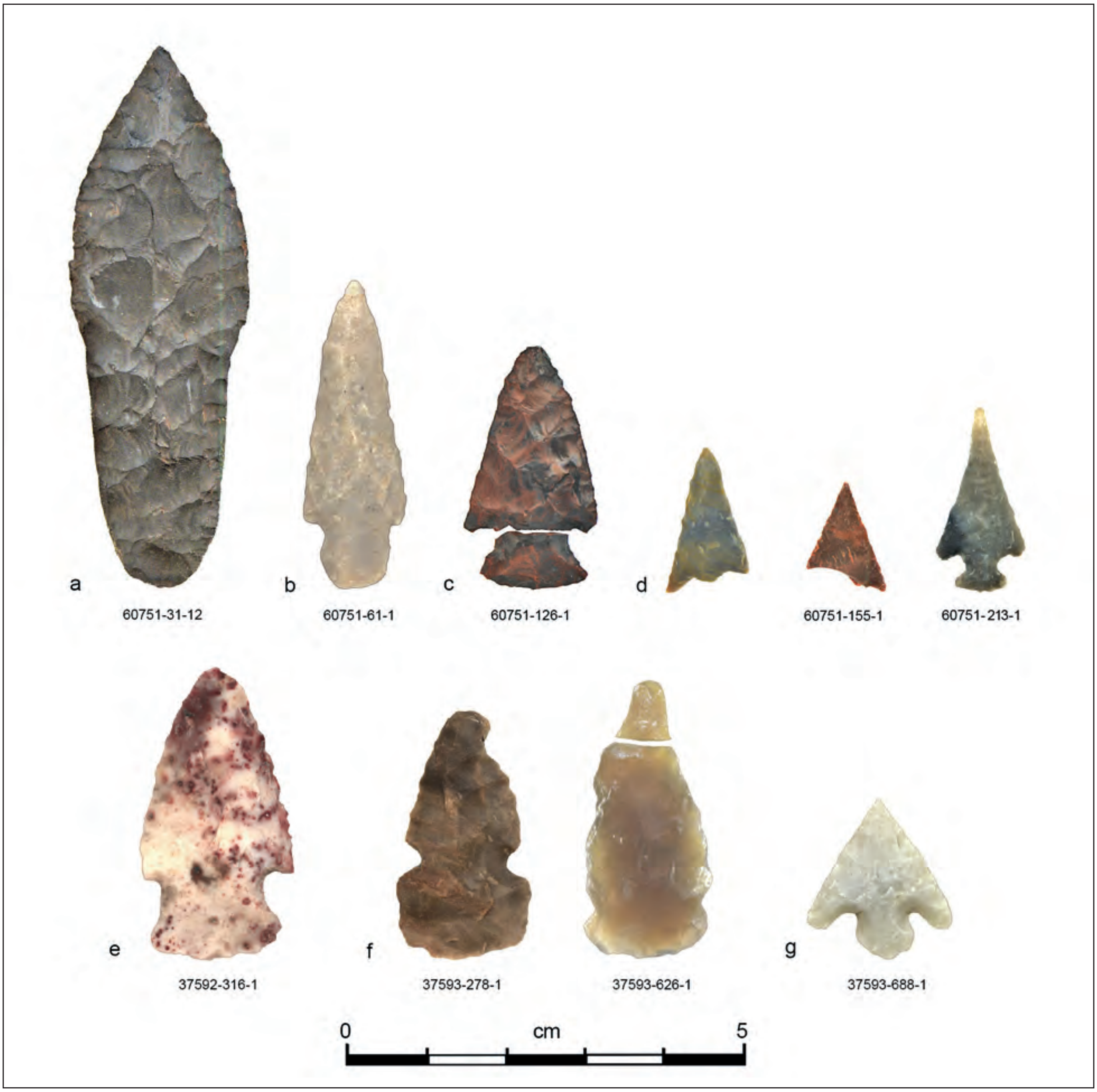


Figure 19.20b [a–g].[was 19.28, then 19.34] Heirloom points and the entire LA 60751 point assemblage, which contains several points from earlier periods. Top row, from left to right, recovered from LA 60751, Pit Structure 1, were three probable heirlooms: a. a Jay point from the floor (the edges of its base are ground); b. a large stemmed (possibly Armijo) point from the lower fill; and c. an En Medio point. Also found at LA 60751, Pit Structure 1: d. three corner-notched points. Probable heirlooms from other sites include (bottom row, left to right): e. an En Medio point from the LA 37592 midden; f. two large side-notched points from LA 37593; and, g. a basally notched (Coal Creek?) point from LA 37593.

cortex remaining on the core, a third with more than half cortex, and 5 percent of the specimens with no cortex (Table 19.34).

At Jackson Lake the smallest cores (3 g or less) are chert and silicified wood (Fig. 19.22). Silicified wood occurs as unusual morphologies more often than other materials, having higher percentages of both bidirectional and multidirectional cores than other materials (Tables 19.30, 19.31). Mean weights of quartzite and siltstone cores are similar and are three times as large as silicified wood cores and over twice as large as chert cores. Maximum weights of

Table 19.29. Chipped stone tool types, counts by major provenience and floor/floor fill contexts.

	Other Structure	Surface Room	Roomblock	Pit Structure	Extramural	Total
Floor Fill						
Debitage	–	276	1	238	119	**634**
Core	–	9	–	14	4	**27**
Biface	–	–	–	–	1	**1**
Retouched, utilized debitage	–	13	–	11	6	**30**
Retouched, utilized core	–	2	–	1	–	**3**
Projectile point	–	–	–	2	–	**2**
Hammerstone	–	8	–	16	–	**24**
Hammerstone flake	–	1	1	–	–	**2**
Chopper, plane	–	2	–	1	–	**3**
Total	**–**	**311**	**2**	**283**	**130**	**726**
.. **Surface or Floor**						
Debitage	–	175	–	555	204	**935**
Core	–	6	–	30	5	**41**
Retouched, utilized debitage	–	10	–	51	12	**73**
Retouched, utilized core	–	–	–	3	–	**3**
Denticulate	–	–	–	2	–	**2**
Bifacial knife, scraper	–	1	–	–	–	**1**
Projectile point	–	2	–	3	1	**6**
Hammerstone	–	10	–	27	2	**39**
Hammerstone flake	–	–	–	3	–	**3**
Chopper, plane	–	–	–	1	–	**1**
Axe	–	–	–	1	–	**1**
Hoe	–	1	–	–	–	**1**
Total	**1**	**205**	**–**	**676**	**224**	**1106**
Overall total	**1**	**516**	**2**	**959**	**354**	**1832**
Specific Floor Groups						
	Debitage	**Core**	**Retouched**	**Denticulate**	**Hammerstone**	**Total**
LA 37593, Room 101, Floor 1	20	1	–	–	–	**21**
LA 37593, Room 101, Floor 3	–	1	–	–	–	**1**
LA 37593, Room 103, Floor 1	68	2	–	–	–	**70**
LA 37595, Pit Structure 2, Floor 1	32	1	1	1	6	**41**
Total	**120**	**5**	**1**	**1**	**6**	**133**

chert and silicified wood cores are in the 500–600 g range, while quartzite and siltstone range between 1.3 and 2.2 kg (Table 19.30).

Around 10 percent of the 1,057 cores show some form of use. Three-fourths of utilization of cores is classified as unidirectional, some of which includes some rounding and some with retouch. Only 10 percent of the utilized cores had bidirectional use. These types of wear on cores, combined with their greater weight and wider edge angles than flakes, suggest that they were used principally for scraping tasks. The forms of utilized cores are similar to those of the whole group of cores, indicating that particular cores were not specially selected for use as tools. The analysis and its standardization do not allow "hammerstone" to be a use for a core; predictably, however, a large number of hammerstones passed through a use-phase as cores (Fig. 19.23 [a–c]). Of 461 hammerstones, 91 percent have core reduction morphologies, most often multidirectional core (Tables 19.26, 19.35, 19.36).

Hammerstones

Hammerstones are the fourth most abundant artifact type, after debitage, utilized debitage, and cores. Although they make up less than 2 percent of

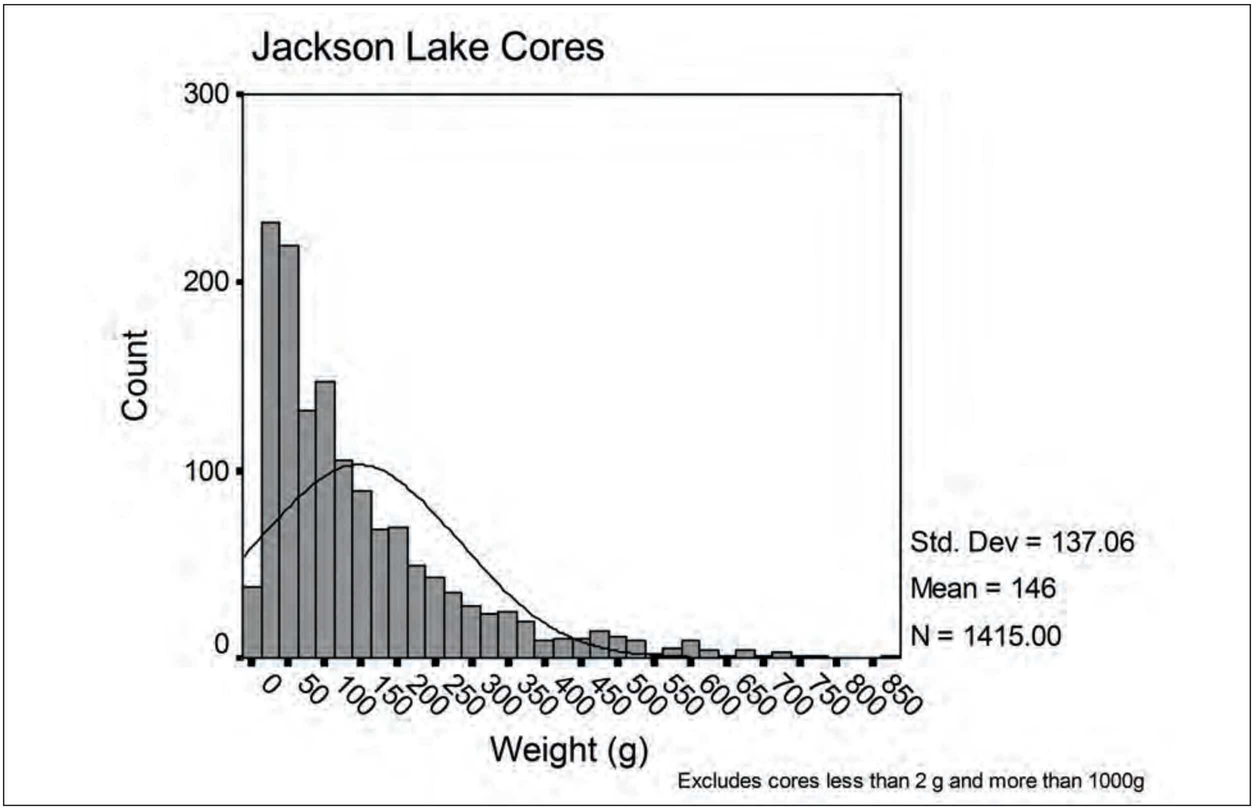


Figure 19.21. Core weights for cores between 2 and 1000 grams; histogram.

Table 19.30. Cores, weight (g) by material type and morphology.

	Mean wt (g)	Count	Standard Deviation	Median wt (g)	Minimum wt (g)	Maximum wt (g)
Material Type						
Chert	77.2	529	71.6	55.0	1.0	608.0
Chalcedony	27.8	5	20.63	15.0	12.0	59.0
Silicified wood	54.9	87	73.36	30.0	2.0	530.0
Quartzite	154.1	33	128.67	117.0	6.0	471.0
Quartzitic sandstone	189.8	44	238.11	110.0	4.0	1363.0
Igneous	236.0	3	152.75	158.0	138.0	412.0
Rhyolite	305.5	4	219.14	249.5	107.0	616.0
Sandstone	190.0	4	155.87	170.0	39.0	381.0
Siltstone	179.9	348	207.51	134.5	4.0	2270.0
Total	**117.8**	**1057**	**152.05**	**74.0**	**1.0**	**2270.0**
Core Morphology						
Core	176.5	381	164.162	130.0	8.0	1195.0
Tested cobble	186.7	161	178.026	128.0	5.0	1016.0
Unidirectional core	125.6	263	147.77	84.0	1.0	1363.0
Bidirectional core	161.3	84	287.914	88.5	13.0	2450.0
Multidirectional core	156.0	562	209.097	104.0	1.0	2270.0
Pyramidal core	114.3	9	141.347	60.0	4.0	448.0
Total	**159.3**	**1460**	**190.875**	**104.0**	**1.0**	**2450.0**

Table 19.31. Core material by reduction morphology; counts and percents.

	Undiffer-entiated Core		Tested Cobble		Unidirect-ional Core		Bidirectional Core		Multidirect-ional Core		Pyramidal Core		Total
Material Type	**N**	**Row %**	**N**	**Row %**	**N**	**Row %**	**N**	**Row %**	**N**	**Row %**	**N**	**Row %**	
Chert	124	23.4%	67	12.7%	116	21.9%	31	5.9%	187	35.3%	4	0.8%	**529**
Chalcedony	–	–	1	20.0%	–	–	–	–	4	80.0%	–	–	**5**
Silicified wood	13	14.9%	4	4.6%	15	17.2%	8	9.2%	46	52.9%	1	1.1%	**87**
Quartzite	8	24.2%	6	18.2%	7	21.2%	2	6.1%	9	27.3%	1	3.0%	**33**
Quartzitic sandstone	10	22.7%	2	4.5%	9	20.5%	1	2.3%	20	45.5%	2	4.5%	**44**
Igneous	1	33.3%	–	–	1	33.3%	–	–	1	33.3%	–	–	**3**
Rhyolite	1	25.0%	–	–	2	50.0%	–	–	1	25.0%	–	–	**4**
Sandstone	1	25.0%	1	25.0%	1	25.0%	–	–	1	25.0%	–	–	**4**
Siltstone	88	25.3%	31	8.9%	65	18.7%	20	5.7%	143	41.1%	1	0.3%	**348**
Total	**246**	**23.3%**	**112**	**10.6%**	**216**	**20.4%**	**62**	**5.9%**	**412**	**39.0%**	**9**	**0.9%**	**1057**

Table 19.32. Edge damage on utilized cores, counts by reduction morphology.

	Core	Tested	Unidirectional	Bidirectional	Multidirectional	Pyramidal	Total
Unidirectional, utilized	9	2	6	2	22	–	**41**
Bidirectional, utilized	1	–	2	–	2	–	**5**
Unidirectional, retouched	1	1	–	–	1	–	**3**
Bidirectional, retouched	–	–	–	–	1	–	**1**
Rounding	–	1	–	1	5	–	**7**
Rounding + unidirectional, utilized	5	3	4	4	11	–	**27**
Rounding + bidirectional, utilized	1	–	2	–	–	–	**3**
Rounding + unidirectional, retouched	–	–	–	–	1	–	**1**
Rounding + bidirectional, retouched	–	–	1	–	–	–	**1**
Unidirectional, utilized + retouched	4	3	2	1	3	1	**14**
Bidirectional, utilized + retouched	–	–	1	–	–	–	**1**
Other	2	–	–	–	2	–	**4**
Total	**23**	**10**	**18**	**8**	**48**	**1**	**108**

the total assemblage count, they account for nearly a quarter of the assemblage by weight (Table 19.3). Unfortunately, only 68 of the 455 hammerstones in the Jackson Lake analysis were coded as to completeness. Of these, 50 (74 percent) were considered whole, which is a reasonable estimate or even an underestimate of the number of these tools that are complete. Breaking down the hammerstone group by reduction morphology reveals that many of the small ones are hammerstone or core flakes, although even here, some are as large as 400 g. Based on a visual inspection of a group of tools from a Barker Arroyo mealing room, I concluded that tools weighing less than 90 g were much more likely to be spalls from hammerstones than they were to be actual hammerstones. For the hammerstone tables I therefore made two modifications of the classification. Items coded as hammerstones but weighing less than 90 g were changed to the category hammerstone flake; 100 cases were reclassified in this way. Another group was included in the hammerstone flake category through the reduction morphology variable, which contains a variable state called hammerstone flake. All of these cases were

Table 19.33. Items with core morphology (all), material type by artifact type; counts and percents.

Material Type	Core		Retouched/ Utilized Core		Notch		Hammer-stone		Chopper/ Plane		Hoe		Total	
	N	Col. %	N	Col. %	N	Col. %	N	Col. %	N	Col. %	N	Col. %	N	Col. %
Chert	480	50.6%	49	45.4%	3	50.0%	140	37.5%	3	14.3%	–	–	**675**	**46.3%**
Chalcedony	5	0.5%	–	–	–	–	1	0.3%	–	–	–	–	**6**	**0.4%**
Silicified wood	72	7.6%	15	13.9%	1	16.7%	2	0.5%	–	–	–	–	**90**	**6.2%**
Quartzite	26	2.7%	7	6.5%	–	–	32	8.6%	1	4.8%	–	–	**66**	**4.5%**
Quartzitic sandstone	40	4.2%	4	3.7%	–	–	43	11.5%	3	14.3%	–	–	**90**	**6.2%**
Igneous	3	0.3%	–	–	–	–	2	0.5%	–	–	–	–	**5**	**0.3%**
Rhyolite	4	0.4%	–	–	–	–	2	0.5%	1	4.8%	–	–	**7**	**0.5%**
Sandstone	4	0.4%	–	–	–	–	2	0.5%	–	–	–	–	**6**	**0.4%**
Siltstone	315	33.2%	33	30.6%	2	33.3%	148	39.7%	13	61.9%	1	50.0%	**512**	**35.1%**
Other	–	–	–	–	–	–	1	0.3%	–	–	1	50.0%	**2**	**0.1%**
Total	**949**	**100.0%**	**108**	**100.0%**	**6**	**100.0%**	**373**	**100.0%**	**21**	**100.0%**	**2**	**100.0%**	**1459**	**100.0%**

Table 19.34. Cortex on cores by material type; counts and percents.

	No Cortex		1–50% Cortex		51–99% Cortex		100% Cortex		Total Count
	Count	Row %	Count	Row %	Count	Row %	Count	Row %	
Chert	25	4.7%	291	55.0%	210	39.7%	3	0.6%	**529**
Chalcedony	1	20.0%	3	60.0%	1	20.0%	–	–	**5**
Silicified wood	28	32.2%	46	52.9%	13	14.9%	–	–	**87**
Quartzite	–	–	14	42.4%	18	54.5%	1	3.0%	**33**
Quartzitic sandstone	–	–	30	68.2%	12	27.3%	2	4.5%	**44**
Igneous	–	–	1	33.3%	2	66.7%	–	–	**3**
Rhyolite	1	25.0%	–	–	3	75.0%	–	–	**4**
Sandstone	–	–	2	50.0%	2	50.0%	–	–	**4**
Siltstone	16	4.6%	213	61.2%	119	34.2%	–	–	**348**
Total	**71**	**6.7%**	**600**	**56.8%**	**380**	**36.0%**	**6**	**0.6%**	**1057**
Hammerstones including hammerstone flakes	17	3.7%	214	46.4%	224	48.6%	6	1.3%	461
Hammerstone/cores without hammerstone flakes	76	5.4%	53.4	3.8%	574	40.5%	11	0.8%	1418

also added to the new artifact category by that name. Since some of the cases coded as hammerstone flakes in morphology are more than 90 g, the transformation may make some misclassifications, and some of the small cases may actually have been hammerstones, but both of these errors are likely to be small.

Seventy-nine percent of the items coded hammerstone after this modification are cores, 14 percent are cobbles or chunks, and 12 percent are flakes. The mean weights for flakes are naturally much smaller than for other forms (Table 19.37); flakes are excluded from hammerstone histograms and means. While the average size of hammerstones is 298 g (median 239 g), hammerstones are most commonly from 100 to 150 g, ranging all the way to 2.5 kg (Fig. 19.24 [a, b]). Hammerstones on flakes—hammerstone flakes and core flake "hammerstones"—range in size from flake size (a third are less than 10 g, and nearly half are lighter than the smallest regular hammerstones) to sizes well within the sizes of hammerstones of other reduction morphologies (Table 19.37).

As noted in the materials section, tough materials such as quartzite and siltstone, which are also more readily available as larger nodules, were

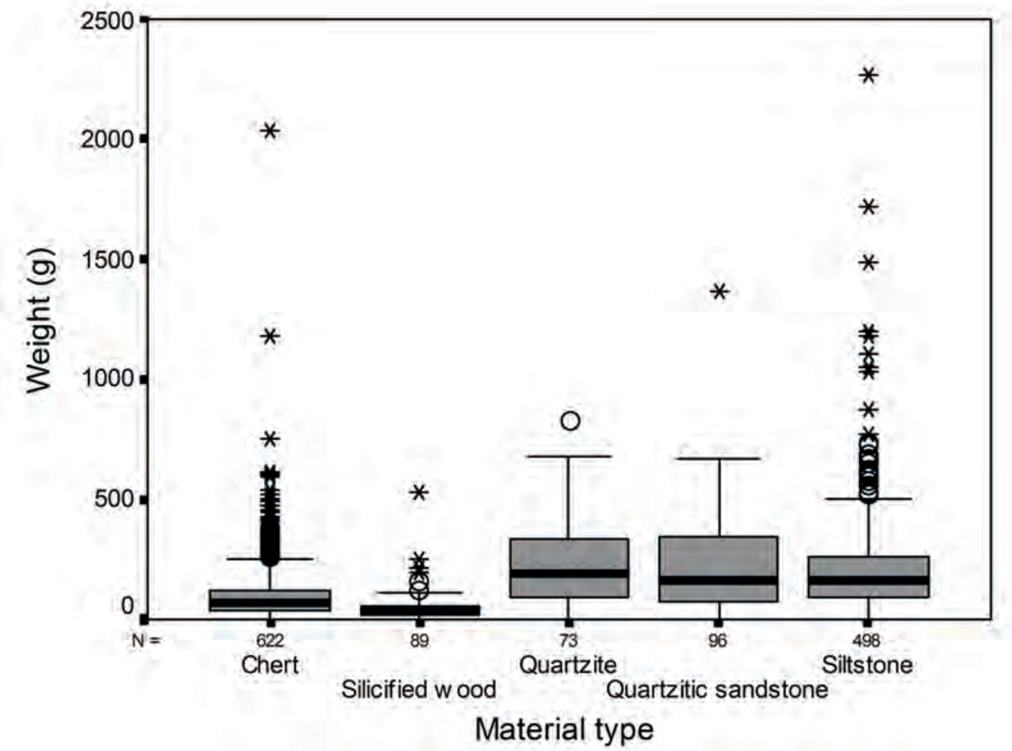


Figure 19.22. Core weights by major material groups (includes all hammerstones coded as cores); box plot.

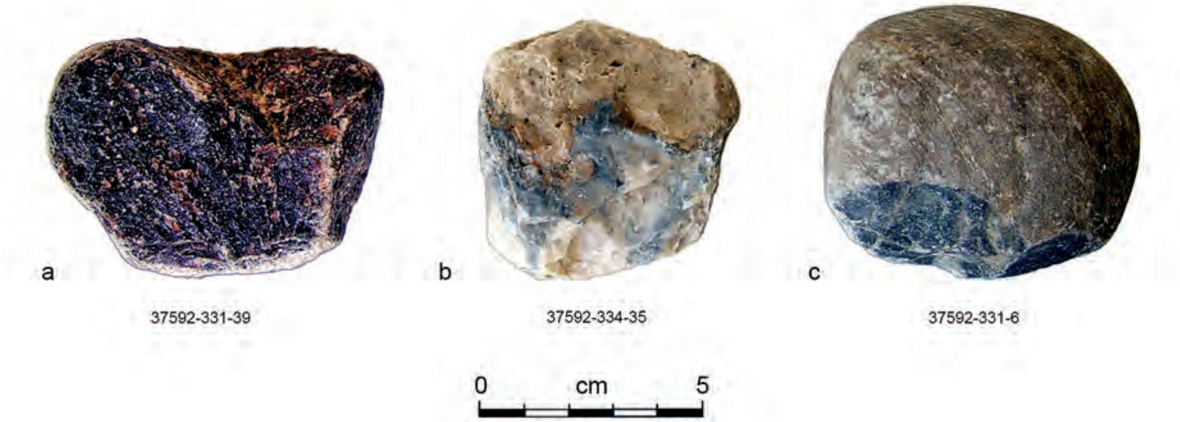


Figure 19.23 [a–c]. Hammerstones made from cores, from LA 37592, Pit Structure 1; note presence of cortex and negative flake scars: a. quartzite (189 g); b. chert (148 g); c. siltstone (274 g).

preferred for hammerstones. Numerically there are more siltstone hammerstones than other materials. The majority (62 percent) of hammerstones are cores, most commonly multidirectional ones, the most common core type (Tables 19.36, 19.38). Ninety-six percent of hammerstones have cortex on them, quite evenly split between more than half and less than half cortex, but favoring more than half. The proportions of quantities of cortex are quite similar between hammerstones and cores, though hammerstones have a somewhat higher occurrence of cortex coverage (Tables 19.34, 19.38).

Table 19.35. Core reduction morphology by material type; counts and percents.

	Undifferen-tiated Core		Tested Cobble		Unidirect-ional Core		Bidirect-ional Core		Multidirect-ional Core		Pyramidal Core		Total	
	N	Col. %	N	Col. %	N	Col. %	N	Col. %	N	Col. %	N	Col. %	N	Col. %
Chert	124	23.4%	67	12.7%	116	21.9%	31	5.9%	187	35.3%	4	0.8%	**529**	**50.0%**
Chalcedony	–	–	1	20.0%	–	–	–	–	4	80.0%	–	–	**5**	**0.5%**
Silicified wood	13	14.9%	4	4.6%	15	17.2%	8	9.2%	46	52.9%	1	1.1%	**87**	**8.2%**
Quartzite	8	24.2%	6	18.2%	7	21.2%	2	6.1%	9	27.3%	1	3.0%	**33**	**3.1%**
Quartzitic sandstone	10	22.7%	2	4.5%	9	20.5%	1	2.3%	20	45.5%	2	4.5%	**44**	**4.2%**
Igneous	1	33.3%	–	–	1	33.3%	–	–	1	33.3%	–	–	**3**	**0.3%**
Rhyolite	1	25.0%	–	–	2	50.0%	–	–	1	25.0%	–	–	**4**	**0.4%**
Sandstone	1	25.0%	1	25.0%	1	25.0%	–	–	1	25.0%	–	–	**4**	**0.4%**
Siltstone	88	25.3%	31	8.9%	65	18.7%	20	5.7%	143	41.1%	1	0.3%	**348**	**32.9%**
Total	**246**	**23.3%**	**112**	**10.6%**	**216**	**20.4%**	**62**	**5.9%**	**412**	**39.0%**	**9**	**0.9%**	**1057**	**100.0%**

Table 19.36. Cores (all) by material and core type, including items coded as hammerstones with reduction morphology of core; counts and percents.

	Undiffer-entiated Core		Tested Cobble		Unidirect-ional Core		Bidirect-ional Core		Multidirect-ional Core		Pyram-idal Core		Total	
Material Type	N	Col. %	N	Col. %	N	Col. %	N	Col. %	N	Col. %	N	Col. %	N	Col. %
Chert	168	45.7%	88	55.3%	132	51.4%	39	48.1%	238	42.8%	4	44.4%	**669**	**46.8%**
Chalcedony	–	–	1	0.6%	–	–	–	–	5	0.9%	–	–	**6**	**0.4%**
Silicified wood	13	3.5%	4	2.5%	15	5.8%	10	12.3%	46	8.3%	1	11.1%	**89**	**6.2%**
Quartzite	18	4.9%	14	8.8%	10	3.9%	2	2.5%	20	3.6%	1	11.1%	**65**	**4.5%**
Quartzitic sandstone	28	7.6%	11	6.9%	13	5.1%	2	2.5%	31	5.6%	2	22.2%	**87**	**6.1%**
Igneous	2	0.5%	1	0.6%	1	0.4%	–	–	1	0.2%	–	–	**5**	**0.3%**
Rhyolite	3	0.8%	–	–	2	0.8%	–	–	1	0.2%	–	–	**6**	**0.4%**
Sandstone	1	0.3%	1	0.6%	1	0.4%	1	1.2%	2	0.4%	–	–	**6**	**0.4%**
Siltstone	135	36.7%	39	24.5%	83	32.3%	27	33.3%	211	37.9%	1	11.1%	**496**	**34.7%**
Other	–	–	–	–	–	–	–	–	1	0.2%	–	–	**1**	**0.1%**
Total	**368**	**100.0%**	**159**	**100.0%**	**257**	**100.0%**	**81**	**100.0%**	**556**	**100.0%**	**9**	**100.0%**	**1430**	**100.0%**
Percent of identified cores	246	23.3%	112	10.6%	216	20.4%	62	5.9%	412	39.0%	9	0.9%	1057	100.0%

Chronological Trends

Around 40 percent of the total lithic collection from Jackson Lake was found in proveniences deemed to be well enough dated and little enough disturbed to be assigned component ages. These 11,174 artifacts were used to examine changes through time in material types and assemblage makeup (Table 19.5). Unfortunately, the samples are small from the two Basketmaker components: Transitional Basketmaker (AD 500s) and Classic Basketmaker III (600s to early 700s; see Toll and Wilson 2000). The sample is further unevenly spread across time groups by the large amount of material from the LA 37592 midden, which means that over half of all the dated lithics are from the late Pueblo III segment.

Intriguingly, the Transitional Basketmaker materials (represented by one structure and associated with the first use of pottery in the area) look quite different from the subsequent phases, while the Classic Basketmaker chipped stone looks much more like the subsequent Pueblo assemblages (Table 19.5). Thus, while the post–AD 600 assemblages show a clear preference for chert, the Transitional Basketmaker materials contain more siltstone than chert, as well as elevated quantities of quartzitic sandstone and silicified wood. Keeping in mind the small sample size, this suggests that the earliest occupation emphasized immediately locally available materials to a greater extent than did the later occupations, which has a parallel in the probable use of riverine clays for pottery manufacture.

Table 19.37. Hammerstones, mean weights (g) by reduction morphology.

	Mean wt(g)	Count	Standard Deviation	Median wt (g)	Minimum wt (g)	Maximum wt (g)
Flakes Excluded						
Angular debris	273.14	7	213.451	158.00	114.00	661.00
Cobble, chunk	378.44	18	195.724	418.50	109.00	827.00
Core flake	105.17	6	14.58	98.50	94.00	131.00
Core	291.91	107	176.246	244.00	93.00	1195.00
Tested cobble	349.81	42	179.553	314.50	97.00	768.00
Unidirectional core	260.86	36	96.413	254.00	111.00	480.00
Bidirectional core	373.91	11	691.941	142.00	93.00	2450.00
Multidirectional core	289.25	130	255.467	222.00	94.00	2033.00
Early-stage biface	342.00	1	–	342.00	342.00	342.00
Total	**298.13**	**358**	**234.657**	**239.00**	**93.00**	**2450.00**
Weights of Hammerstone Flakes*						
Angular debris	41.25	4	28.088	35.50	16.00	78.00
Cobble, chunk	55.00	1	–	55.00	55.00	55.00
Core flake	25.44	25	20.956	21.00	1.00	67.00
Hammerstone flake	29.59	90	51.809	16.00	1.00	431.00
Core	49.67	15	21.286	51.00	17.00	87.00
Tested cobble	71.40	5	16.365	82.00	53.00	84.00
Unidirectional core	59.60	5	20.756	57.00	33.00	89.00
Bidirectional core	65.13	8	26.465	76.50	21.00	89.00
Multidirectional core	56.93	14	25.5	61.00	18.00	89.00
Total	**37.35**	**167**	**42.915**	**26.00**	**1.00**	**431.00**
Total flakes and other	**215.18**	**525**	**229.95**	**162.00**	**1.00**	**2450.00**

*Using 90 g rule

The rankings summarizing material occurrence by period at the end of Table 19.5 show patterns in material use through time. Each column represents an artifact group, and the numbers represent the ranking of material occurrence in that group. Thus, for flakes in the overall assemblage (the first number in the last group of rankings: 1, 6, 3, 5, 4, 2), the order of occurrence of raw materials is chert (most numerous), siltstone, silicified wood, quartzitic sandstone, quartzite, and chalcedony (fewest). This pattern is remarkably consistent through time in the dominant flake category, with minor deviations only in the Basketmaker III segments. Preferences for chert, chalcedony, and silicified wood for projectile points through time are also apparent, though with small samples the ranks do vary some. Strikingly, chert and siltstone are the two most abundant materials in all tool classes in all time periods except for the absence of siltstone points. Rankings of major artifact types by material types show the consistent preference for siltstone, quartzitic sandstone, and quartzite, respectively, for hammerstones, but chert is so generally abundant and was so heavily collected that it dominates even these categories (Table 19.5), especially as smaller hammerstones. The tough, high-tensile-strength nature of these materials is well suited to use as hammers.

Chalcedony flakes occur in all time periods, but chalcedony cores and hammerstones only were recovered in Late Pueblo III contexts, where they are small and rare, and where the sample is largest (Tables 19.30, 19.39, 19.40, 19.41). This suggests that chalcedony was not locally available. Silicified wood, too, occurs in substantial quantities in all periods but shows an especially high frequency in Late Pueblo II (Tables 19.40, 19.42, 19.43). After this spike in occurrence, the silicified wood percentages are lowest of all Jackson Lake time periods in Early and Late Pueblo III. Silicified wood is of interest as a relatively high frequency material that was used often for more completely worked tools; the yellow-brown variety of silicified wood is a more specific type that may be more specifically traceable with further work (Figs. 19.9, 19.10, 19.11).

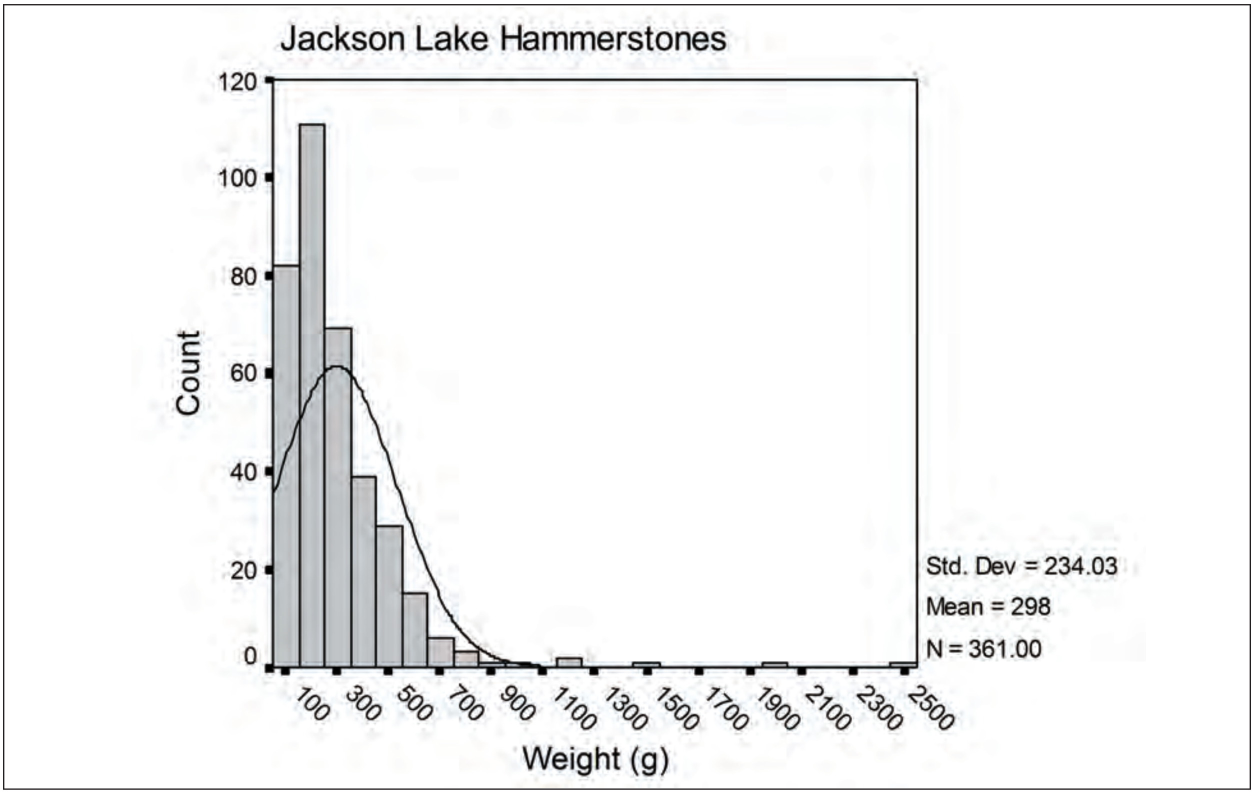


Figure 19.24 [a–b]. Hammerstone weights: a. all hammerstones except for those coded as flakes.

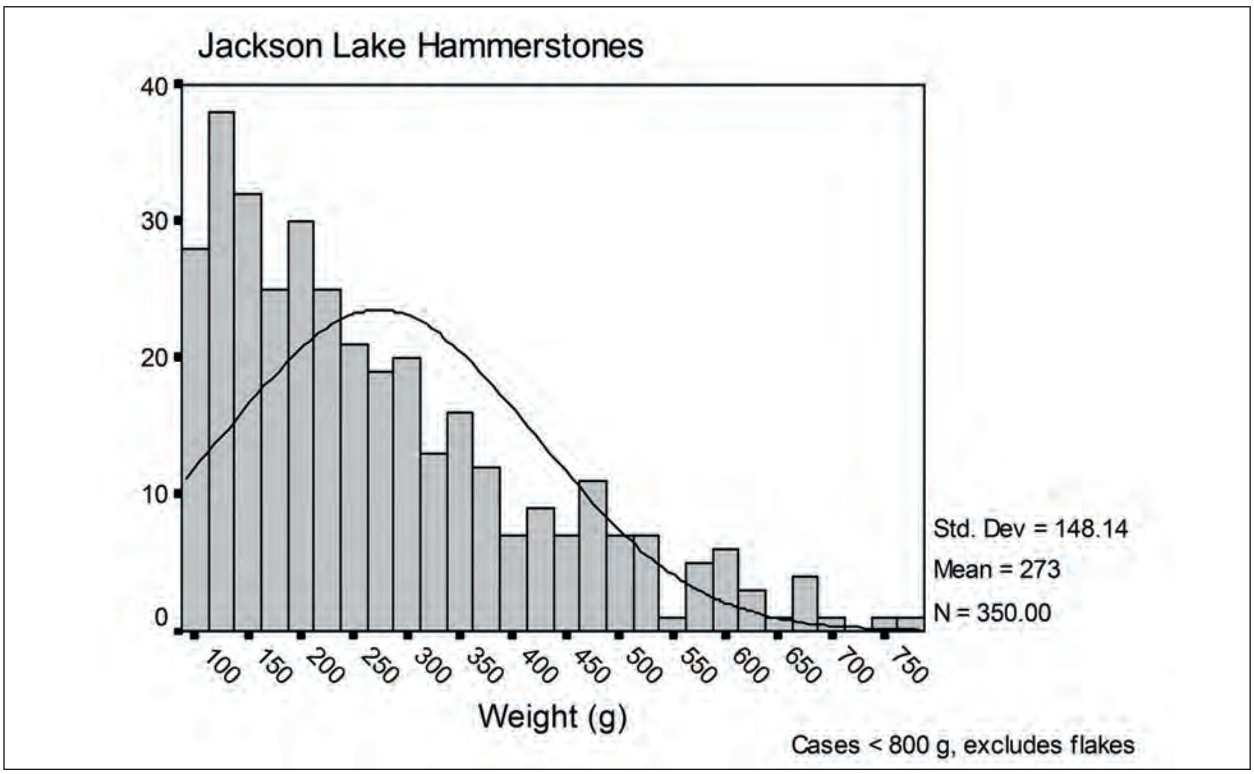


Figure 19.24 [a–b].Hammerstone weights: b. detail of hammerstone weight distribution of hammerstones less than 700 g.

Table 19.38. Cortex on hammerstones by morphology; counts and percents.

	No Cortex		1–50% Cortex		51–99% Cortex		100% Cortex		Total	
	Count	Row %	Count	Row %	Count	Row %	Count	Row %	Count	Col. %
Hammerstones*										
Angular debris	–	–	1	14.3%	5	71.4%	1	14.3%	**7**	**2.0%**
Cobble, chunk	–	–	3	16.7%	11	61.1%	4	22.2%	**18**	**5.0%**
Core flake	–	–	5	83.3%	1	16.7%	–	–	**6**	**1.7%**
Core	3	2.8%	49	45.8%	55	51.4%	–	–	**107**	**29.9%**
Tested cobble	–	–	3	7.1%	39	92.9%	–	–	**42**	**11.7%**
Unidirectional core	–	–	16	44.4%	20	55.6%	–	–	**36**	**10.1%**
Bidirectional core	–	–	6	54.5%	5	45.5%	–	–	**11**	**3.1%**
Multidirectional core	2	1.5%	73	56.2%	55	42.3%	–	–	**130**	**36.3%**
Early-stage biface	–	–	–	–	1	100.0%	–	–	**1**	**0.3%**
Total	**5**	**1.4%**	**156**	**43.6%**	**192**	**53.6%**	**5**	**1.4%**	**358**	**100.0%**
Hammerstone Flakes										
Angular debris	–	–	2	50.0%	2	50.0%	–	–	**4**	**2.4%**
Cobble, chunk	–	–	–	–	1	100.0%	–	–	**1**	**0.6%**
Core flake	4	16.0%	16	64.0%	5	20.0%	–	–	**25**	**15.1%**
Hammerstone flake	17	19.1%	51	57.3%	18	20.2%	3	3.4%	**89**	**53.6%**
Core	–	–	8	53.3%	7	46.7%	–	–	**15**	**9.0%**
Tested cobble	–	–	2	40.0%	3	60.0%	–	–	**5**	**3.0%**
Unidirectional core	–	–	4	80.0%	1	20.0%	–	–	**5**	**3.0%**
Bidirectional core	–	–	7	87.5%	1	12.5%	–	–	**8**	**4.8%**
Multidirectional core	3	21.4%	5	35.7%	6	42.9%	–	–	**14**	**8.4%**
Total	**24**	**14.5%**	**95**	**57.2%**	**44**	**26.5%**	**3**	**1.8%**	**166**	**100.0%**

* 90 g rule

Table 19.39. Chipped stone by time period, showing identified imported materials; counts and percents.

	Early Basket-maker III		Basket-maker III		Mid Pueblo II		Late Pueblo II		Early Pueblo III		Late Pueblo III		Total	
	N	Col. %	N	Col. %	N	Col. %	N	Col. %	N	Col. %	N	Col. %	N	Col. %
Cherts	19	27.1%	127	54.5%	1023	49.5%	601	45.6%	553	49.0%	5087	52.4%	**7410**	**51.0%**
Narbona Pass	–	–	–	–	3	0.1%	1	0.1%	–	–	7	0.1%	**11**	**0.1%**
Brushy Basin	–	–	–	–	2	0.1%	1	0.1%	–	–	2	0.0%	**5**	**0.0%**
Zuni	–	–	–	–	–	–	–	–	–	–	1	0.0%	**1**	**0.0%**
Woods	9	12.9%	25	10.7%	217	10.5%	259	19.7%	94	8.3%	621	6.4%	**1225**	**8.4%**
Chalced-onies	1	1.4%	8	3.4%	32	1.5%	17	1.3%	12	1.1%	157	1.6%	**227**	**1.6%**
Quartzites*	15	21.4%	16	6.9%	253	12.2%	131	9.9%	107	9.5%	890	9.2%	**1412**	**9.7%**
Sandstones	–	–	–	–	12	0.6%	6	0.5%	2	0.2%	30	0.3%	**50**	**0.3%**
Siltstones	25	35.7%	56	24.0%	507	24.5%	286	21.7%	350	31.0%	2860	29.5%	**4084**	**28.1%**
Igneous	1	1.4%	–	–	4	0.2%	2	0.2%	8	0.7%	25	0.3%	**40**	**0.3%**
Obsidian	–	–	–	–	–	–	–	–	–	–	3	0.0%	**3**	**0.0%**
Other	–	–	1	0.4%	13	0.6%	13	1.0%	2	0.2%	25	0.3%	**54**	**0.4%**
Total	**70**	**100.0%**	**233**	**100.0%**	**2066**	**100.0%**	**1317**	**100.0%**	**1128**	**100.0%**	**9708**	**100.0%**	**14,522**	**100.0%**

N = count

* Quartzite and quartzitic sandstone combined

Table 19.40. Major chipped stone material types by tool groups and time period; counts and percents.

	Early Basket-maker III		Basket-maker III		Mid Pueblo II		Late Pueblo II		Early Pueblo III		Late Pueblo III		Total	
	N	Col. %	N	Col. %	N	Col. %	N	Col. %	N	Col. %	N	Col. %	N	Col. %
Debitage														
Chert	16	28.6%	110	55.0%	874	51.9%	512	46.2%	501	51.0%	4532	53.3%	**6545**	**52.2%**
Chalcedony	1	1.8%	8	4.0%	29	1.7%	13	1.2%	8	0.8%	137	1.6%	**196**	**1.6%**
Silicified wood	6	10.7%	20	10.0%	171	10.2%	220	19.9%	79	8.0%	480	5.6%	**976**	**7.8%**
Quartzite	11	19.6%	12	6.0%	207	12.3%	113	10.2%	92	9.4%	814	9.6%	**1249**	**10.0%**
Siltstone	22	39.3%	50	25.0%	403	23.9%	250	22.6%	302	30.8%	2541	29.9%	**3568**	**28.5%**
Total	**56**	**100.0%**	**200**	**100.0%**	**1684**	**100.0%**	**1108**	**100.0%**	**982**	**100.0%**	**8504**	**100.0%**	**12534**	**100.0%**
Core														
Chert	1	33.3%	9	56.3%	58	51.8%	28	51.9%	22	40.0%	191	57.5%	**309**	**54.0%**
Chalcedony	–	–	–	–	–	–	–	–	–	–	3	0.9%	**3**	**0.5%**
Silicified wood	–	–	1	6.3%	7	6.3%	8	14.8%	2	3.6%	20	6.0%	**38**	**6.6%**
Quartzite	1	33.3%	1	6.3%	10	8.9%	2	3.7%	6	10.9%	18	5.4%	**38**	**6.6%**
Siltstone	1	33.3%	5	31.3%	37	33.0%	16	29.6%	25	45.5%	100	30.1%	**184**	**32.2%**
Total	**3**	**100.0%**	**16**	**100.0%**	**112**	**100.0%**	**54**	**100.0%**	**55**	**100.0%**	**332**	**100.0%**	**572**	**100.0%**
Retouched, Utilized Debitage														
Chert	2	28.6%	4	50.0%	63	43.2%	43	45.3%	21	42.9%	303	49.8%	**436**	**47.8%**
Chalcedony	–	–	–	–	3	2.1%	2	2.1%	1	2.0%	12	2.0%	**18**	**2.0%**
Silicified wood	3	42.9%	3	37.5%	36	24.7%	28	29.5%	9	18.4%	99	16.3%	**178**	**19.5%**
Quartzite	2	28.6%	–	–	10	6.8%	11	11.6%	2	4.1%	43	7.1%	**68**	**7.4%**
Siltstone	–	–	1	12.5%	34	23.3%	11	11.6%	16	32.7%	151	24.8%	**213**	**23.3%**
Total	**7**	**100.0%**	**8**	**100.0%**	**146**	**100.0%**	**95**	**100.0%**	**49**	**100.0%**	**608**	**100.0%**	**913**	**100.0%**
Hammerstone														
Chert	–	–	1	50.0%	23	33.3%	15	53.6%	5	31.3%	24	32.9%	**68**	**36.0%**
Chalcedony	–	–	–	–	–	–	–	–	–	–	1	1.4%	**1**	**0.5%**
Silicified wood	–	–	–	–	–	–	–	–	–	–	1	1.4%	**1**	**0.5%**
Quartzite	–	–	1	50.0%	20	29.0%	4	14.3%	6	37.5%	9	12.3%	**40**	**21.2%**
Siltstone	1	100.0%	–	–	26	37.7%	9	32.1%	5	31.3%	38	52.1%	**79**	**41.8%**
Total	**1**	**100.0%**	**2**	**100.0%**	**69**	**100.0%**	**28**	**100.0%**	**16**	**100.0%**	**73**	**100.0%**	**189**	**100.0%**
Total	**67**		**226**		**2111**		**1285**		**1102**		**9517**		**14,308**	

N = count

Groups quartzitic sandstone and quartzite, utilized and unutilized cores.

The expected correspondence between numbers of cores of a given material and numbers of flakes of the same material holds except for Transitional Basketmaker III, for which there is a very small sample, and Early Pueblo III, where there is an unexpectedly high percentage of siltstone cores (Table 19.40).

Figures 19.25a, 19.25b, 19.26a, 19.26b, 19.26c, 19.26d and Table 19.41 show flake sizes through time (note: there were too few whole chalcedony flakes to be statistically meaningful for these categories). The Basketmaker samples are too small to trust, but the other time groups do show some interesting trends. One of the most consistent is that flakes of all material types are the smallest in the terminal time group, Late Pueblo III. This probably relates in part to the context of the majority of that material, the midden at LA 37592, which contains more refuse than other more mixed contexts. It could indicate a trend toward more complete reduction of stone tools, but samples of size and context comparable to the LA 37592 collection would be necessary from other time periods to make such an interpretation. It does not appear that a shift in raw material use accounts for this possible change, since the material profile for the latest period is quite similar to that of preceding periods. With the exception of silicified

Table 19.41. Whole flake size (mm) by time period and major material type.

	Early Basketmaker III	Basketmaker III	Mid Pueblo II	Late Pueblo II	Early Pueblo III	Late Pueblo III	All
Chert							
Mean	4.2	8.53	9.75	10.74	10.00	8.25	8.79
Standard Deviation	3.01	8.3	16.21	21.86	14.74	12.69	14.39
Count	10	38	573	333	205	2581	3740
Median	3.5	5	4	4	4	4	4
Silicified Wood							
Mean	9.86	10.17	8.44	4.99	9.21	4.34	5.3
Standard Deviation	11.99	8.28	8.52	6.96	10.32	5.3	6.99
Count	7	6	103	116	33	282	547
Median	2	10.5	3	2	5	2	2
Quartzite							
Mean	38.43	4.29	12.29	26.17	14.56	12.12	14.36
Standard Deviation	61.6	3.73	21.99	42.73	19.14	18.15	24.77
Count	7	7	133	88	43	388	666
Median	22	4	6	9	8	5	6
Siltstone							
Mean	4.62	13.03	15.84	19.34	15.59	10.94	12.59
Standard Deviation	4.11	19.62	33.09	33.32	29.99	17.73	22.92
Count	13	19	242	184	141	1427	2036
Median	3	6	6	7.5	5	4	5
Total							
Mean	**11.82**	**9.8**	**11.01**	**13.69**	**12.27**	**9.1**	**10.08**
Standard Deviation	**28.55**	**13.42**	**21.47**	**21.57**	**21.29**	**14.72**	**18.13**
Count	**38**	**81**	**1080**	**739**	**427**	**4796**	**7161**
Median	**4**	**5**	**4**	**5**	**5**	**4**	**5**

wood, most of the materials have their largest mean flake size in Late Pueblo II.

A correspondence analysis of major material types by well-dated proveniences shows that Early Basketmaker III is different from other time periods, and also points up the high percentage of silicified wood occurring in Late Pueblo II (Fig. 19.27). At least as important in this plot is the similarity it demonstrates among Basketmaker III, Mid Pueblo II, and both Early and Late Pueblo III. This similarity indicates very similar material procurement strategies over around 700 years, as do the rankings in Table 19.5.

Exotic materials confidently placed in time slots are so few that it is difficult to say much (Table 19.39). Disallowing the "Alibates" material group, there are only 46 items placed from Mid Pueblo II to Late Pueblo III. Over half of all materials placed in time slots are in Late Pueblo III, and this corresponds to the distribution of exotic materials as well—obsidian, Narbona Pass chert, Pedernal, and yellow-brown spotted chert (possibly from Zuni; see Cameron 1997:620) all occur in the latest time slot. The most notable occurrence of exotic materials is in Late Pueblo II, where 19 percent of the exotic materials occur, although the time group contains only 14 percent of the overall chipped stone count. In Mid Pueblo II contexts there is a disproportionate amount of Narbona Pass chert—a grand total of three pieces. This occurrence corresponds to higher (but still very small) counts of ceramics from the Chuska Valley at about this time or somewhat earlier. Pieces of Narbona Pass chert are also small; the 28 pieces average 2 g in weight (SD = 2.0), and the largest piece is 8 g. As with all obsidian found during the project, all of the Jackson Lake obsidian came from the Jemez Mountains. Three of the pieces of obsidian are broken projectile points (Fig. 19.13

Table 19.42. Silicified wood by site and time period; counts and percents.

	Early Basketmaker III		Basketmaker III		Middle Pueblo II		Late Pueblo II		Early Pueblo III		Late Pueblo III		Total	
	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%
LA 37591	–	–	–	–	–	–	–	–	14	14.9	71	11.4	**85**	**6.9**
LA 37592	–	–	–	–	3	1.4	–	–	21	22.3	551	88.3	**575**	**46.8**
LA 37593	–	–	–	–	10	4.6	249	96.1	5	5.3	2	0.3	**266**	**21.6**
LA 37594	9	100.0	–	–	99	45.4	–	–	–	–	–	–	**108**	**8.8**
LA 37595	–	–	5	20.0	42	19.3	–	–	–	–	–	–	**47**	**3.8**
LA 37598	–	–	–	–	63	28.9	10	3.9	5	5.3	–	–	**78**	**6.3**
LA 60745	–	–	–	–	1	0.5	–	–	–	–	–	–	**1**	**0.1**
LA 60749	–	–	–	–	–	–	–	–	49	52.1	–	–	**49**	**4.0**
LA 60751	–	–	20	80.0	–	–	–	–	–	–	–	–	**20**	**1.6**
Total	**9**	**100.0**	**25**	**100.0**	**218**	**100.0**	**259**	**100.0**	**94**	**100.0**	**624**	**100.0**	**1229**	**100.0**

Table 19.43. Silicified wood by tool type and time period; counts and percents.

	Early Basketmaker III		Basketmaker III		Middle Pueblo II		Late Pueblo II		Early Pueblo III		Late Pueblo III		Total	
	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%	n =	%
Debitage	6	66.7	20	80.0	171	78.4	220	84.9	79	84.0	479	76.8	**976**	**79.4**
Core	–	–	1	4.0	5	2.3	6	2.3	2	2.1	19	3.0	**33**	**2.7**
Uniface	–	–	–	–	–	–	–	–	1	1.1	–	–	**1**	**0.1**
Retouched/ utilized debitage	3	33.3	3	12.0	36	16.5	28	10.8	10	10.6	99	15.9	**178**	**14.5**
Retouched/ utilized core	–	–	–	–	2	0.9	2	0.8	–	–	1	0.2	**5**	**0.4**
Drill	–	–	–	–	1	0.5	–	–	1	1.1	3	0.5	**5**	**0.4**
Notch	–	–	–	–	1	0.5	–	–	–	–	5	0.8	**6**	**0.5**
Denticulate	–	–	–	–	1	0.5	–	–	1	1.1	–	–	**2**	**0.2**
Knife/scraper	–	–	–	–	–	–	–	–	–	–	2	0.3	**3**	**0.2**
Projectile point	–	–	1	4.0	1	0.5	3	1.2	–	–	12	1.9	**17**	**1.4**
Hammerstone	–	–	–	–	–	–	–	–	–	–	1	0.2	**1**	**0.1**
Hammerstone flake	–	–	–	–	–	–	–	–	–	–	2	0.3	**2**	**0.2**
Total	**9**	**100.0**	**25**	**100.0**	**218**	**100.0**	**259**	**100.0**	**94**	**100.0**	**624**	**100.0**	**1229**	**100.0**

[a]), and two are thinning or sharpening flakes from bifaces. One of the points is from the El Rechuelos source, and the other four are Valle Grande obsidian; the two sources are close to one another in the Valles Caldera. It is important to note that Early Pueblo II contexts are missing from Jackson Lake; exotic lithics and ceramics are more abundant in the one good Early Pueblo II deposit in the Barker Arroyo segment.

The Basketmaker III materials (n = 303) do not contain any recognizable nonlocal materials. Since nonlocal materials form negligible percentages of the larger samples from other periods (Table 19.39), the Classic Basketmaker period is similar to later periods. Recognizable imported materials never constitute more than 0.1 percent of any period's assemblage, and their absence in smaller samples is not surprising. Narbona Pass chert, Brushy Basin chert, obsidian, and Zuni silicified wood compose the entire assemblage of recognized imported materials. Although the Early Pueblo III sample is larger than the Basketmaker samples, it also lacks imported chipped stone. All of the obsidian comes from Late Pueblo III contexts.

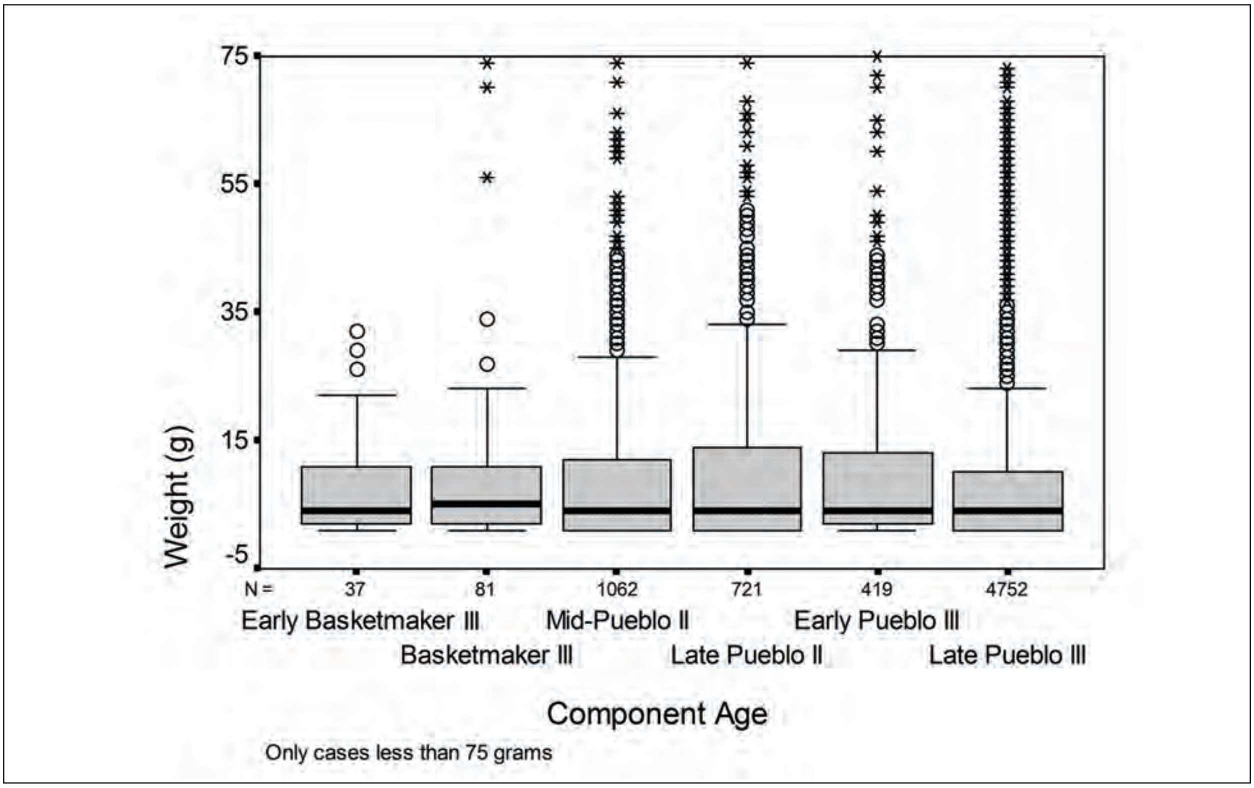


Figure 19.25a. Whole flakes, weight by time period (shows only flakes 75 g or less); box plot.

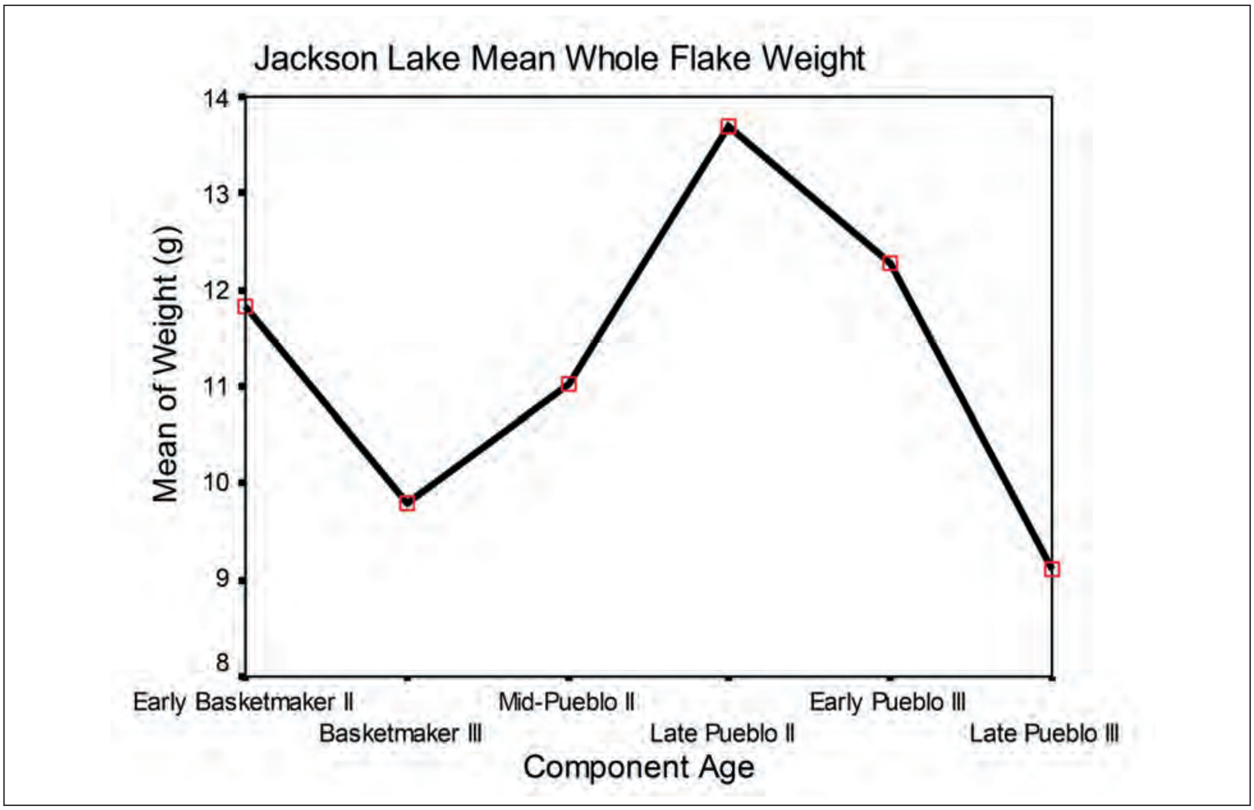


Figure 19.25b. Whole flakes, weight by time period; line chart.

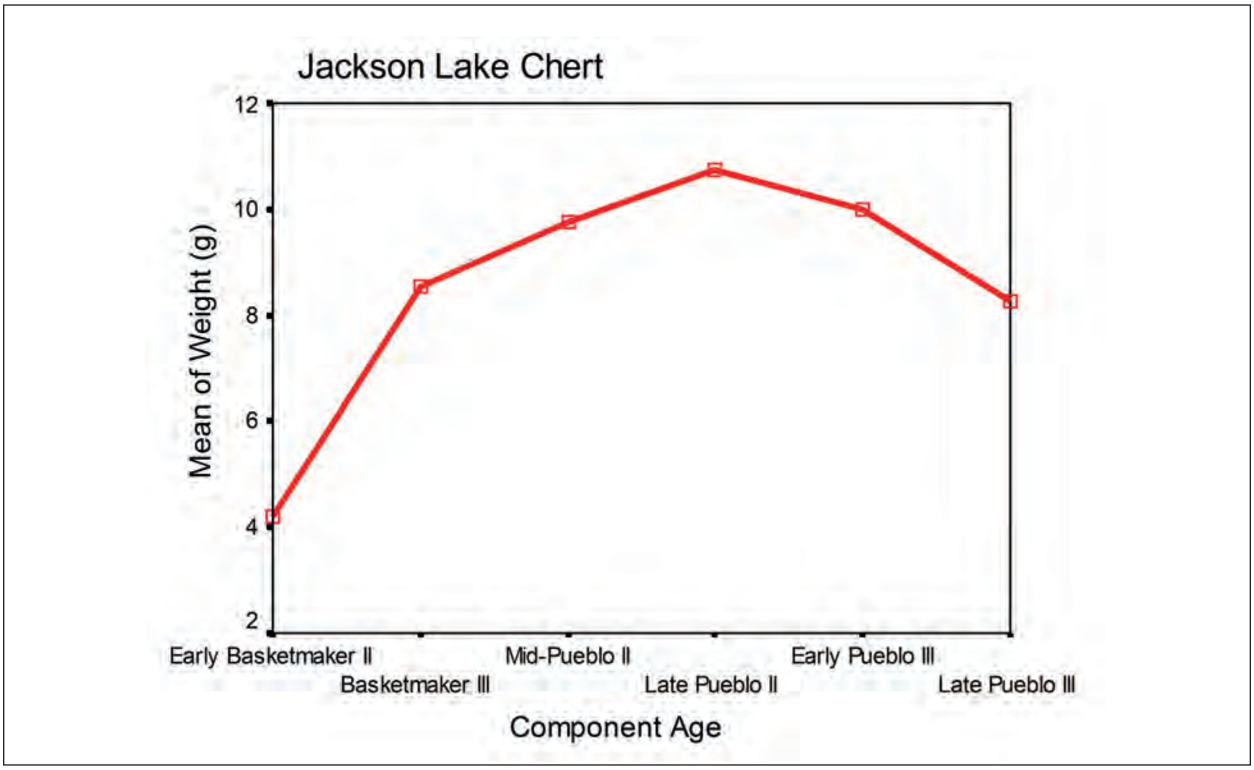


Figure 19.26a. Whole chert flakes, mean weight by time period.

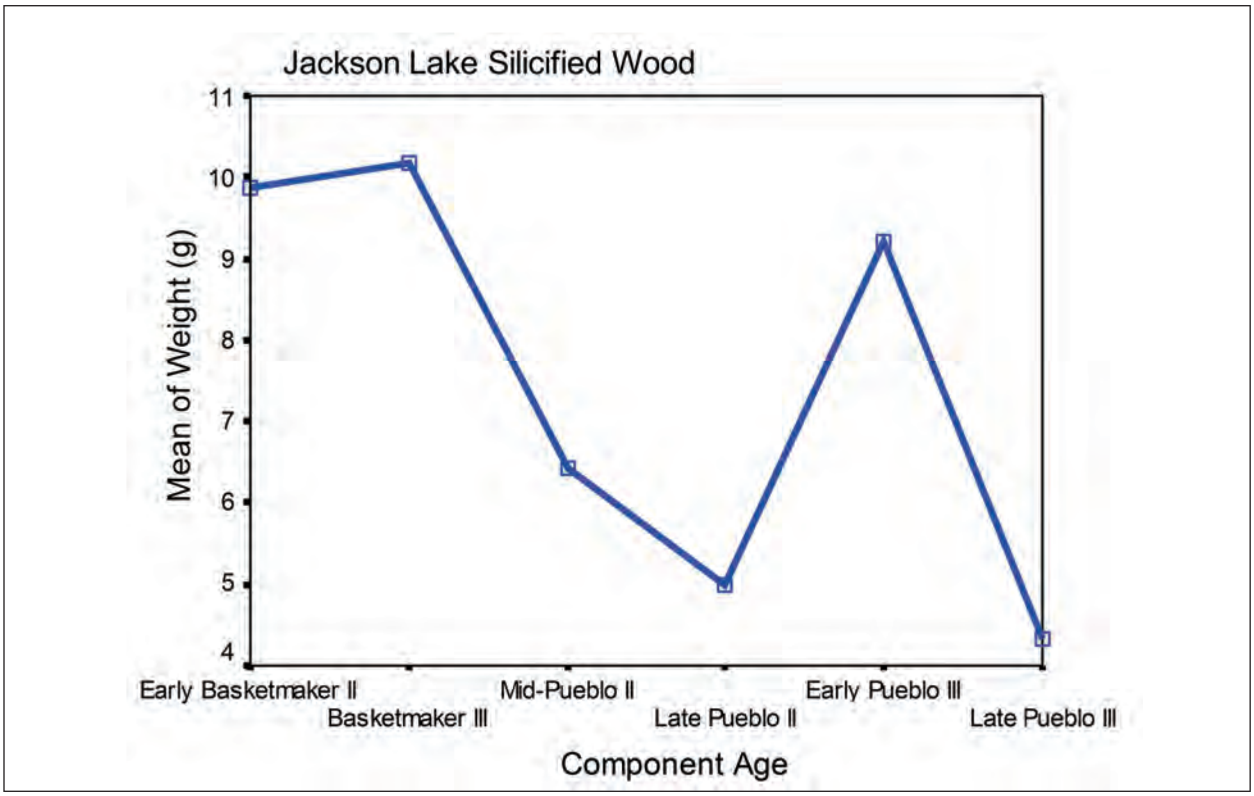


Figure 19.26b. Whole silicified wood flakes, mean weight by time period.

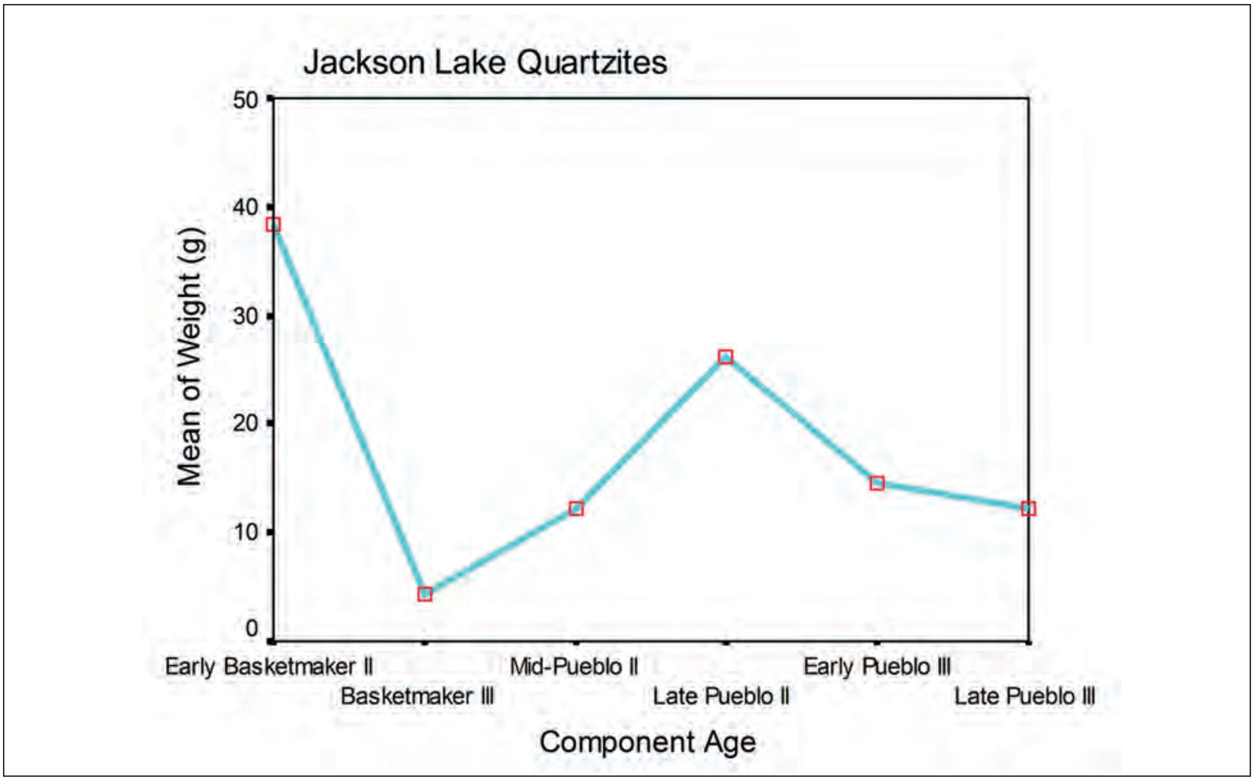


Figure 19.26c. Whole quartzite flakes, mean weight by time period.

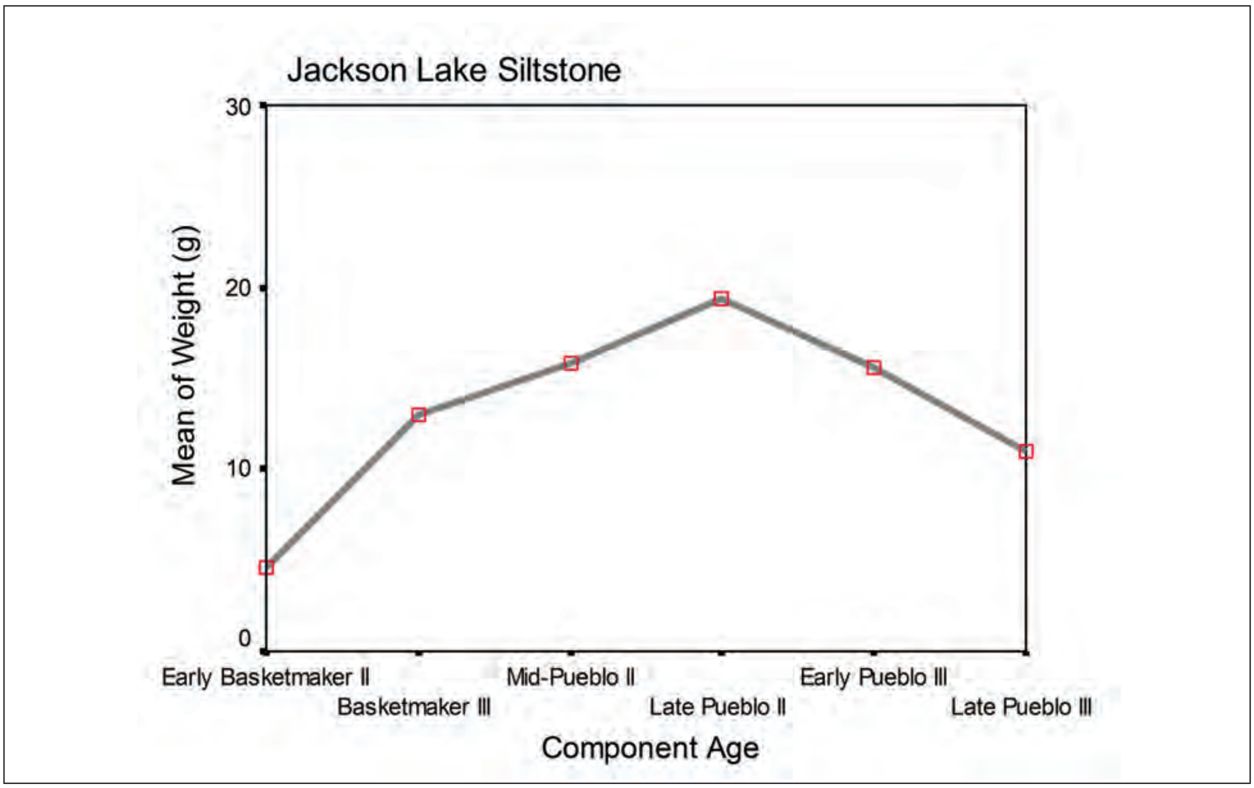


Figure 19.26d. Whole siltstone flakes, mean weight by time period.

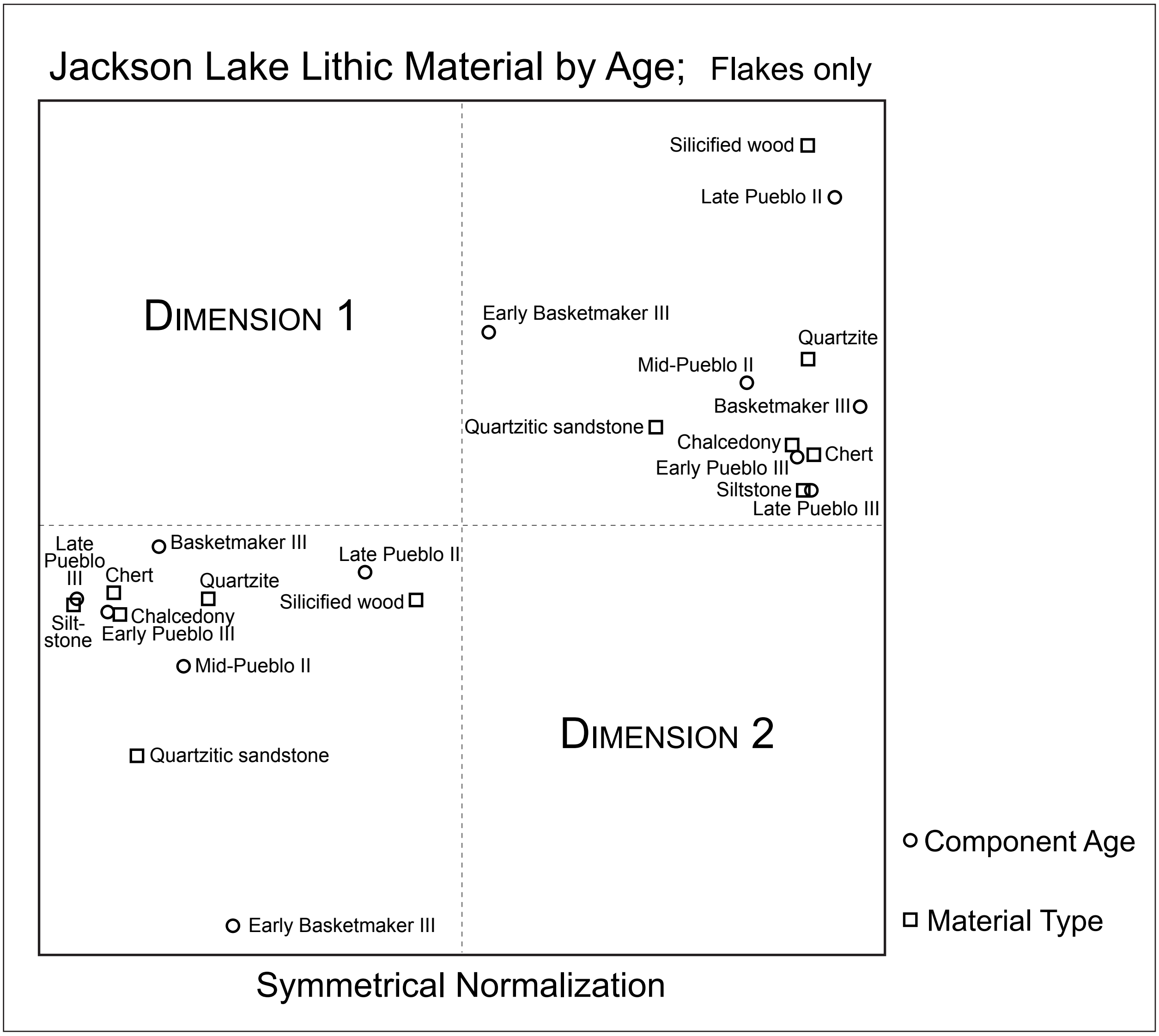


Figure 19.27. Major lithic material types by component age; correspondence analysis.

Projectile Point Style

As noted in the introduction, projectile points were among the tool categories separated for more detailed analysis. The point analysis selected hafting width and base outline, overall size and weight, and completeness as recordable and perhaps related to function. Lekson (1997:663) developed a series of point shapes for his analysis of Chaco projectile points. This system was modified somewhat to attempt to record primary shapes and avoid overly split groups, resulting in the categories seen in Tables 19.44, 19.45, 19.46, 19.47, 19.48, 19.49, 19.50, 19.51. The notching categories codify further variability in blade shape, base shape, degree of finish, and, of course, a nearly infinite number of other attributes (see, e.g., White 1963; Phagan 1988; Turnbow 1997:162–167).

Side-Notched Points

Of the 60 projectile points whose form could be identified, 63 percent are side-notched, and 17 percent are corner-notched (Tables 19.44, 19.48; Figs. 19.9, 19.11, 19.28 [a–e], 19.29 [a–k], 19.30 [a–e], 19.31 [a–e]). LA 37592, a predominantly late site, dominates the sample and provided most of the side-notched points, although most of the other, rarer point forms

Table 19.44. Projectile points and hafted tools, counts by time period.

Tool Type	Basketmaker III	Mid Pueblo II	Late Pueblo II	Early Pueblo III	Late Pueblo III	Total
Projectile Points						
Indeterminate	–	–	–	–	2	**2**
Stemmed	1	–	–	–	–	**1**
Basal notch	–	–	1	–	–	**1**
Unidentified small	–	1	–	–	1	**2**
Unidentified corner-notched	1	–	–	1	1	**3**
Unidentified side-notched	–	–	–	–	4	**4**
Large (early?) side-notched	–	–	1	–	–	**1**
Jay Point	1	–	–	–	–	**1**
En Medio Point	1	–	–	–	1	**2**
Unnotched	–	–	1	–	–	**1**
Stemmed, long tangs	–	–	–	1	–	**1**
Corner-notched l>w	1	1	–	–	1	**3**
Side-notched convex	–	–	1	–	2	**3**
Side-notched straight	–	–	1	–	12	**13**
Side-notched concave	–	–	–	1	1	**2**
Total	**5**	**2**	**5**	**3**	**25**	**40**
Ground and Chipped Hafted Tool Types						
Notched maul	–	2	–	–	–	**2**
Grooved maul	3	1	–	–	–	**4**
Weight	–	1	–	–	–	**1**
Axe	–	1	–	–	1	**2**
One-notch axe	–	1	–	–	–	**1**
Two-notch axe	–	3	4	–	3	**10**
Full-grooved axe	–	1	–	–	2	**3**
Hoe	–	–	1	–	–	**1**
Tchamahia	–	1	1	1	6	**9**
Total	**3**	**11**	**6**	**1**	**12**	**33**

were also recovered from that site. Although the samples of points from sites are relatively small, almost every site that contained points has several different forms. The 14 straight-based, side-notched points from LA 37592 constitute by far the largest site-type group. Although the overall variability is not great, this dispersion of types suggests multiple knappers at sites and, again, expediency in lithic production. Similarly, there is a dispersion of point forms and quality of workmanship among raw material groups, further suggesting a low level of organization of tool production (Tables 19.14, 19.47).

Unfortunately, most of the samples of classifiable points from well-dated proveniences are small, with by far the largest group in the final period (Tables 19.44; Fig. 19.28 [a–e]). Removing the large, probably early points, there is a tendency for corner-notched points to be early and for small side-notched points to be absent in earlier contexts. Corner-notched points continue to occur in later contexts because of recycling or continued use, but their manufacture may also have continued. We have no way of determining which process is in effect for given points, but in the case of ceramic styles we generally assume that, after relatively brief transitions, styles are replaced. Following this assumption, the corner-notched points in post–Early Pueblo II contexts were probably made earlier and kept in service or found and reused.

Sizes within late side-notched points are quite consistent across groups defined by basal shape (Table 19.45; Figs. 19.30 [a–e], 19.31 [a–e]). Weights, lengths, and widths are all rather similar among side-notched points. Within corner- and side-notched points, length correlates significantly with all dimensions except internotch distance; the strongest correlation is between length and weight (Fig. 19.32). Internotch distance correlates only with width and weight (Table 19.46). There is much more variability, however, in the internotch distance of

Table 19.45. Projectile point dimensions (mm) and weights (g), whole dimensions only.

Tool Type	Mean	Count	Standard Deviation	Minimum	Maximum	Median
Weight (g)						
Stemmed	4.23	1	–	4.23	4.23	4.23
Basal notch	1.27	1	–	1.27	1.27	1.27
Unidentified side-notched	0.51	3	0.004	0.48	0.55	0.49
Large (early?) side-notched	4.50	2	0.636	4.05	4.95	4.50
Jay point	18.83	1	–	18.83	18.83	18.83
En Medio point	4.15	2	1.789	2.88	5.41	4.15
Unnotched	1.31	1	–	1.31	1.31	1.31
Stemmed, long tangs	0.61	2	0.240	0.44	0.78	0.61
Corner-notched l>w	0.64	2	0.276	0.44	0.83	0.64
Corner-notched convex base	1.73	1	–	1.73	1.73	1.73
Side-notched convex	0.79	9	0.419	0.11	1.51	0.78
Side-notched straight	0.77	16	0.356	0.37	1.38	0.67
Side-notched concave	0.74	4	0.275	0.40	1.01	0.78
Total	**1.58**	**45**	**2.893**	**0.11**	**18.83**	**0.78**
Length (mm)						
Stemmed	46.44	1	–	46.44	46.44	46.44
Basal notch	23.56	1	–	23.56	23.56	23.56
Unidentified side-notched	18.76	3	0.672	18.06	19.40	18.82
Large (early?) side-notched	39.46	2	2.510	37.68	41.23	39.46
Jay point	82.02	1	–	82.02	82.02	82.02
En Medio point	39.96	2	5.897	35.79	44.13	33.96
Unnotched	42.81	1	–	42.81	42.81	42.81
Stemmed, long tangs	20.22	2	0.071	20.17	20.27	20.22
Corner-notched l>w	25.82	2	2.991	23.70	27.93	25.82
Corner-notched convex base	32.37	1	–	32.37	32.37	32.37
Side-notched convex	22.41	9	5.497	13.57	29.24	23.17
Side-notched straight	23.77	16	5.238	15.35	31.66	24.22
Side-notched concave	24.31	4	5.649	17.26	29.47	25.25
Total	**26.97**	**45**	**11.507**	**13.57**	**82.02**	**23.70**
Width (mm)						
Stemmed	15.43	1	–	15.43	15.43	15.43
Basal notch	21.06	1	–	21.06	21.06	21.06
Eccentric	11.68	1	–	11.68	11.68	11.68
Unidentified small	10.11	4	1.124	9.29	11.75	9.71
Unidentified corner-notched	13.69	2	0.799	13.12	14.25	13.69
Unidentified side-notched	11.66	6	0.500	11.12	12.51	11.67
Large (early?) side-notched	20.01	2	0.778	19.46	20.56	20.01
Jay point	27.37	1	–	27.37	27.37	27.37
En Medio point	21.93	2	1.881	20.60	23.26	21.93
Unnotched	13.18	3	2.084	11.00	15.15	13.40
Stemmed, long tangs	12.72	3	1.248	11.40	13.88	12.88
Corner-notched l>w	11.38	4	1.792	9.70	13.49	11.17
Corner-notched convex base	14.09	1	–	14.09	14.09	14.09
Side-notched convex	11.37	9	2.374	6.95	15.94	11.53
Side-notched straight	12.31	18	1.451	10.39	15.60	12.21
Side-notched concave	12.93	4	1.321	11.00	13.91	13.40
Total	**13.07**	**62**	**3.491**	**6.95**	**27.37**	**12.18**

Table 19.45 (continued)

Tool Type	Mean	Count	Standard Deviation	Minimum	Maximum	Median
Thickness (mm)						
Indeterminate	2.70	3	0.647	2.30	3.45	2.36
Stemmed	6.78	1	–	6.78	6.78	6.78
Basal notch	3.18	1	–	3.18	3.18	3.18
Eccentric	2.63	1	–	2.63	2.63	2.63
Unidentified point	2.66	3	0.842	1.89	3.56	2.54
Unidentified small	2.51	5	0.562	1.85	3.35	2.34
Unidentified corner-notched	2.78	4	0.499	2.28	3.36	2.73
Unidentified side-notched	2.45	6	0.686	1.25	3.28	2.60
Large (early?) side-notched	6.12	2	1.110	5.33	6.90	6.12
Jay point	7.50	1	–	7.50	7.50	7.50
En Medio point	4.55	2	0.149	4.44	4.65	4.55
Unnotched	2.50	3	0.286	2.27	2.82	2.41
Stemmed, long tangs	3.03	3	0.715	2.31	3.74	3.04
Corner-notched l>w	3.11	4	0.643	2.67	4.05	2.87
Corner-notched convex base	4.15	1	–	4.15	4.15	4.15
Side-notched convex	3.20	10	1.118	1.07	4.83	3.20
Side-notched straight	2.62	18	0.521	1.83	3.57	2.47
Side-notched concave	2.81	4	0.523	2.47	3.58	2.59
Total	**3.05**	**72**	**1.156**	**1.07**	**7.50**	**2.72**
Internotch Distance (mm)						
Stemmed	9.80	1	–	9.80	9.80	9.80
Basal notch	12.65	1	–	12.65	12.65	12.65
Unidentified small	5.78	3	0.322	5.55	6.15	5.65
Unidentified corner-notched	5.65	2	0.141	5.55	5.75	5.65
Unidentified side-notched	7.15	5	1.266	5.85	9.00	6.95
Large (early?) side-notched	14.58	2	2.298	12.95	16.20	14.58
Jay point	22.60	1	–	22.60	22.60	22.60
En Medio point	14.25	2	1.909	12.90	15.60	14.25
Stemmed, long tangs	5.75	3	0.656	5.15	6.45	5.65
Corner-notched l>w	5.04	4	0.716	4.10	5.75	5.15
Corner-notched convex base	6.30	1	–	6.30	6.30	6.30
Side-notched convex	7.87	10	1.755	4.95	9.95	7.88
Side-notched straight	7.52	18	0.875	5.00	9.10	7.58
Side-notched concave	7.46	4	0.668	6.90	8.35	7.30
Total	**7.98**	**57**	**3.136**	**4.10**	**22.60**	**7.30**

side-notched points with convex bases than there is in the larger group of straight-based points (Fig. 19.33). Corresponding to this variability in width at the hafting point is greater mean thickness and more variability in thickness.

Corner-Notched Points

Corner-notched points are surprisingly rare at Jackson Lake (Fig. 19.29 [a–k]; Tables 19.44, 19.45, 19.51). Two nicely made, delicate corner-notched points are from the upper fill of Pit Structure 1 at LA 60751 (Basketmaker III), a context most likely to date around AD 700. Although this site had occupations subsequent to the Basketmaker structure, the context of the points is unlikely to be mixed, and we associate the points with the terminal stages of the structure. Both points from LA 60749, contiguous with the south edge of LA 37592, are corner-notched and made from the same distinctive white chalcedony with red and black inclusions (looking similar to Pedernal chert, but not fluorescent under black light, a test that works for Pedernal, but also other materials; J. L. Moore, personal communication, 2003). Sherds from this site are, on the whole,

Table 19.46. Projectile points, correlations among metric variables, whole corner- and side-notched points only.

		Internotch Distance (mm)	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)
Internotch distance (mm)	Pearson Correlation	1	0.327	0.510	0.333	0.442
	Significance (2-tailed)	–	0.059	0.002	0.054	0.009
	Count	34	34	34	34	34
Length (mm)	Pearson Correlation	0.327	1	0.663	0.634	0.887
	Significance (2-tailed)	0.059	–	0	0	0
	Count	34	34	34	34	34
Width (mm)	Pearson Correlation	0.510	0.663	1	0.427	0.674
	Significance (2-tailed)	0.002	0	–	0.012	0
	Count	34	34	34	34	34
Thickness (mm)	Pearson Correlation	0.333	0.634	0.427	1	0.786
	Significance (2-tailed)	0.054	0	0.012	–	0
	Count	34	34	34	34	34
Weight (g)	Pearson Correlation	0.442	0.887	0.674	0.786	1
	Significance (2-tailed)	0.009	0	0	0	–
	Count	34	34	34	34	34

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 19.47. Subjective point workmanship categories, counts by material type.

	Crude	Expedient	Workmanlike	Good	Fine	Exquisite	Heirloom	Fine Heirloom	Unobserved	Total
Chert	–	1	4	3	2	–	–	1	1	**12**
Chert, Pedernal	–	–	–	–	–	–	1	–	–	**1**
Chert, Narbona Pass	–	2	1	1	–	1	–	–	–	**5**
Chalcedony	–	5	7	2	–	–	1	–	2	**17**
Silicified wood	–	3	5	4	–	–	–	–	1	**13**
Silicified wood, yellow-brown jasper	3	6	3	5	1	–	–	–	2	**20**
Obsidian, Jemez	–	–	2	1	–	–	–	–	–	**3**
Quartzite	–	2	–	2	2	–	1	–	–	**7**
Total	**3**	**19**	**22**	**18**	**5**	**1**	**3**	**1**	**6**	**78**

Early Pueblo III, including more organic-painted than mineral-painted vessels and very few earlier types. Accounting for these points is thus difficult, although they could also have been surface finds by the occupants of the site.

Stylistically Early Points

There is a small but distinctive group of points that closely resemble tools from much earlier periods. Most of these were probably found and recycled by the residents of the sites we excavated. Some may also have been made at the sites we excavated, probably for purposes other than projectile points, but we assume that the majority were actually made at much earlier times.

The assemblage of materials on the floor of the Basketmaker III pithouse at LA 60751 is the most stylistically diverse of all. One of the most striking items in the Jackson Lake lithic assemblage is a beautifully made tool from this floor (Fig. 19.20b [a]; Table 19.51). This artifact, made from black chert by percussion and abundant pressure flaking, has shoulders above a 4.1 cm long hafting element, the sides of which are ground. The overall length is 8.3 cm, extremely close to a very similarly shaped artifact from Pueblo Bonito, which Judd (1954:367,

Table 19.48. Chipped stone formal and large hafted tools, counts by major provenience.

	Roomblock	Pit Structure	Extramural Area	Total
Formal Tools				
Indeterminate	1	2	–	**3**
Stemmed	–	1	–	**1**
Basal notch	1	–	–	**1**
Eccentric	1	–	–	**1**
Unidentified point	2	–	1	**3**
Unidentified small	2	4	–	**6**
Unidentified corner-notched	–	3	1	**4**
Unidentified side-notched	1	4	1	**6**
Large (early?) side-notched	2	–	–	**2**
Jay point	–	1	–	**1**
En Medio point	–	2	–	**2**
Unnotched	–	–	4	**4**
Stemmed, long tangs	–	2	1	**3**
Corner-notched longer	–	4	–	**4**
Corner-notched convex base	–	–	1	**1**
Side-notched convex	3	5	2	**10**
Side-notched straight	2	12	4	**18**
Side-notched concave	–	3	1	**4**
Knife	1	2	–	**3**
Serrated knife	–	1	–	**1**
Straight-sided drill	–	1	1	**2**
Total	**16**	**47**	**17**	**80**
Percent	20.0%	58.8%	21.3%	
Large Hafted Tools				
Notched maul	1	2	2	**5**
Grooved maul	–	4	–	**4**
Weight	1	–	–	**1**
Axe	–	3	1	**4**
One-notch axe	–	–	1	**1**
Two-notch axe	7	11	6	**24**
Three-fourths grooved axe	1	–	–	**1**
Full-grooved axe	–	3	1	**4**
Hoe	1	–	–	**1**
Notched hoe	–	–	1	**1**
Tchamahia	3	7	4	**14**
Total	**14**	**30**	**16**	**60**
Percent	23.3%	50.0%	26.7%	

Table 19.49. Formal tools, counts and percents by stratigraphic context and major provenience.

	Roomblock		Pit Structure		Extramural Area		Total	
	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %
General structure fill	5	31.3%	5	10.6%	–	–	**10**	**12.5%**
Upper fill above roof	–	–	34	72.3%	–	–	**34**	**42.5%**
Roofing material	–	–	3	6.4%	–	–	**3**	**3.8%**
Extramural fill	3	18.8%	–	–	14	82.4%	**17**	**21.3%**
Floor fill	–	–	2	4.3%	–	–	**2**	**2.5%**
Surface or floor	3	18.8%	3	6.4%	1	5.9%	**7**	**8.8%**
Ground surface	5	31.3%	–	–	2	11.8%	**7**	**8.8%**
Total	**16**	**100.0%**	**47**	**100.0%**	**17**	**100.0%**	**80**	**100.0%**

Table 19.50. Chipped stone formal and large hafted tools, counts by type and stratigraphic context.

	General Fill	Above Roof	Below Roof	Roofing	Extramural Area	Floor Fill	Floor	Surface	Total
Formal Tools									
Indeterminate	2	2	–	–	1	–	–	1	**6**
Stemmed	–	–	–	1	–	–	–	–	**1**
Basal notch	–	–	–	–	–	–	1	–	**1**
Eccentric	–	–	–	–	1	–	–	–	**1**
Unidentified small	1	3	–	–	1	–	–	1	**6**
Unidentified corner-notched	–	1	–	1	1	1	–	–	**4**
Unidentified side-notched	–	4	–	–	2	–	–	–	**6**
Large (early?) side-notched	1	–	–	–	–	–	–	1	**2**
Jay Point	–	–	–	–	–	–	1	–	**1**
En Medio Point	–	1	–	1	–	–	–	–	**2**
Unnotched	–	–	–	–	4	–	–	–	**4**
Stemmed, long tangs	–	2	–	–	1	–	–	–	**3**
Corner-notched longer	3	–	–	–	–	–	1	–	**4**
Corner-notched convex base	–	–	–	–	–	–	1	–	**1**
Side-notched convex	1	4	–	–	2	1	–	2	**10**
Side-notched straight	2	11	–	–	3	–	1	1	**18**
Side-notched concave	–	2	–	–	1	–	1	–	**4**
Knife	–	3	–	–	–	–	1	–	**4**
Straight-sided drill	–	1	–	–	–	–	–	1	**2**
Total	**10**	**34**	**–**	**3**	**17**	**2**	**7**	**7**	**80**
Large Hafted Tools									
Notched maul	1	1	–	1	1	–	–	1	**5**
Grooved maul	–	–	–	–	–	–	4	–	**4**
Weight	1	–	–	–	–	–	–	–	**1**
Axe	2	–	–	–	–	–	1	1	**4**
One-notch axe	1	–	–	–	–	–	–	–	**1**
Two-notch axe	6	4	2	1	4	1	3	3	**24**
Three-fourths grooved axe	1	–	–	–	–	–	–	–	**1**
Full-grooved axe	1	1	–	–	1	–	1	–	**4**
Hoe	–	–	–	–	–	–	1	–	**1**
Notched hoe	–	–	–	–	1	–	–	–	**1**
Tchamahia	4	4	–	–	–	1	1	4	**14**
Total	**17**	**10**	**2**	**2**	**7**	**2**	**11**	**9**	**60**

Plate 28g) reports at 3 1/4 in (8.26 cm) long. The La Plata artifact is somewhat narrower (2.7 cm vs. 3.1 cm). I believe that it is an Archaic artifact, found and treasured by the inhabitants of this pit structure, and then left as part of a structure-closing ceremony. It has the general shape of a Jay point (Irwin-Williams 1973), but James L. Moore suggests that the workmanship and use of pressure flaking do not correspond with the normal definition of this style, which is generally less fine (see Turnbow 1997:171). The hafting element of the tool is thick (0.82 cm), and Moore suggests that this item may have been a well-crafted knife from Basketmaker times rather than a curated heirloom or find. Perhaps unwisely, I disagree with Moore and argue that this tool is in fact Archaic in origin. The shape is correct, the workmanship is in a class different from almost all the rest of the tools, and the basal edges are ground. Though it is somewhat longer, the other dimensions of this tool are also close to those of a Jay point found in the Jemez Mountains (Turnbow 1997:171).

The collection of points from LA 60751 is truly eclectic and provides some useful stylistic information. In addition to the possible Archaic point on the floor, there are two large points (Fig. 19.20b [b, c]) from lower fill contexts and two very much

Table 19.51. Chipped stone formal tools, counts by type and site.

	LA 37591	LA 37592	LA 37593	LA 37594	LA 37595	LA 37598	LA 60747	LA 60749	LA 60751	Total
Indeterminate	–	3	–	–	–	–	–	–	–	**3**
Stemmed	–	–	–	–	–	–	–	–	1	**1**
Basal notch	–	–	1	–	–	–	–	–	–	**1**
Eccentric	–	–	–	–	–	1	–	–	–	**1**
Unidentified point	–	–	3	–	–	–	–	–	–	**3**
Unidentified small	1	2	1	–	1	1	–	–	–	**6**
Unidentified corner-notched	–	2	–	–	–	–	–	1	1	**4**
Unidentified side-notched	–	5	–	–	–	1	–	–	–	**6**
Large side-notched	–	–	2	–	–	–	–	–	–	**2**
Jay point	–	–	–	–	–	–	–	–	1	**1**
En Medio point	–	1	–	–	–	–	–	–	1	**2**
Unnotched	–	1	2	–	–	–	–	–	–	**3**
Stemmed, long tangs	–	1	–	–	–	–	–	1	1	**3**
Corner-notched 1>w	1	–	–	–	1	1	–	–	1	**4**
Corner-notched convex	–	1	–	–	–	–	–	–	–	**1**
Side-notched convex	–	5	2	2	–	1	–	–	–	**10**
Side-notched straight	1	14	1	–	–	1	1	–	–	**18**
Side-notched concave	1	3	–	–	–	–	–	–	–	**4**
Knife	–	2	1	–	–	–	–	–	–	**3**
Serrated knife	–	1	–	–	–	–	–	–	–	**1**
Straight-sided drill	–	–	2	–	–	–	–	–	–	**2**
Total	**4**	**41**	**15**	**2**	**2**	**6**	**1**	**2**	**6**	**79**

smaller, very delicate corner-notched points from upper fill (Fig. 19.20b [d]). The stemmed dart point might be an Armijo stemmed point (see Turnbow 1997:175–177) but most closely matches Turnbow's (1997:199) "indeterminate dart" point, and the corner-notched point (Fig. 19.20b [c]) is most similar to the En Medio style. We must be careful not to overinterpret the collection of an early point collector, but given the excellent dating of this structure (built in AD 654 and used until 695), we are provided with an idea of when the transition between these two distinctive styles may have taken place. Presumably the corner-notched points were in use at or just after terminal use of the structure, while the larger points (probably used with atlatls) were in use when the structure was established (Fig. 19.20b [a–d]). If this argument is correct, the beautiful "Jay point" was most likely collected by an occupant and saved for its significance, since Jay points are thought to have been made only until about 3000 BC. There are no side-notched points from LA 60751. The En Medio point from LA 60751 may also be an heirloom, since the style seems to end at about AD 400 (Turnbow 1997:186), a couple of centuries before this structure was established. The floor assemblage from the floor of Pit Structure 1 is not large, but it includes a bowl with a figure (Fig. 11.16[b]; possibly a shaman?), mauls, pieces of selenite with pigment, and an unusual array of points.

Other likely heirlooms include En Medio points from the LA 37592 midden (Fig. 19.20b [e]) and Pit Structure 1 at LA 60751, large side-notched points from LA 37593 (Fig. 19.20b [f]), an exotic basally notched point from LA 37593 (Fig 19.20b [g]), a large stemmed point from the lower fill of Pit Structure 1 at LA 60751 (possibly an Armijo point), and the possible Jay point (Fig. 19.20b [a]). Armijo (1800 to 800 BC; Turnbow 1997) and En Medio (1000 BC to 400 AD) points are readily attributable to chance finds from the surrounding areas, where abundant Archaic sites are now known. The context of the En Medio point at LA 60751 potentially falls outside the production span, but only by a couple of hundred years—certainly an heirloom in our society, but perhaps just a conservative knapper in the 600s. The En Medio point from the much later context at LA 37592 (post-1150) is much more likely to be an heirloom. It is particularly interesting as the only

Figure 19.28 [a–e]. Points with identifiable forms from dated proveniences (heirloom points not included): a. Basketmaker III–Pueblo I (LA 60751); b. mid Pueblo II (LA 37598); c. late Pueblo II (LA 37593); d. early Pueblo III (LA 37592, LA 60749); and, e. late Pueblo III (LA 37591, LA 37592).

Figure 19.29 [a–k]. Corner-notched points, by material and location found: a. quartzite (LA 37591, Pit Structure 1, Layer 2); b. chert (LA 37592, Pit Structure 1 midden, Layer 5); c. yellow-brown silicified wood (LA 37592, Pit Structure 1, Layer 28); d. yellow-brown silicified wood (LA 37592, Extramural Area 2); e. chert (LA 37595, Pit Structure 3, Layer 1); f. chalcedony (LA 37598, Room 102); g. Pedernal chert (LA 60749, Extramural Area 3); h. chert (LA 60749, Pit Structure 1, Floor 2); i. silicified wood (LA 60751, Pit Structure 1, Layer 1); j. chert (LA 60751, Pit Structure 1, Floor 4); k. chert (LA 60751, Pit Structure 1 fill).

piece of Pedernal chert in the collection. Not only is the style unusual, but the material fits well with the more peripatetic lifestyle assumed for the Archaic period.

Other Notable Assemblages Containing Points

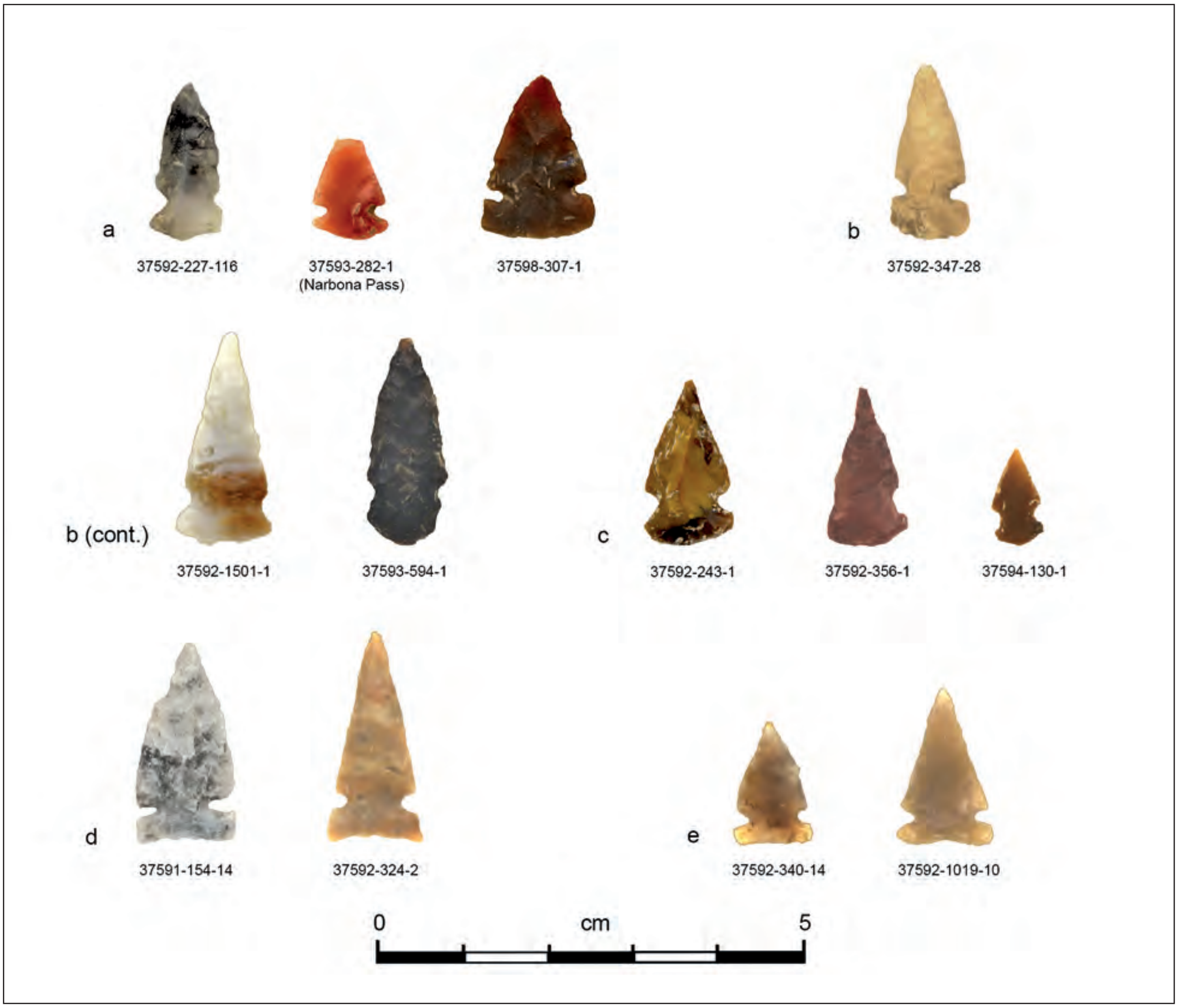
Room 103, LA 37593, was interesting both for suggestive features—a possible tunnel to a provenience outside the right-of-way—and the assemblage of unusual items. Lithics include a stunning, long, slender point with small side notches, a square base, and possible drill use at the tip (Fig. 19.13 [b]). The material was identified as Narbona Pass chert, although the material is highly translucent and could easily be some other pink chalcedony; it is not "classic" Narbona Pass chert. LA 37593 is unusual, however, in that a number of formal tools made from Narbona Pass chert are present in the assemblage.

Also from this provenience are the following:

1. A basal-notched white chalcedony point, possibly Coal Creek, a type defined for western Colorado (Fig. 19.20b [g]; Buckles 1971:1185, 1220). The Coal Creek phase dates to AD 700–1300 and is thus partially contemporaneous. This point is unlike forms shown by Turnbow (1997) for the Jemez Mountains or Lekson (1997) for Chaco, but it is similar to one found on the Dolores Project (Phagan 1988:86, 2G.52-l, 5MT5107).

2. A well-crafted, gray quartzite very large point or knife (tip only; Fig. 19.10 [a]).

3. Coincidentally or otherwise, there are two broken points, both parts of which were found in this roomblock: a small side-notched point (Fig. 19.31 [e]: FS 668-1; PP 1), and FS 626-1. Both parts of broken points are rarely recovered, and here there are two from two adjacent rooms. This roomblock



19.30 [a–e]. Side-notched points. Convex base (a., b., and c., left to right): a. chalcedony (LA 37592), Narbona Pass chert (LA 37593), silicified wood (LA 37598); b. silicified wood (LA 37592, LA 37593); c. yellow-brown silicified wood (LA 37592, LA 37594). Concave base (d. and e., left to right): d. chert (LA 37591, LA 37592); e. chalcedony (LA 37592).

(especially Room 103) contained a number of unusual items in addition to this distinctive collection of points. Also present were malachite and turquoise; a small, probably specialized miniature slab metate (Chapter 20, Vol. 2, this report: Fig. 20.13); two complete two-hand manos; two axes; anvils; a slab that appears to have been used next to the fire; two vessels; and an entryway to an unknown, unexcavated feature.

4. The Pit Structure 1 midden at LA 37592 dominates the Jackson Lake collections in most categories; this is true of projectile points and to a lesser extent formal tools, containing over a fourth of all formal tools from this project segment. Most of the points dated to Late Pueblo III come from the midden, as do most of the side-notched points with straight bases, as well as an heirloom point, a knife, and a denticulate biface.

Spatial Trends

Formal tools follow general material distributions by being most commonly found in pit structures; the same pattern is visible in large hafted tools, although they are somewhat more abundant in extramural areas and less common in rooms (Table 19.48). Within pit structures, the majority of formal tools were recovered from upper fills, rather than

19.31 [a–e]. Side-notched points with straight bases, by material and location found: a. chert (three points from LA 37592, Pit Structure 1; left to right, points are from Layer 5; Level 2; and Layer 3 respectively); b. chalcedony (two points from LA 37592; left point is from Extramural Area 3; right is from Pit Structure 1 fill); c. quartzite (three points from LA 37592; left to right points are from Pit Structure 1, midden Layer 2; Room 203; and Pit Structure 1, midden, Layer 5); and silicified wood (far right; from LA 60747, Extramural Area 1, Level 3); d. quartzite (left point is from LA 37592, Pit Structure 1 fill; right is from LA 37598 Extramural Area 1 surface); e. yellow-brown silicified wood (left to right, the first five points are from LA 37592 [the far left point is from Extramural Area 4; the next is from Pit Structure 1 fill, Level 5; the three to its right are also from Pit Structure 1 fill—from midden Layers 1, 5, 3 respectively]; the far right point is from LA 37593, Room 103, Floor 2).

in floor contexts (Tables 19.49, 19.50). Perhaps because of shallower fills or perhaps because of location of use (probably some of each), artifacts are more likely to be in floor contexts in rooms than in pit structures or extramural areas. Use of formal tools in pit structures clearly took place, but the function of pit structures as receptacles for discard overshadows the occurrence of tools in use context. The larger size of axes and tchamahias does not seem to affect location of deposition, although whole tchamahias—which are very rare—were found only in apparently special spaces (Tables 19.48, 19.50). Counts of artifacts in floor and floor fill contexts suggest much higher counts of in situ materials (Table 19.29). The large numbers come primarily from debitage in feature fills, which are likely in most cases to be further examples of discard or floor sweeping, rather than direct use. The debitage

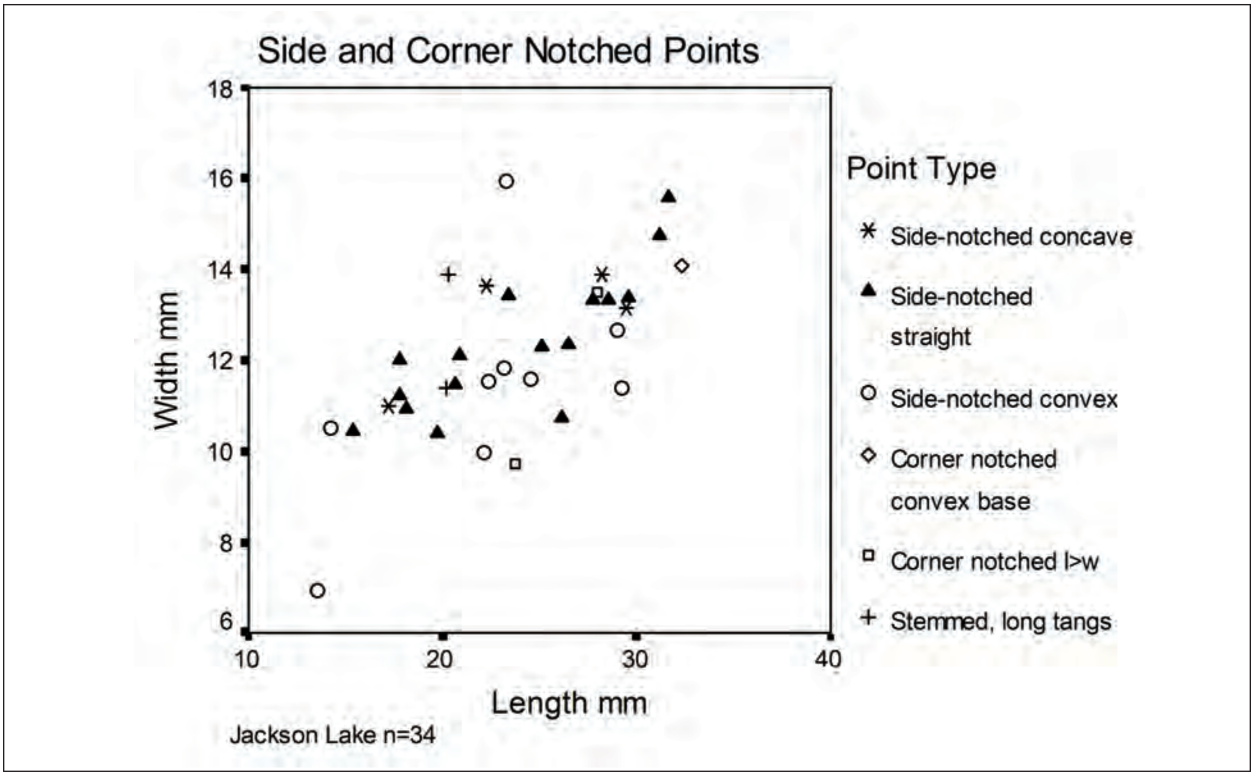


Figure 19.32. Side- and corner-notched points, length by width and indicating different point styles (n = 34); plot.

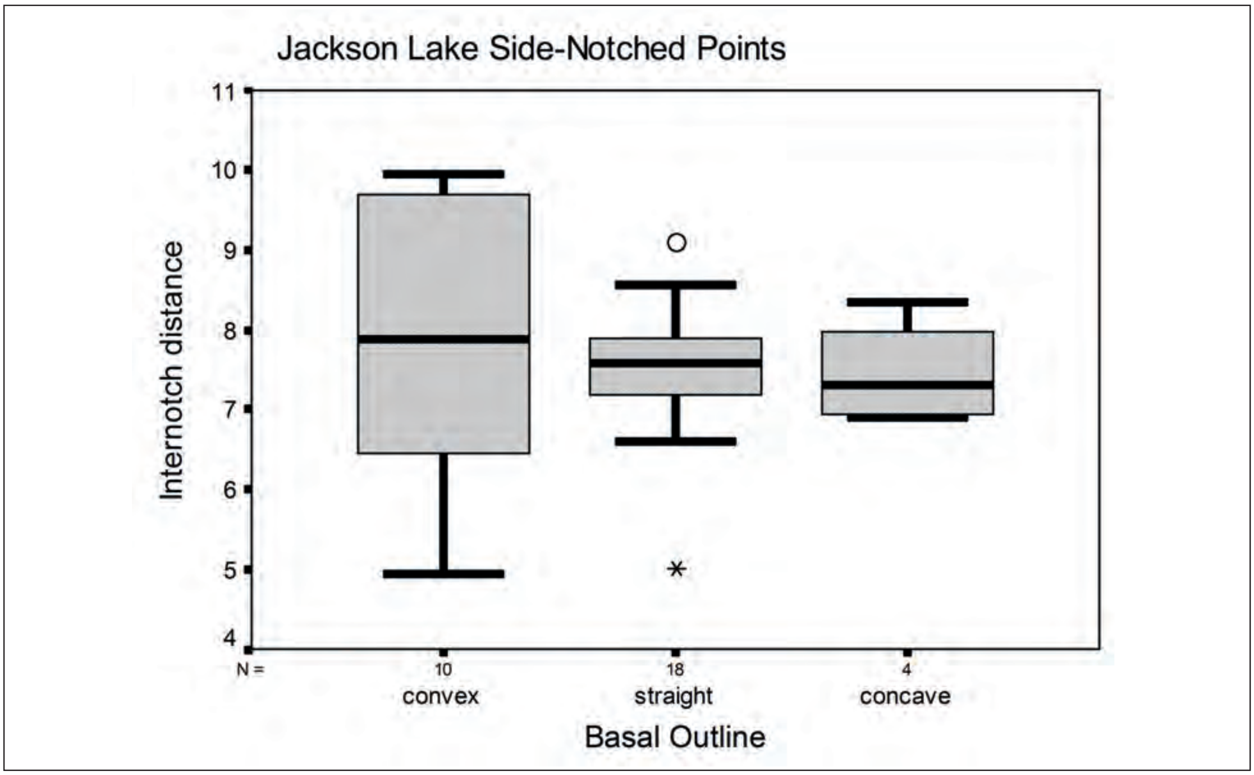


Figure 19.33. Side-notched points, distance between notches by base shape; box plot.

may well be by-products of stone working on the structure floor, but may not be direct evidence of activity on the floor.

Chipped Stone Tools at Jackson Lake: Conclusions

Chipped stone from Jackson Lake is evidence of great industry and activity, if not great devotion of time to careful shaping of stone tools. Some of the abundance of chipped stone no doubt results from the ready accessibility of raw material. With replacement edges so readily at hand, there was little reason to be particularly careful with expediently produced tools. This accessibility of material is an important aspect of the assemblage, leading to larger numbers of pieces and larger pieces. The profile of heavy use of siltstone—probably the most abundant material in large nodules—for much of the disposable edge use, and the use of finer-grained materials such as chert and chalcedony for finer work such as small retouch, is similar to sites in Mancos Canyon, another river originating in the La Plata Mountains (Gillespie 1976:148).

Material sources of chipped stone follow patterns seen in other materials, especially ceramics. Identifiable exotic materials from as far away as the Jemez Mountains and as near as the Chuska Valley are present, but in very small quantities. Evidence for participation in larger social systems is largely stylistic. Projectile point styles follow regional trajectories, but this conformity is expressed in local materials. Narbona Pass chert seems to have had particular significance in Chaco Canyon during the latter 1000s, when activity in Chaco was its greatest (Cameron 2001), and evolving exchange relationships are also evident in obsidian in Chaco, where obsidian is especially notable in pre-900 and post-1100 contexts. The distances between the Narbona Pass source and Chaco and the La Plata Valley are comparable, but this material is scarce in the La Plata Valley, suggesting different valuation of the material and perhaps restricted access to it. Unlike Chaco Canyon, the La Plata did not participate in obsidian exchange in any period represented in our materials.

Although abundant materials are close at hand, is it possible to define community and site uses? In one sense it is, since siltstone was more heavily used in Barker Arroyo sites and chert at Jackson Lake sites. It appears that this difference can be explained largely by proximity to source, since Jackson Lake is nearer to chert and silicified wood sources, and siltstone predominates in the terrace deposits around Barker Arroyo. Residents of the valley obviously understood the qualities of materials available and where to find them. The use of given materials for certain tasks is consistent: quartzite and siltstone for heavy tasks and hammering, and siliceous materials for smaller, finer work. These choices are conditioned not only by the working qualities of the stone, but also by the size of the raw material. Residents of La Plata communities must have applied a calculus between workability and predictability (better with chert and silicified wood), size (siltstone and quartzite larger), accessibility (chert and silicified wood closer at Jackson Lake), and the job at hand (see Chapman 1977:450).

It is likely that any resident of La Plata villages that were big enough to do so engaged in lithic tool production and use. A much smaller part of the populace were skilled stone workers who produced fine chipped and ground tools, some for special use in special contexts, and some for daily use by themselves and those able to acquire their products.

20 Ground Stone, Large Hafted Tools, Other Ground Stone, and Ornaments

H. Wolcott Toll and Laurel Wallace

Ground stone tools from Jackson Lake sites fit conformably within Basketmaker and Pueblo II–III assemblages. Ground stone comprises a number of tool groups. The majority by count and weight relate to the central pueblo processes of food preparation, primarily grinding of maize, although grinding of other materials and shaping by grinding entered into many activities in both formalized and informal ways. Sites in the Jackson Lake community range in age from the middle sixth century to about AD 1300. During that entire span, maize agriculture and processing were fundamental to pueblo life. Other ground stone tools include axes and mauls used in construction and field preparation, and tchamahias—a much rarer tool type, which probably also functioned in agriculture, perhaps in tilling; at least some examples probably had special significance. Stone ornaments are also classified as ground stone. This chapter focuses on grinding tools, though it also deals with other types of artifacts included in the ground stone analysis. Hafted tools and ornaments have been analyzed separately; while included with the summaries of the Jackson Lake artifacts in this chapter, they are also covered in the La Plata synthesis volume (Vol. 6, this report; see Larralde and Schlanger, and Wallace, respectively), which addresses the full scope of the La Plata Highway project.

The Assemblage

Eight hundred sixty-eight items of all categories of ground stone weighing a total of 829 kg were collected from Jackson Lake excavations (Tables 20.1, 20.2, 20.3, 20.4). Due to the variety of artifact types, weights of individual specimens range from 1 g to over 54 kg. Few ground stone items come

Table 20.1. Ground stone, by site; counts, weight (g), and percents.

Site	Count	Col. %	Weight (g)	Col. %
LA 37591	37	4.3%	11,646.0	1.4%
LA 37592	296	34.1%	176,561.0	21.3%
LA 37593	160	18.4%	224,009.0	27.0%
LA 37594	115	13.2%	117,051.0	14.1%
LA 37595	77	8.9%	128,647.0	15.5%
LA 37596	1	0.1%	650.0	0.1%
LA 37597	1	0.1%	300.0	0.0%
LA 37598	142	16.4%	114,980.0	13.9%
LA 60749	7	0.8%	2219.0	0.3%
LA 60751	29	3.3%	52,670.0	6.4%
LA 60752	3	0.3%	363.0	0.0%
Total	**868**	**100.0%**	**829,096.0**	**100.0%**

Table 20.2. Ground stone, material types; counts, weight (g), and percents.percents.

	Count	Col. %	Weight (g)	Col. %
Silicified wood	1	0.1	1.0	0
Igneous	34	3.9	28,511.0	3.4
Tuff	1	0.1	18.0	0
Granite	91	10.5	55,593.0	6.7
Sedimentary	1	0.1	1000.0	0.1
Travertine	3	0.3	3.0	0
Sandstone	559	64.4	635,569.0	76.7
Siltstone	60	6.9	23,077.0	2.8
Mudstone	1	0.1	1.0	0
Shale	56	6.5	574.0	0.1
Metamorphic	1	0.1	791.0	0.1
Quartzite	11	1.3	8523.0	1
Quartzitic sandstone	32	3.7	75,161.0	9.1
Turquoise	1	0.1	1.0	0
Malachite	1	0.1	1.0	0
Massive quartz	3	0.3	195.0	0
Selenite	7	0.8	52.0	0
Hematite	1	0.1	5.0	0
Jet	3	0.3	17.0	0
Crinoid stem	1	0.1	3.0	0
Total	**868**	**100**	**829,096.0**	**100**

Table 20.3. Ground stone, tool types; counts, weight (g), and percents.

	Count	Col. %	Weight (g)	Col. %
Indeterminate fragment	14	1.6%	1548.0	0.2%
Indeterminate	1	0.1%	610.0	0.1%
Pottery polishing stone	6	0.7%	1321.0	0.2%
Plaster polishing stone	10	1.2%	4972.0	0.6%
Abrading stone	11	1.3%	3621.0	0.4%
Shaft straightener	1	0.1%	229.0	0.0%
Shaped slab	119	13.7%	55,392.0	6.7%
Sandal last	1	0.1%	494.0	0.1%
Jar cover	15	1.7%	4071.0	0.5%
Anvil	7	0.8%	8728.0	1.1%
Pitted pounding stone	4	0.5%	3004.0	0.4%
Palette	2	0.2%	2070.0	0.2%
Lapidary stone	12	1.4%	28,842.0	3.5%
Bowl or basin	1	0.1%	3.0	0.0%
Mano	214	24.7%	61,206.0	7.4%
One-hand mano	28	3.2%	13,447.0	1.6%
Two-hand mano	112	12.9%	101,032.0	12.2%
Two-hand trough mano	18	2.1%	15,702.0	1.9%
Two-hand slab mano	71	8.2%	98,505.0	11.9%
Two-hand loaf mano	2	0.2%	2350.0	0.3%
Metate	26	3.0%	12,534.0	1.5%
Basin metate	1	0.1%	910.0	0.1%
Trough metate	16	1.8%	61,751.0	7.4%
Ends-open trough	2	0.2%	77,291.0	9.3%
One-end-open trough	1	0.1%	13,800.0	1.7%
Slab metate	33	3.8%	218,062.0	26.3%
Miniature metate	1	0.1%	2200.0	0.3%
Notched maul	5	0.6%	4550.0	0.5%
Grooved maul	3	0.3%	4050.0	0.5%
Weight	1	0.1%	2100.0	0.3%
Axe	3	0.3%	3386.0	0.4%
One-notch axe	1	0.1%	800.0	0.1%
Two-notch axe	23	2.6%	10,210.0	1.2%
Three-fourths grooved axe	1	0.1%	1550.0	0.2%
Full-grooved axe	4	0.5%	2558.0	0.3%
Notched hoe	1	0.1%	700.0	0.1%
Tchamahia	15	1.7%	1505.0	0.2%
Wedge	1	0.1%	2800.0	0.3%
Paint stone	3	0.3%	44.0	0.0%
Lightning stone	3	0.3%	195.0	0.0%
Ornament	37	4.3%	264.0	0.0%
Pendant	31	3.6%	164.0	0.0%
Bead	4	0.5%	4.0	0.0%
Pipe	1	0.1%	18.0	0.0%
Concretion	1	0.1%	500.0	0.1%
Fossil	1	0.1%	3.0	0.0%
Total	**868**	**100.0%**	**829,096.0**	**100.0%**

Table 20.4. Ground stone tool types, counts by site.

	LA 37591	LA 37592	LA 37593	LA 37594	LA 37595	LA 37598	LA 60749	LA 60751	Total
Indeterminate fragment	1	7	1	1	2	2	–	–	**14**
Indeterminate	–	–	–	–	–	1	–	–	**1**
Pottery polishing stone	–	1	1	2	1	–	–	1	**6**
Plaster polishing stone	–	3	4	2	1	–	–	–	**10**
Abrading stone	1	2	5	2	–	–	–	–	**10**
Shaft straightener	–	–	–	1	–	–	–	–	**1**
Shaped slab	8	59	23	14	7	7	1	–	**119**
Sandal last	–	–	–	–	–	1	–	–	**1**
Jar cover	–	5	4	–	–	4	1	1	**15**
Anvil	1	1	2	–	–	–	–	2	**6**
Pitted pounding stone	–	–	–	1	–	–	–	3	**4**
Palette	–	–	–	–	1	1	–	–	**2**
Lapidary stone	–	4	5	–	2	1	–	–	**12**
Bowl or basin	–	1	–	–	–	–	–	–	**1**
Mano	12	68	23	35	14	55	1	4	**212**
One-hand mano	1	3	10	4	4	6	–	–	**28**
Two-hand mano	–	44	24	10	12	15	3	2	**110**
Two-hand trough mano	–	4	4	5	1	5	–	–	**19**
Two-hand slab mano	2	10	24	14	7	12	–	3	**72**
Two-hand loaf mano	–	–	1	–	–	–	–	1	**2**
Metate	3	6	3	5	1	8	–	–	**26**
Basin metate	–	–	–	–	–	1	–	–	**1**
Trough metate	–	5	3	1	5	1	–	1	**16**
Ends-open trough metate	–	–	–	–	2	–	–	–	**2**
One-end-open trough metate	–	–	–	–	–	1	–	–	**1**
Slab metate	1	9	8	6	2	6	–	1	**33**
Miniature metate	–	–	1	–	–	–	–	–	**1**
Notched maul	–	2	–	2	1	–	–	–	**5**
Grooved maul	–	–	–	–	1	–	–	2	**3**
Weight	–	–	–	1	–	–	–	–	**1**
Axe	1	–	–	–	–	2	–	–	**3**
One-notch axe	–	–	–	1	–	–	–	–	**1**
Two-notch axe	1	9	5	1	3	4	–	–	**23**
Three-fourths grooved axe	–	1	–	–	–	–	–	–	**1**
Full-grooved axe	1	2	1	–	–	–	–	–	**4**
Notched hoe	–	1	–	–	–	–	–	–	**1**
Tchamahia	2	6	2	1	1	2	1	–	**15**
Wedge	–	–	1	–	–	–	–	–	**1**
Paint stone	–	1	–	–	2	–	–	–	**3**
Lightning stone	–	–	–	–	1	–	–	2	**3**
Ornament	1	25	3	–	–	2	–	5	**36**
Pendant	1	17	2	3	3	4	–	1	**31**
Bead	–	–	–	1	3	–	–	–	**4**
Pipe	–	–	–	1	–	–	–	–	**1**
Concretion	–	–	–	1	–	–	–	–	**1**
Fossil	–	–	–	–	–	1	–	–	**1**
Total	**37**	**296**	**160**	**115**	**77**	**142**	**7**	**29**	**863**

Artifacts from LA 37596 (1), LA 37597 (1), and LA 60752 (3) not shown.

from primary or use contexts; most are from discard or reuse. More than 60 percent of the assemblage (by count or weight) is assigned to grinding functions: manos and metates. Manos are by far the most numerous category. Three-quarters of the ground stone comes from the four closely spaced Pueblo II–III sites (LA 37592, LA 37593, LA 37594, and LA 37595), and nearly half is from just LA 37592 and LA 37593 (Tables 20.1, 20.4). Like most artifact categories, the LA 37592 collection contains the largest material count because of the dense midden found in the pit structure there, but LA 37593 accounts for a greater mass of material (224 kg).

The material was analyzed according to the OAS standardized ground stone analysis manual (OAS Staff 1994) with only very minor modifications. Most ground stone was separated in the field, with verification in the lab. Each item was recorded individually, with attributes, dimensions, and weight entered into the database. Extensive checking and correction of the data set were performed during the analysis.

Grinding Tools

Manos

Hand-held grinding tools were divided into several categories based on size, shape, and probable use. Most manos in these sites were designed to be used with large, fixed metates, and are considered two-hand manos, further divided into trough manos, slab manos, loaf-shaped manos, and two-hand manos without further specification. Tools falling into the more generic categories, such as "mano" or "two-hand mano," are usually incomplete and therefore impossible to classify further, whereas most more fully identified tools are complete in three dimensions (Table 20.5).

One-Hand Manos

One-hand manos are smaller in size and number than two-hand manos: about 6 percent of the total grinding tool assemblage. Generally, one-hand manos are considered characteristic of earlier, more mobile strategies, but these tools probably had special functions rather than being older tools. One-hand manos average 109 by 81 by 31 mm, while the average of all complete two-hand manos from Jackson Lake is 202 by 112 by 41 mm (Table 20.6; Figs. 20.1, 20.2). One-hand manos are predominantly unshaped and unsharpened (Table 20.7; see also Cameron 1997:1003), and predominantly oval in plan outline (Table 20.8). This form is especially abundant at LA 37593—seven were found on the floor of Pit Structure 1. Twenty-six of 33 one-hand manos were made from cobbles, primarily flat ones, and the majority of surface cross sections are flat. Far more one-hand manos are oval than other

Table 20.5. Grinding tools, mano and metate types by completeness; counts and percents.

	Fragment		Thickness Intact		Width and Thickness Intact		Whole*		Total	
	Count	Row%	Count	Row%	Count	Row%	Count	Row%	Count	Col. %
Mano	14	6.5%	137	64.0%	60	28.0%	3	1.4%	**214**	**40.8%**
One-hand mano	–	–	3	10.7%	5	17.9%	20	71.4%	**28**	**5.3%**
Two-hand mano	–	–	16	14.5%	54	49.1%	40	36.4%	**110**	**21.0%**
Two-hand trough mano	–	–	1	5.3%	5	26.3%	13	68.4%	**19**	**3.6%**
Two-hand slab mano	–	–	5	6.9%	19	26.4%	48	66.7%	**72**	**13.7%**
Two-hand loaf mano	–	–	–	–	1	50.0%	1	50.0%	**2**	**0.4%**
Metate	1	3.8%	25	96.2%	–	–	–	–	**26**	**5.0%**
Basin metate	–	–	1	100.0%	–	–	–	–	**1**	**0.2%**
Trough metate	1	6.3%	14	87.5%	–	–	1	6.3%	**16**	**3.1%**
Ends-open trough	–	–	–	–	–	–	2	100.0%	**2**	**0.4%**
One-end-open trough	–	–	–	–	–	–	1	100.0%	**1**	**0.2%**
Slab metate	–	–	16	48.5%	10	30.3%	7	21.2%	**33**	**6.3%**
Total	**16**	**3.1%**	**218**	**41.6%**	**154**	**29.4%**	**136**	**26.0%**	**524**	**100.0%**

* Includes one metate with length and thickness intact.

Table 20.6. Manos (whole only), mean dimensions (mm), counts, and weights (g) by type.

	Mean	Count	Standard Deviation	Median	Minimum	Maximum
Length (mm)						
Mano	95.7	3	25.1	87.0	76.0	124.0
One-hand mano	114.1	20	20.7	113.5	76.0	151.0
Two-hand mano	195.2	42	31.8	198.5	128.0	262.0
Two-hand trough mano	199.3	12	16.8	198.5	174.0	235.0
Two-hand slab mano	209.4	47	24.7	204.0	162.0	272.0
Two-hand loaf mano	220.0	1	–	220.0	220.0	220.0
Total	**185.8**	**125**	**44.2**	**198.0**	**76.0**	**272.0**
Width (mm)						
Mano	87.4	63	27.1	88.0	33.0	136.0
One-hand mano	83.6	25	15.7	82.0	61.0	120.0
Two-hand mano	109.4	96	14.0	110.0	66.0	138.0
Two-hand trough mano	107.1	17	12.8	110.0	89.0	125.0
Two-hand slab mano	114.0	66	18.1	120.0	46.0	153.0
Two-hand loaf mano	91.0	2	25.5	91.0	73.0	109.0
Total	**102.7**	**269**	**22.2**	**107.0**	**33.0**	**153.0**
Thickness (mm)						
Mano	33.6	200	14.8	30.5	4.0	86.0
One-hand mano	32.7	28	8.1	32.5	18.0	57.0
Two-hand mano	38.8	112	14.1	35.5	16.0	81.0
Two-hand trough mano	33.2	18	5.3	32.0	23.0	43.0
Two-hand slab mano	41.4	71	14.6	41.0	13.0	91.0
Two-hand loaf mano	47.5	2	3.5	47.5	45.0	50.0
Total	**36.2**	**431**	**14.3**	**35.0**	**4.0**	**91.0**
Weight (g)						
Mano	340.0	3	115.3	300.0	250.0	470.0
One-hand mano	547.5	20	315.8	498.0	196.0	1500.0
Two-hand mano	1263.3	42	606.9	1052.5	550.0	2750.0
Two-hand trough mano	1022.3	12	344.5	898.5	350.0	1600.0
Two-hand slab mano	1675.1	47	835.0	1500.0	520.0	5300.0
Two-hand loaf mano	1650.0	1	–	1650.0	1650.0	1650.0
Total	**1261.4**	**125**	**762.1**	**1100.0**	**196.0**	**5300.0**

types, and the cobble source also shows up in the higher frequency of biconvexity (Tables 20.9, 20.10). Though there is a variety of grain size, they tend to be fine grained (Table 20.7).

Two-Hand Manos

Most of the grinding that took place at these sites was done with two-hand manos. Two types of metates were in use: trough metates and slab metates. The manos used with these "netherstones" (Adams 2002:143) can be distinguished by the shape of the outer edges of the tool, either curved from contact with the trough or flat from contact with a slab netherstone (Fig. 20.3 [a–b]). There is, however, a substantial group that are two-hand manos by virtue of their size and shape, but which cannot be confidently assigned to either "slab" or "trough." Slab manos on the whole are larger than manos used in trough metates, averaging 9 mm shorter (Fig. 20.1; Table 20.6). Slab manos are also more variable than trough manos. Obviously the unspecified two-hand mano group contains manos of both kinds and is an even more variable group. On the whole, however, the dimensions of this group are more like those of trough manos, indicating that there were probably more trough metates in use than slab metates.

At site after site there is a strong tendency for

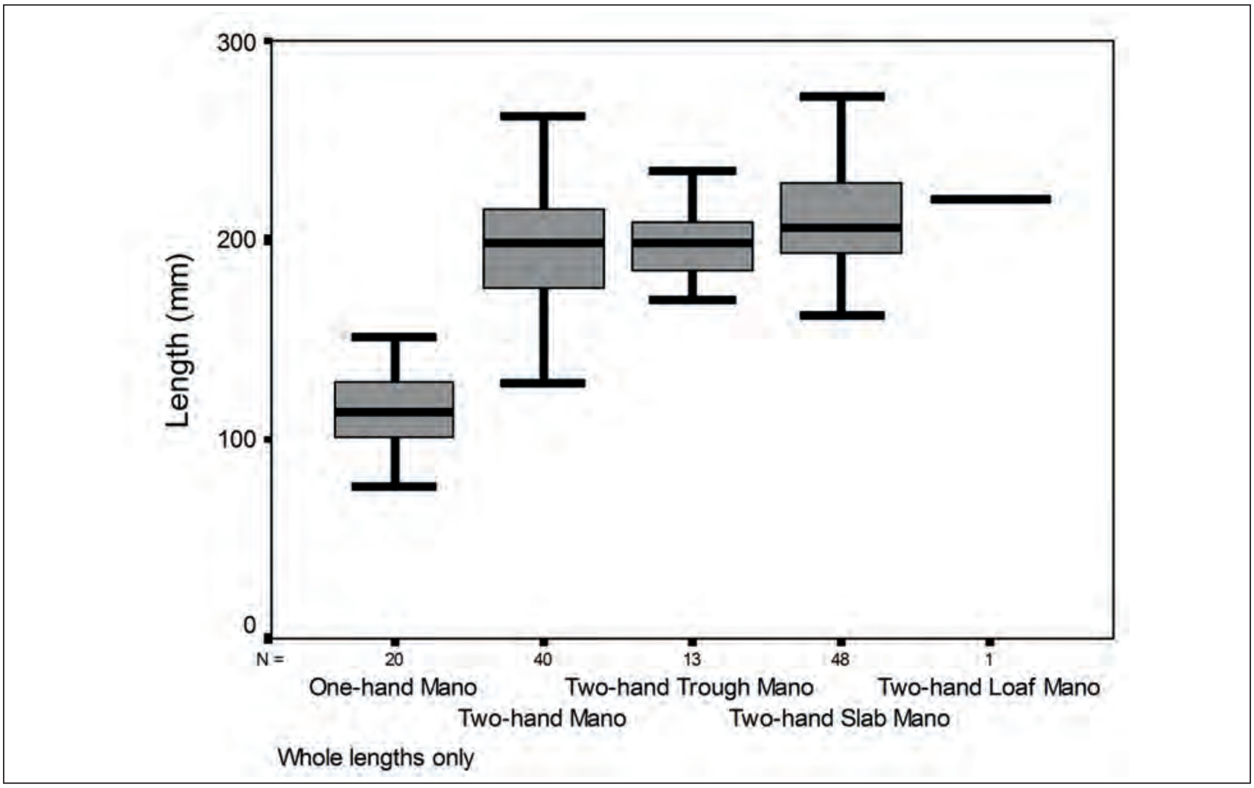


Figure 20.1. Box plot, manos, counts by type and length, whole dimensions only. Solid bar in the center of the boxes is the mean value.

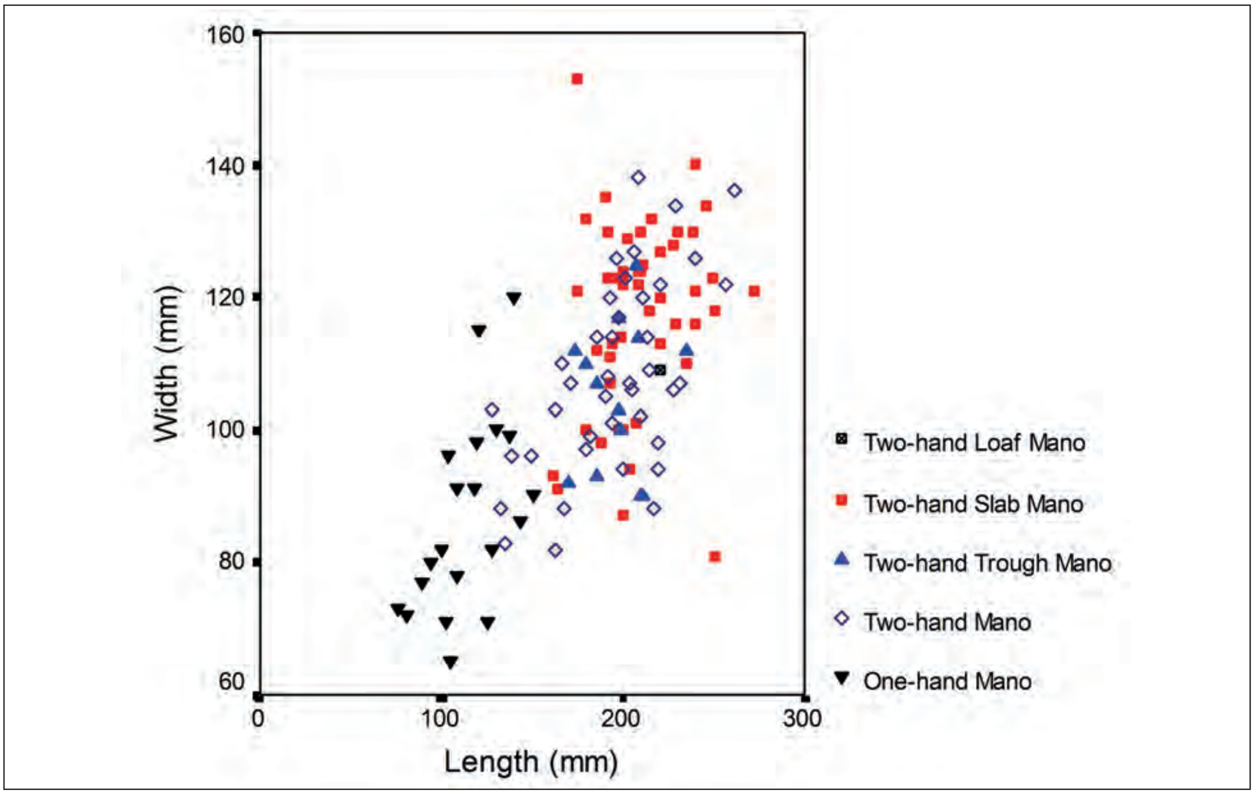


Figure 20.2. Scatter plot, manos, lengths by widths of whole manos, with mano type keyed.

Table 20.7. Manos (all), production and material attributes by mano type, counts and percents.

	Mano		One-hand Mano		Two-hand Mano		Trough Mano		Slab Mano		Loaf Mano		Total	
	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %
Preform Morphology														
Indeterminate	115	53.7%	3	10.7%	15	13.4%	11	61.1%	34	47.9%	–	–	**178**	**40.0%**
Round cobble	4	1.9%	4	14.3%	10	8.9%	–	–	–	–	1	50.0%	**19**	**4.3%**
Angular chunk	2	0.9%	–	–	1	0.9%	–	–	–	–	–	–	**3**	**0.7%**
Flat cobble	78	36.4%	17	60.7%	77	68.8%	1	5.6%	21	29.6%	1	50.0%	**195**	**43.8%**
Slab	2	0.9%	2	7.1%	–	–	–	–	6	8.5%	–	–	**10**	**2.2%**
Thick slab	–	–	–	–	–	–	–	–	1	1.4%	–	–	**1**	**0.2%**
Thin slab	–	–	–	–	–	–	–	–	3	4.2%	–	–	**3**	**0.7%**
Very thin slab	13	6.1%	2	7.1%	9	8.0%	6	33.3%	6	8.5%	–	–	**36**	**8.1%**
Total	**214**	**100.0%**	**28**	**100.0%**	**112**	**100.0%**	**18**	**100.0%**	**71**	**100.0%**	**2**	**100.0%**	**445**	**100.0%**
Production Input														
Indeterminate	50	23.4%	–	–	–	–	–	–	1	1.4%	–	–	**51**	**11.5%**
None	61	28.5%	17	60.7%	25	22.3%	–	–	4	5.6%	–	–	**107**	**24.0%**
Slightly modified	90	42.1%	9	32.1%	82	73.2%	6	33.3%	38	53.5%	1	50.0%	**226**	**50.8%**
Mostly modified	10	4.7%	–	–	4	3.6%	5	27.8%	18	25.4%	1	50.0%	**38**	**8.5%**
Fully shaped	3	1.4%	2	7.1%	1	0.9%	7	38.9%	10	14.1%	–	–	**23**	**5.2%**
Total	**214**	**100.0%**	**28**	**100.0%**	**112**	**100.0%**	**18**	**100.0%**	**71**	**100.0%**	**2**	**100.0%**	**445**	**100.0%**
Shaping														
Indeterminate	47	22.0%	–	–	–	–	–	–	–	–	–	–	**47**	**10.6%**
None	64	29.9%	17	60.7%	25	22.3%	–	–	5	7.0%	–	–	**111**	**24.9%**
Grinding	11	5.1%	4	14.3%	4	3.6%	–	–	3	4.2%	–	–	**22**	**4.9%**
Flaking	10	4.7%	1	3.6%	9	8.0%	–	–	5	7.0%	–	–	**25**	**5.6%**
Pecking	33	15.4%	1	3.6%	22	19.6%	1	5.6%	17	23.9%	1	50.0%	**75**	**16.9%**
Grinding, flaking	12	5.6%	2	7.1%	8	7.1%	2	11.1%	9	12.7%	–	–	**33**	**7.4%**
Pecking, grinding, flaking	5	2.3%	–	–	13	11.6%	4	22.2%	3	4.2%	–	–	**25**	**5.6%**
Pecking, flaking	4	1.9%	1	3.6%	11	9.8%	3	16.7%	8	11.3%	–	–	**27**	**6.1%**
Pecking, grinding	28	13.1%	2	7.1%	20	17.9%	8	44.4%	21	29.6%	1	50.0%	**80**	**18.0%**
Total	**214**	**100.0%**	**28**	**100.0%**	**112**	**100.0%**	**18**	**100.0%**	**71**	**100.0%**	**2**	**100.0%**	**445**	**100.0%**
Material Texture														
Indeterminate	1	0.5%	–	–	–	–	–	–	1	1.4%	–	–	**2**	**0.4%**
Fine grain	117	54.7%	15	53.6%	57	50.9%	14	77.8%	40	56.3%	1	50.0%	**244**	**54.8%**
Medium grain	38	17.8%	6	21.4%	31	27.7%	2	11.1%	21	29.6%	–	–	**98**	**22.0%**
Coarse grain	58	27.1%	7	25.0%	24	21.4%	2	11.1%	9	12.7%	1	50.0%	**101**	**22.7%**

Table 20.7 (continued)

	Mano		One-hand Mano		Two-hand Mano		Trough Mano		Slab Mano		Loaf Mano		Total	
	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %
Total	**214**	**100.0%**	**28**	**100.0%**	**112**	**100.0%**	**18**	**100.0%**	**71**	**100.0%**	**2**	**100.0%**	**445**	**100.0%**
Surface Profile														
Indeterminate	2	0.9%	–	–	–	–	–	–	2	2.8%	–	–	**4**	**0.9%**
Flat	116	54.2%	16	57.1%	57	50.9%	4	22.2%	38	53.5%	–	–	**231**	**51.9%**
Concave	1	0.5%	1	3.6%	2	1.8%	1	5.6%	1	1.4%	–	–	**6**	**1.3%**
Convex	91	42.5%	11	39.3%	52	46.4%	13	72.2%	30	42.3%	2	100.0%	**199**	**44.7%**
Irregular	1	0.5%	–	–	–	–	–	–	–	–	–	–	**1**	**0.2%**
Faceted	3	1.4%	–	–	1	0.9%	–	–	–	–	–	–	**4**	**0.9%**
Total	**214**	**100.0%**	**28**	**100.0%**	**112**	**100.0%**	**18**	**100.0%**	**71**	**100.0%**	**2**	**100.0%**	**445**	**100.0%**
Sharpening														
No	152	71.0%	26	92.9%	36	32.1%	5	27.8%	16	22.5%	1	50.0%	**236**	**53.0%**
Yes	62	29.0%	2	7.1%	76	67.9%	13	72.2%	55	77.5%	1	50.0%	**209**	**47.0%**
Total	**214**	**100.0%**	**28**	**100.0%**	**112**	**100.0%**	**18**	**100.0%**	**71**	**100.0%**	**2**	**100.0%**	**445**	**100.0%**

two-hand manos to be around 200 mm long, with most being between 190 and 210 mm in the long dimension (Fig. 20.4). Profiles for each site are remarkably variable, however (Fig. 20.5). The outlying cases, at LA 37593 and LA 37598, are small, specialized manos (see below). LA 37593, with much the largest sample of complete manos, has the greatest variability, but also the largest mean size. The same consistency is indicated across time, though the samples from some periods are small (Fig. 20.6).

Relationships among dimensions of two-hand manos are somewhat surprising. Volume is of course a good predictor of weight, but length and width are not good predictors of weight; instead, thickness is much more strongly related to overall size (Figs. 20.6, 20.7). Manos identified as trough metate manos are considerably thinner than slab manos and much less variable (Table 20.6). Length and width are significantly correlated, but the correlation is surprisingly weak ($r = .443$) (Table 20.10). Even stranger, the correlations within specific types are still smaller: slab manos ($n = 46$) correlate at .173, and trough manos ($n = 12$) correlate at only .007. Within the less well-defined group, length and width correlate at .649 ($n = 41$). The smaller size and reduced variability of trough manos probably results from three interrelated causes: narrower grinding surface, greater wear (hence confident identification as trough manos), and less latitude in shape and size because of trough shapes. The lack of correlation between width and length indicates further that length was the critical dimension in trough manos.

Raw material types among the mano varieties reflect sizes and shapes of naturally occurring pieces and functional quality preferences. The materials found in one-hand manos are more diverse than in longer manos, at least in part due to the ready conversion of a cobble into a one-hand mano (Table 20.11). Thus, only 60 percent of the one-hand manos are sandstone, with substantial numbers of igneous and granitic materials. Two-hand manos are 79 percent sandstone; the only other material is "granite," primarily diorite, a common cobble material. Preference for sandstone results from the necessity of shaping longer, flatter manos, in addition to texture more suitable to grinding. Some dioritic manos in the assemblage have glassy surfaces where they have not been sharpened.

Table 20.8. Manos (whole only), plan-view outline (based on length and width of complete manos) by mano type; counts and percents.

	Mano		One-hand Mano		Two-hand Mano		Trough Mano		Slab Mano		Loaf Mano		Total	
	N	Col. %	N	Col. %	N	Col. %	N	Col. %	N	Col. %	N	Col. %	N	Col. %
Indeterminate	3	100.0%	1	5.0%	1	2.4%	–	–	–	–	–	–	**5**	**4.0%**
Circular	–	–	1	5.0%	–	–	–	–	1	2.1%	–	–	**2**	**1.6%**
Oval	–	–	11	55.0%	11	26.2%	–	–	5	10.6%	–	–	**27**	**21.6%**
Subrectangular	–	–	5	25.0%	22	52.4%	11	91.7%	26	55.3%	1	100.0%	**65**	**52.0%**
Irregular	–	–	1	5.0%	5	11.9%	–	–	4	8.5%	–	–	**10**	**8.0%**
Rectangular	–	–	–	–	3	7.1%	–	–	10	21.3%	–	–	**13**	**10.4%**
Subtriangular	–	–	1	5.0%	–	–	1	8.3%	1	2.1%	–	–	**3**	**2.4%**
Total	**3**	**100.0%**	**20**	**100.0%**	**42**	**100.0%**	**12**	**100.0%**	**47**	**100.0%**	**1**	**100.0%**	**125**	**100.0%**

N = count

Table 20.9. Manos (with complete widths only), cross-section shape by mano type; counts and percents.

	Mano		One-hand Mano		Two-hand Mano		Trough Mano		Slab Mano		Loaf Mano		Total	
	N	Col. %	N	Col. %	N	Col. %	N	Col. %	N	Col. %	N	Col. %	N	Col. %
Indeterminate	6	9.8%	–	–	1	1.0%	–	–	–	–	–	–	**7**	**2.6%**
Biconvex	19	31.1%	10	40.0%	29	30.2%	1	5.9%	12	18.5%	1	50.0%	**72**	**27.1%**
Convex concave	1	1.6%	2	8.0%	1	1.0%	1	5.9%	1	1.5%	–	–	**6**	**2.3%**
Dome	9	14.8%	5	20.0%	24	25.0%	–	–	11	16.9%	–	–	**49**	**18.4%**
Subrectangular	6	9.8%	4	16.0%	11	11.5%	–	–	9	13.8%	–	–	**30**	**11.3%**
Rectangular, square		0.0%	1	4.0%	2	2.1%	1	5.9%	8	12.3%	–	–	**12**	**4.5%**
Wedge	2	3.3%	–	–	1	1.0%	1	5.9%	2	3.1%	–	–	**6**	**2.3%**
Loaf	–	–	–	–	–	–	–	–	–	–	1	50.0%	**1**	**0.4%**
Irregular flat	–	–	1	4.0%	–	–	–	–	1	1.5%	–	–	**2**	**0.8%**
Irregular convex	–	–	–	–	–	–	1	5.9%	3	4.6%	–	–	**4**	**1.5%**
Triangle	–	–	–	–	3	3.1%	–	–	–	–	–	–	**3**	**1.1%**
Airfoil	14	23.0%	2	8.0%	15	15.6%	8	47.1%	11	16.9%	–	–	**50**	**18.8%**
Trapezoid	4	6.6%	–	–	9	9.4%	4	23.5%	7	10.8%	–	–	**24**	**9.0%**
Total	**61**	**100.0%**	**25**	**100.0%**	**96**	**100.0%**	**17**	**100.0%**	**65**	**100.0%**	**2**	**100.0%**	**266**	**100.0%**

N = count

Trough manos. Manos used in trough metates are the most completely shaped of all mano types. They are almost always rectangular in plan and are predominantly airfoil in cross section (Tables 20.8, 20.9). The trailing edge of trough manos would become thin enough that the tool was no longer functional (Fig. 20.8 [a–b]). The lateral sides of the grinding faces are distinctively curved or canted from contact with the sides of the trough (Fig. 20.3 [b]). The wear along the edges of metate troughs and the interfacing canted mano ends indicates that while the base of the trough and the bottom of the mano were kept sharp by pecking, the mano ends and trough sides were not. Trough walls and mano ends are often distinctly smoother than the other grinding faces. This suggests that less grinding took place at the margins of the trough and that sharpening was avoided to prolong the life of the fit of the interfacing tools.

Slab manos. Aside from grinding-surface morphology, slab manos are generally larger in all di-

Table 20.10. Two-hand manos (whole), correlations by dimensions (mm), weight (g), and volume (liters).

	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)	Volume (l)
Length (mm)					
Pearson Correlation	1	.419**	0.031	.432**	.480**
Sigma (2-tailed)	–	0	0.754	0	0
Count	102	102	102	102	102
Width (mm)					
Pearson Correlation	.419**	1	0.144	.530**	.544**
Sigma (2-tailed)	0	–	0.148	0	0
Count	102	102	102	102	102
Thickness (mm)					
Pearson Correlation	0.031	0.144	1	.732**	.834**
Sigma (2-tailed)	0.754	0.148	–	0	0
Count	102	102	102	102	102
Weight (g)					
Pearson Correlation	.432**	.530**	.732**	1	.887**
Sigma (2-tailed)	0	0	0	–	0
Count	102	102	102	102	102
Volume (l)					
Pearson Correlation	.480**	.544**	.834**	.887**	1
Sigma (2-tailed)	0	0	0	0	–
Count	102	102	102	102	102

** Correlation is significant at the 0.01 level (2-tailed).

mensions, much more likely to be rectangular in cross section, and less likely to be airfoil-shaped in section than trough manos (Figs. 20.1, 20.3 [a], 20.8, 20.9 [a–g]; Table 20.9). Though these manos also tend to be rectangular or subrectangular, there is greater freedom in outline (Table 20.8). Slab manos are much more abundant in the Jackson Lake collection than trough manos, in spite of the predominance of Mid Pueblo II ground stone in the collection. The mixture of slab and trough manos from the LA 37595 mealing room (Pit Structure 2) suggests that both types of metate may have been in use simultaneously. The single example of a complete two-hand "loaf" mano is a thick variety of a slab mano.

Specialized "manos." A small group of carefully shaped tools with lengths of around 130 mm show up clearly at the lower left of the length-width scatter plot (Fig. 20.2). Morphologically they look like two-hand manos (and were so coded in the analysis), but there are several subtle differences. The first is the length: they are too short to be used with two hands side by side, even for the most petite adult hands. Secondly, the flat surface of each is slightly concave. Also interesting is that they were found in two pairs: one pair from a Roomblock 1 floor at LA 37598 (Figs. 20.5, 20.10 [a–b]), the other from a large storage cist at LA 37593 (Figs. 20.5, 20.10 [c–d]). The LA 37593 storage cist contained a number of unusual items such as baskets, a corrugated jar filled with selenite, and other ground stone. The slight concavity of the main use-surface and the one-hand size of these tools suggest that they may have been used for an activity such as hide preparation. The two tools from LA 37598 appear to be reshaped pieces of a slab metate (quite possibly the same metate). The high points show some polishing, again suggesting use on materials such as hide. Both of these tools—which are 135 and 138 mm long—show some abrasion on the convex face opposite the slightly concave, flat face with squared edges. As discussed below, this roomblock is also a node for unusual artifacts, including tchamahias, a "sandal last" palette, and a possible pestle.

Two-Hand Manos as a Group

Most (69 percent) of the two-hand manos from Jackson Lake are rectangular or subrectangular in plan, and most (38 percent) have two flat surfaces (rectangular, subrectangular, and trapezoidal in section; Fig. 20.9). Of 179 two-hand manos with complete widths, 109 show some other use. Most (n = 105) of these second uses are as manos, indicating that over half of two-hand manos were used on two surfaces (Table 20.12). Slab manos tend to be wider and blockier than trough manos, which are more likely to be oblong (Figs. 20.2, 20.7, 20.8, 20.9).

Cross sections of nonsandstone manos are, predictably, much more likely to be convex on one or both faces. Manos with squared and airfoil cross sections are almost entirely sandstone. Among the common shapes, airfoil cross sections tend to be thinner (mean = 28.5 mm for two face, 31.3 mm for one face) than biconvex manos (40.5 mm two face, 41.2 mm one face; Tables 20.6, 20.13).

A number of manos in the collection have been used so extensively that it is difficult to see how the grinder was still able to grip the tool. This is especially evident in airfoil trough manos, where the trailing edge is thin and brittle (Fig. 20.8, 20.9), although some slab manos have also become quite thin. The degree of use evident on these tools suggests that grinders developed favorites that they used as long as possible, and that at least some manos required enough production input that they were not casually replaced.

Some proveniences are notable for their array of manos. LA 37593 stands out as having a collection of manos out of proportion to other materials. Within that large count there is considerable variety (Figs. 20.5, 20.9). In spite of the temporal trend to more slab grinding later, both slab and trough manos occur at the same site, and even within the same mealing room. Thus, while LA 37593 has a sample of 18 complete slab manos, there are also 4 trough

Figure 20.3 [a–b]. Two-hand manos from LA 37595, Pit Structure 2, mealing room, Floor 1: a. slab, sandstone, 220 mm length; b. trough, sandstone, 170 mm length (note its curved ends).

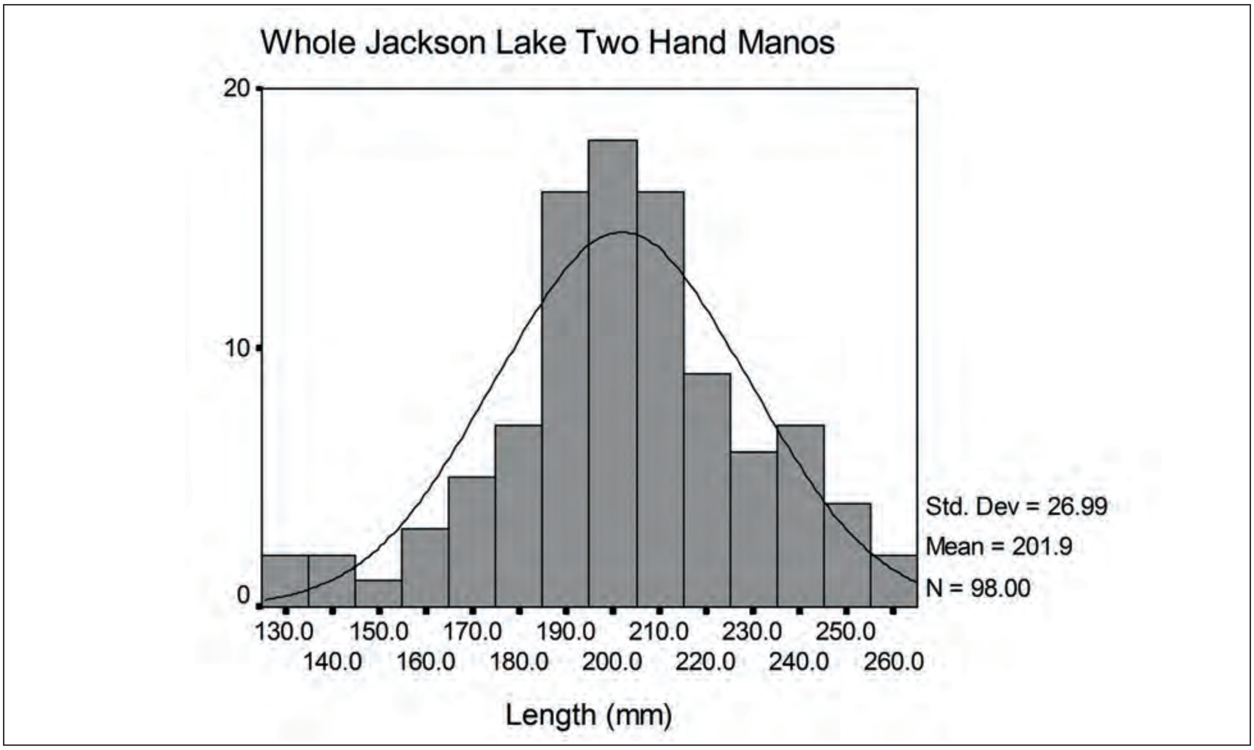


Figure 20.4. Histogram of two-hand mano lengths of all types (slab, trough, loaf, and general).

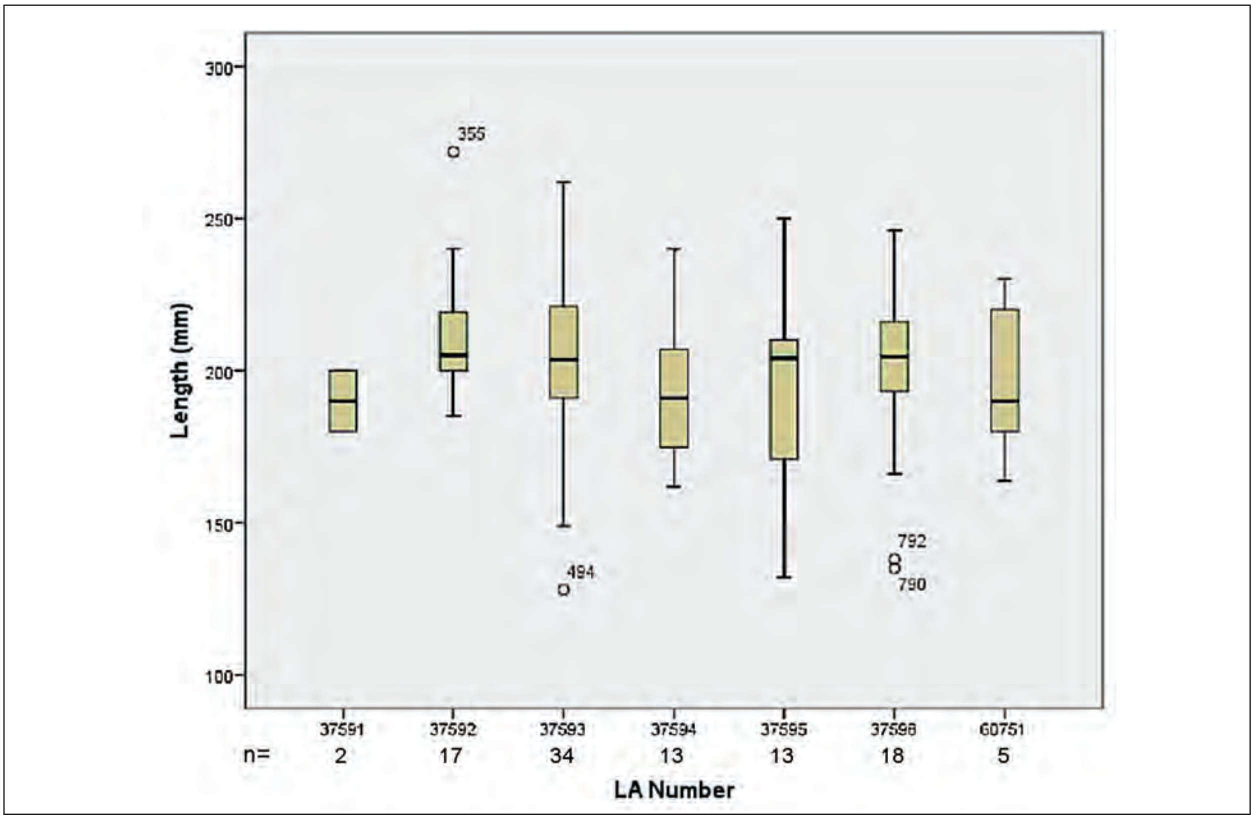


Figure 20.5. Box plot, whole two-hand manos, lengths by site; the small outliers at sites LA 37593 and LA 37598 are the "specialized manos" shown in Fig. 20.10.

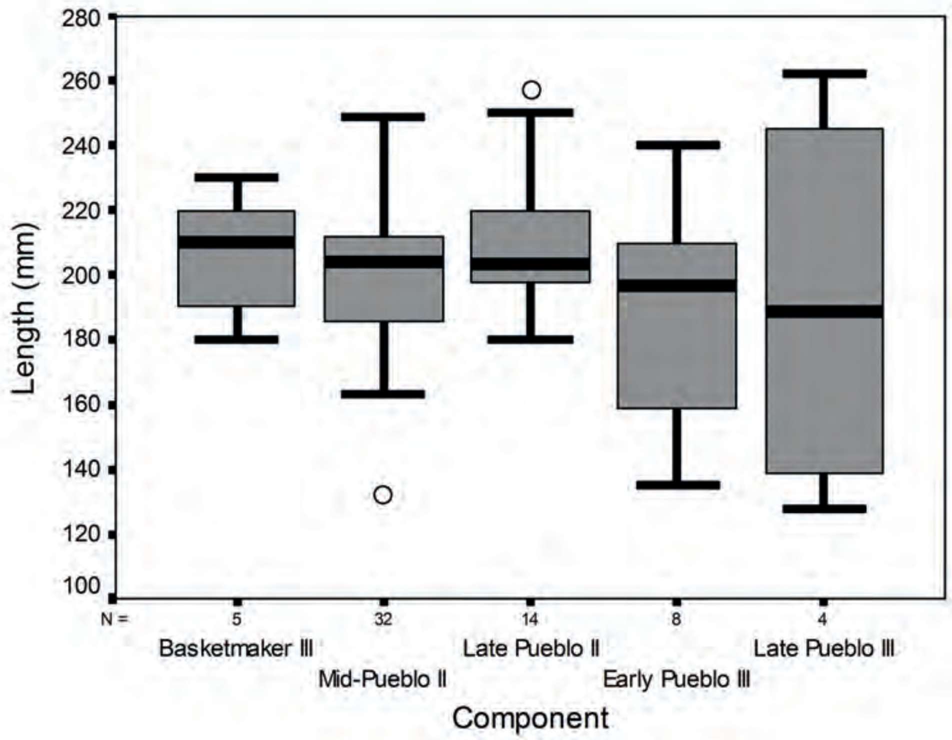


Figure 20.6. Box plot, two-hand manos, lengths by period, all mano types with complete lengths only.

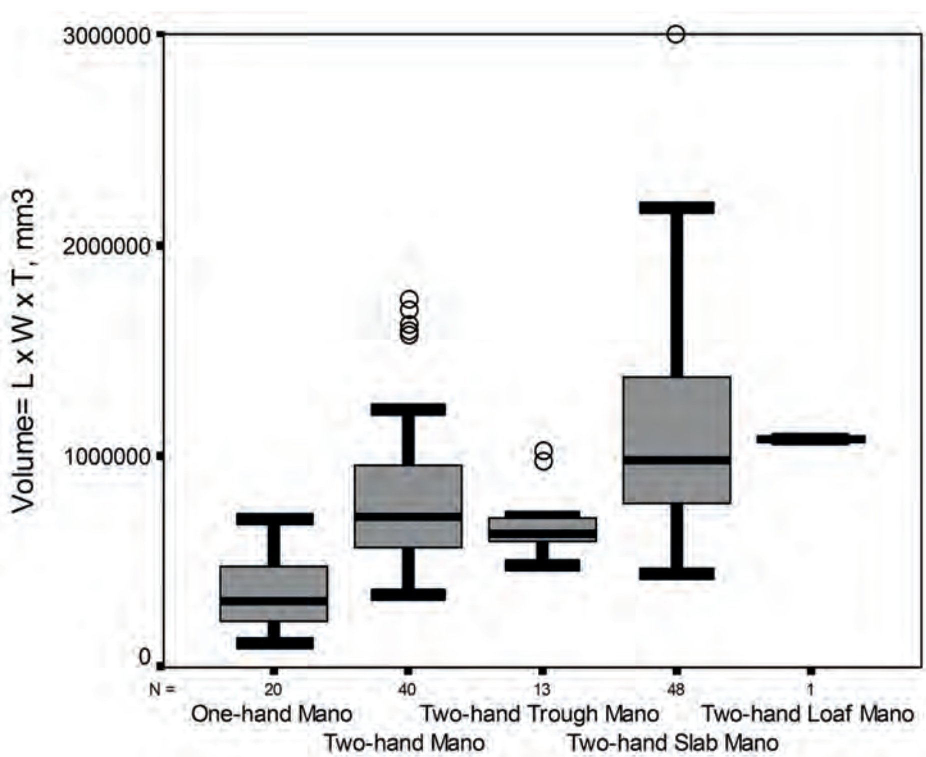


Figure 20.7. Box plot, manos, volume (length by width by thickness, in mm) by mano type.

Table 20.11. Ground stone tool types by material type; counts and percents.

	Igneous		Granite		Sandstone		Siltstone		Shale		Quartzite		Quartzitic Sandstone		Total
	Count	Row %	Count	Row %	Count	Row %	Count	Row %	Count	Row %	Count	Row %	Count	Row %	
Indeterminate fragment	–	–	–	–	11	78.6%	1	7.1%	–	–	–	–	2	14.3%	**14**
Indeterminate	–	–	–	–	1	100.0%	–	–	–	–	–	–	–	–	**1**
Pottery polishing stone	–	–	–	–	2	33.3%	3	50.0%	–	–	1	16.7%	–	–	**6**
Plaster polishing stone	2	20.0%	4	40.0%	2	20.0%	–	–	–	–	1	10.0%	1	10.0%	**10**
Abrading stone	1	9.1%	2	18.2%	5	45.5%	2	18.2%	–	–	–	–	1	9.1%	**11**
Shaft straightener	–	–	–	–	1	100.0%	–	–	–	–	–	–	–	–	**1**
Shaped slab	1	0.8%	3	2.5%	109	91.6%	3	2.5%	2	1.7%	–	–	1	0.8%	**119**
Sandal last	–	–	–	–	1	100.0%	–	–	–	–	–	–	–	–	**1**
Jar cover	–	–	–	–	13	86.7%	2	13.3%	–	–	–	–	–	–	**15**
Anvil	1	14.3%	–	–	3	42.9%	1	14.3%	–	–	2	28.6%	–	–	**7**
Pitted pounding stone	–	–	–	–	–	–	1	25.0%	–	–	3	75.0%	–	–	**4**
Palette	1	50.0%	–	–	1	50.0%	–	–	–	–	–	–	–	–	**2**
Lapidary stone	2	16.7%	1	8.3%	7	58.3%	–	–	–	–	–	–	2	16.7%	**12**
Mano	9	4.2%	39	18.2%	144	67.3%	10	4.7%	1	0.5%	4	1.9%	7	3.3%	**214**
One-hand mano	2	7.1%	7	25.0%	17	60.7%	1	3.6%	–	–	–	–	1	3.6%	**28**
Two-hand mano	3	1.5%	24	11.8%	159	78.3%	4	2.0%	–	–	–	–	13	6.4%	**203**
Metate	–	–	3	11.1%	24	88.9%	–	–	–	–	–	–	–	–	**27**
Trough metate	–	–	–	–	19	100.0%	–	–	–	–	–	–	–	–	**19**
Slab metate	–	–	–	–	31	93.9%	–	–	–	–	–	–	2	6.1%	**33**
Miniature metate	–	–	–	–	–	–	–	–	–	–	–	–	1	100.0%	**1**
Maul	1	12.5%	4	50.0%	–	–	2	25.0%	–	–	–	–	1	12.5%	**8**
Axe	9	28.1%	3	9.4%	4	12.5%	15	46.9%	–	–	1	3.1%	–	–	**32**
Hoe	–	–	1	100.0%	–	–	–	–	–	–	–	–	–	–	**1**
Tchamahia	–	–	–	–	–	–	12	80.0%	3	20.0%	–	–	–	–	**15**
Other hafted tool	1	50.0%	–	–	1	50.0%	–	–	–	–	–	–	–	–	**2**
Total	**33**	**4.2%**	**91**	**11.6%**	**555**	**70.6%**	**57**	**7.3%**	**6**	**0.8%**	**12**	**1.5%**	**32**	**4.1%**	**786**

Does not include ornaments. Quartzite includes 1 "metamorphic"; shale includes 1 "sedimentary."

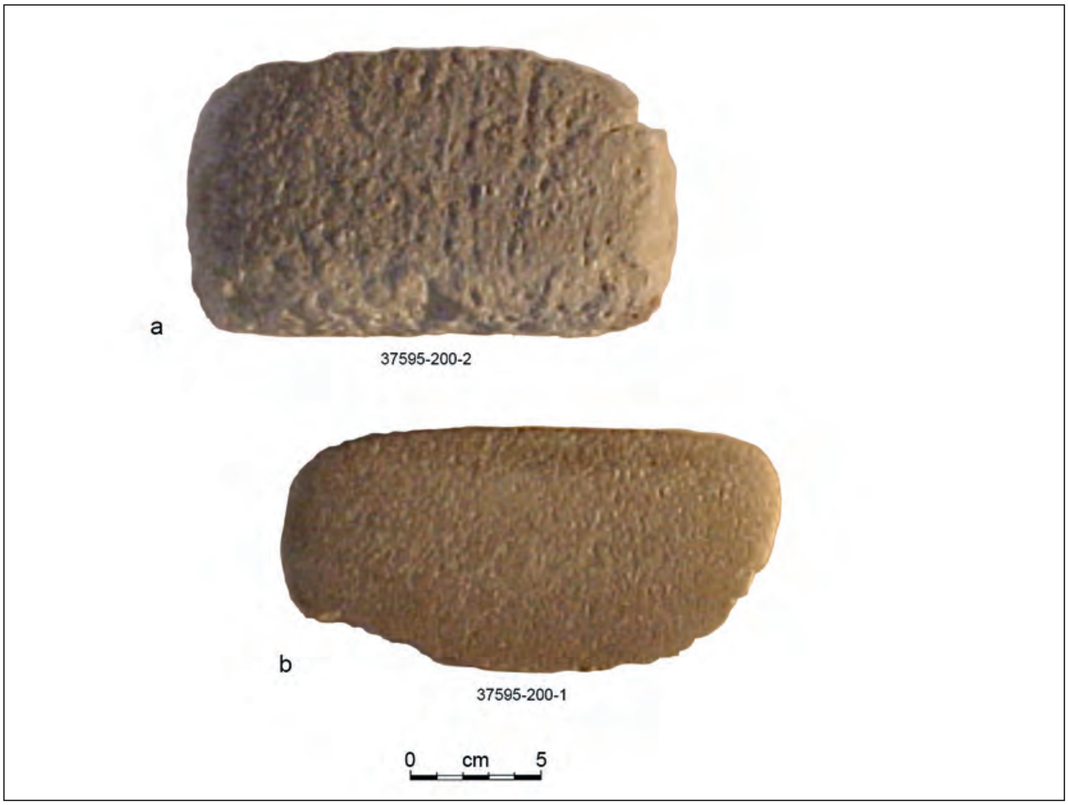


Figure 20.8 [a–b]. Manos from LA 37595, Pit Structure 2; b. shows very thin, somewhat irregular trailing edge of exhausted mano.

manos; more notable, the mealing room at LA 37594 (Pit Structure 1) contains 3 trough manos and 4 slab manos. At LA 37593 the majority of the large mano sample comes from extramural contexts, most from features, especially a large storage cist, which contained a variety of materials. The pit structure had a large off-chamber cist, but most of the manos were associated with the floor of the structure rather than the cist.

Metates

Metates form 9.3 percent of the overall ground stone count, but they constitute nearly half of the ground stone assemblage by weight: specimens weigh up to 54 kg. Although 82 items were identified as coming from metates, only 14 complete metates were recorded. In view of this kind of fragmentation, different pieces are amenable to different levels of interpretation. The most numerous form is slab metate, followed by the generic category "metate," including items not further specifiable, although some artifacts in this category are coded as whole in length, width, and thickness. Certain portions of trough metates must be present for an item to be identifiable as a particular type of metate, and even more particular portions to identify trough morphology (Fig. 20.11). Trough metates are the predominant form in most Pueblo II assemblages from the area, and it is likely that trough metates are underrepresented in the tallies. All of the metates from Chaco Canyon are trough metates (Schelberg 1997:1025). The sites providing the most specimens (LA 37592, LA 37598, and LA 37593) are dominated by later deposits. At these sites there are around twice as many slab as trough metates. Within dated contexts a shift from more trough to more slab and finally all slab metates is apparent, although metates of both types are present until the final period (Late Pueblo III), when only slab metates were recovered.

Trough metates are larger than slab metates, averaging 52 cm long by 42 cm wide by 7 cm thick (Table 20.14). They are a great deal more variable, again because of the presence of very large specimens, such

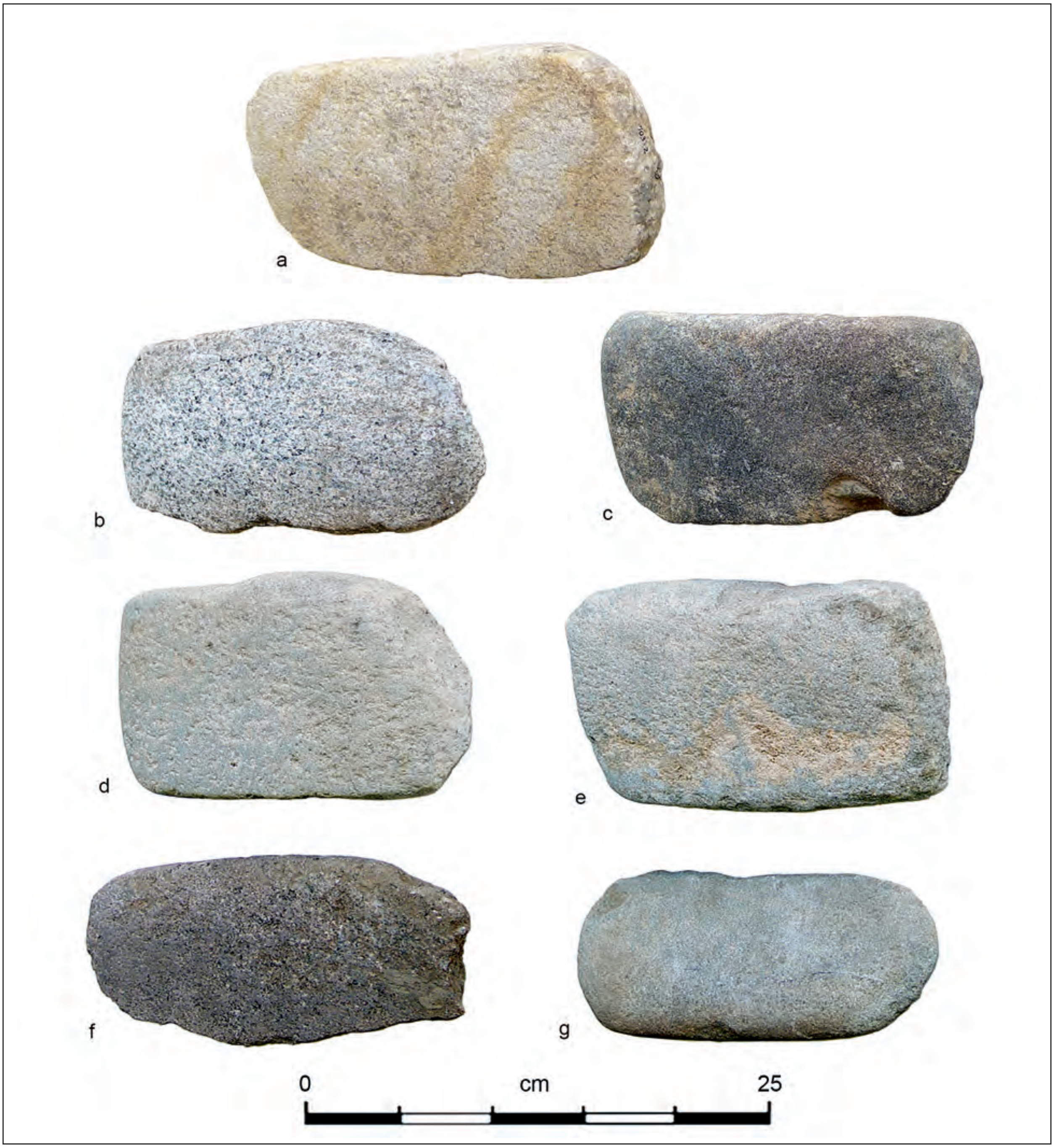


Figure 20.9 [a–g]. Two-hand slab manos: a. igneous and sandstone, 228 mm length (LA 37592, Extramural Area 1, BHT 5); b.–c. igneous and sandstone, lengths 198 mm (b) and 215 mm (c) (LA 37593, Room 101, Floor 3); d.–g. sandstone, lengths 175–209 mm (LA 37593, Roomblock 2).

as the 54 kg trough metate from the vicinity of the mealing room associated with Pit Structure 2 at LA 37595. This specimen was clearly made from a huge cobble. Slab metates are more likely to be mostly or completely shaped, whereas some trough metates have a worked grinding surface on an otherwise little-modified slab (Table 20.15). Use of cobbles for metates is less common at the Jackson Lake sites, where all cobble-based metates are slab metates, than at the Barker Arroyo sites. This probably relates to the greater cobble selection at Barker Arroyo sites and the closer access to sandstone at Jackson Lake.

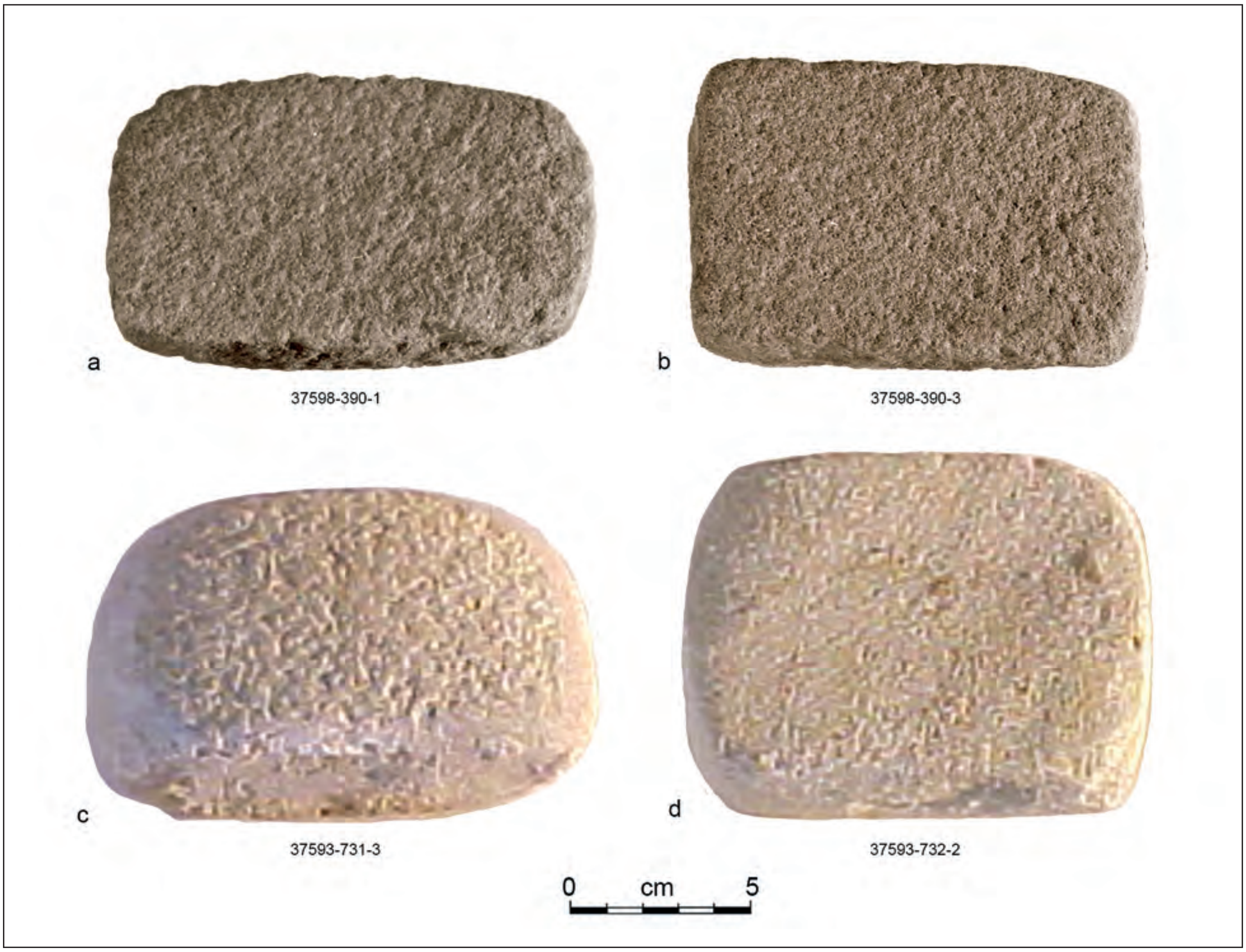


Figure 20.10 [a–d]. Small, specialized manos that were found in pairs: a.–b. LA 37598, Roomblock 1; c.–d. LA 37593, Extramural Area 1, Feature 2 (major storage cist).

Most often, metates are of raw materials that are only slightly modified. Shaping includes a well-distributed set of techniques and combinations of flaking, grinding and flaking, pecking and flaking, and pecking and grinding. Almost all metates are medium or fine grained, with fine-grained materials preferred. Sharpening is visible on 70 percent of the specimens; sharpening is present at about the same relative frequency on all material textures (Table 20.15).

Materials used for manos are more variable than those used for metates. Virtually all metates are made of sandstone, especially if quartzitic sandstone is included with sandstone (although it is more logically the same as quartzite). Probably because of smaller size and the availability of cobbles of appropriate size and shape, manos encompass more materials, although the great majority of manos are also sandstone. Searching site assemblages for possible pairings of mano and metate material, there are too few non-sandstone metates to identify a pattern. As would be expected, sites with larger ground stone assemblages contain the rarer metate materials: granite and siltstone at LA 37592, quartzitic sandstone at LA 37593, and granite at LA 37594. The distinctive conglomeratic sandstone containing chert pebbles is present at Jackson Lake: there are, for example, a slab metate (Fig. 20.12) and a large two-hand mano of this material from LA 37593. This distinctive material was not recorded separately during the analysis, so it cannot be tracked across all proveniences; from postanalysis observation, it does occur in Barker Arroyo assemblages as well.

An object found in the trench beneath Room 101 at LA 37593 has been identified as a miniature metate. It measures 13 by 19 by 5 cm and has been

Table 20.12. Manos, tool type counts by re-use function.

	Mano	One-hand Mano	Two-hand Mano	Trough Mano	Slab Mano	Loaf Mano	Total
Anvil	–	–	1	–	–	–	**1**
Hammerstone	4	1	1	–	–	–	**6**
Mano	93	1	–	–	–	–	**94**
One-hand mano	–	12	–	–	–	–	**12**
Two-hand mano	–	–	61	2	1	–	**64**
Two-hand trough mano	–	–	–	10	1	–	**11**
Two-hand slab mano	–	–	–	1	34	–	**35**
Two-hand loaf mano	–	–	–	–	–	2	**2**
Metate	1	–	–	–	1	–	**2**
Trough metate	–	–	–	–	1	–	**1**
Total	**98**	**14**	**63**	**13**	**38**	**2**	**228**
All manos	**214**	**28**	**112**	**18**	**71**	**2**	**445**

Table 20.13. Two-hand manos, cross-section shape by plan-view outline; counts and percents.

	Circular		Oval		Sub-rectangular		Irregular		Rectangular		Sub-triangular		Total	
	N	Col. %	N	Col. %	N	Col. %	N	Col. %	N	Col. %	N	Col. %	N	Col. %
Biconvex	1	100.0%	14	51.9%	18	20.9%	1	6.7%	2	10.5%	–	–	**36**	**23.5%**
Convex concave	–	–	–	–	–	–	2	13.3%	1	5.3%	–	–	**3**	**2.0%**
Dome	–	–	4	14.8%	14	16.3%	1	6.7%	4	21.1%	2	40.0%	**25**	**16.3%**
Sub-rectangular	–	–	2	7.4%	14	16.3%	–	–	–	–	–	–	**16**	**10.5%**
Rectan-gular, square	–	–	–	–	3	3.5%	2	13.3%	6	31.6%	–	–	**11**	**7.2%**
Wedge	–	–	–	–	3	3.5%	1	6.7%	–	–	–	–	**4**	**2.6%**
Loaf	–	–	–	–	1	1.2%	–	–	–	–	–	–	**1**	**0.7%**
Irregular, flat	–	–	–	–	1	1.2%	–	–	–	–	–	–	**1**	**0.7%**
Irregular, convex	–	–	–	–	2	2.3%	1	6.7%	2	10.5%	–	–	**5**	**3.3%**
Triangle	–	–	1	3.7%	1	1.2%	–	–	–	–	–	–	**2**	**1.3%**
Airfoil	–	–	5	18.5%	18	20.9%	4	26.7%	2	10.5%	2	40.0%	**31**	**20.3%**
Trapezoid	–	–	1	3.7%	11	12.8%	3	20.0%	2	10.5%	1	20.0%	**18**	**11.8%**
Total	**1**	**100.0%**	**27**	**100.0%**	**86**	**100.0%**	**15**	**100.0%**	**19**	**100.0%**	**5**	**100.0%**	**153**	**100.0%**

N = count
Does not include 49 manos with indeterminate plan outline.

carefully shaped from dense, hard quartzitic sandstone (Fig. 20.13). It is quite possibly a reworked piece of a larger slab metate, especially since the bottom shows the sort of wear seen on larger metates that results from use and movement on the underside. This tool has a clearly concave 10 by 16 cm working surface that has been pecked (possibly when the stone was a larger metate) and then considerably used. We have no manos small enough to be used on this stone, and it could have served as a working surface for fine work such as bead making. In addition to this unusual artifact, there are eight whole and four partial full-sized manos, two whole and one partial slab metates, a jar cover, and a portion of a tchamahia from this provenience (not fully excavated due to its location outside the right-

Figure 20.11. Trough metate from LA 37598, Pit Structure 1, Floor 1, top and side views. Break shows thinness of the base; top view shows the closed-at-one-end configuration of the trough.

of-way), suggesting that a specialized grinding complex may have been present in this undefined feature.

Grinding Tools: Summary

During excavation I often got the impression that broken ground stone tools were rarely discarded but were instead incorporated into construction. This impression is not really supported by the coding, since only 1.5 percent of grinding tools were recovered from intact construction (Table 20.16). Most of the grinding tools were from structure fill and floor contexts. Still, ground stone in fill contexts is likely to represent in good part building materials, whether from the structure itself or from the deposit of materials from another structure.

Far more of the ground stone assemblage is broken than is whole. Only about a quarter of the material in the analysis is complete in length, width, and thickness, and 42 percent is measurable in thickness alone. Although both manos and metates regularly became "exhausted" through use, the actual use process probably did not result in such

Table 20.14. Metates (whole only), mean dimensions (mm), counts, and weights (g) by type.

	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)	Depth (mm)
Metate					
Mean	426.00	346.00	36.08	18,200.00	4.00
Count	1	1	25	1	1
Standard deviation	–	–	17.96	–	–
Minimum	–	–	12.00	–	–
Maximum	–	–	70.00	–	–
Median	–	–	36.00	–	–
Basin Metate					
Mean	–	–	41.00	–	–
Count	–	–	1.00	–	–
Trough Metate					
Mean	620.00	350.00	55.93	30,600.00	8.00
Count	1	1	15	1	1
Standard deviation	–	–	23.41	–	–
Minimum	–	–	16.00	–	–
Maximum	–	–	90.00	–	–
Ends-open Trough Metate					
Mean	530.00	342.00	141.50	38,645.50	22.50
Count	2	2	2	2	2
Standard deviation	14.14	39.60	54.45	21,843.24	3.54
Minimum	520.00	314.00	103.00	23,200.00	20.00
Maximum	540.00	370.00	180.00	54,091.00	25.00
Median	530.00	342.00	141.50	38,645.50	22.50
One-end-open Trough Metate					
Mean	520.00	310.00	96.00	13,800.00	60.00
Count	1	1	1	1	1
Slab Metate					
Mean	395.00	217.53	72.76	20,089.57	2.58
Count	7	17	33	7	12
Standard deviation	70.70	74.61	45.21	7,167.41	2.07
Minimum	241.00	94.00	13.00	12,300.00	0.00
Maximum	444.00	346.00	189.00	32,727.00	6.00
Median	420.00	237.00	70.00	18,150.00	2.50
All Metates*					
Mean	451.36	240.10	59.25	23,847.09	9.00
Count	11	21	77	11	16
Standard deviation	98.97	82.77	39.51	12,119.08	15.32
Minimum	241.00	94.00	12.00	12,300.00	0.00
Maximum	620.00	370.00	189.00	54,091.00	60.00
Median	440.00	237.00	48.00	18,500.00	4.00
All Trough Metates Only					
Mean	525.20	338.00	67.67	27,978.20	16.14
Count	5	5	18	5	7
Standard deviation	69.10	25.46	37.89	15,876.22	21.85
Minimum	426.00	310.00	16.00	13,800.00	0.00
Maximum	620.00	370.00	180.00	54,091.00	60.00
Median	520.00	346.00	65.00	23,200.00	8.00

* Does not include "metate" category.

Table 20.15. Metates (all), production and material attributes, counts by metate type.

	Metate	Basin Metate	Trough Metate	Ends-open Metate	One-end-open Metate	Slab Metate	Total
Preform Morphology							
Indeterminate	14	–	11	1	–	5	**31**
Round cobble	–	–	–	–	–	2	**2**
Angular chunk	1	–	1	–	–	5	**7**
Flat cobble	–	1	–	–	–	4	**5**
Slab	2	–	3	–	–	5	**10**
Thick slab	–	–	–	1	1	1	**3**
Thin slab	1	–	1	–	–	6	**8**
Very thin slab	8	–	–	–	–	5	**13**
Total	**26**	**1**	**16**	**2**	**1**	**33**	**79**
Production Input							
Indeterminate	11	–	–	–	–	–	**11**
None	1	1	–	–	–	3	**5**
Slightly modified	10	–	11	1	–	18	**40**
Mostly modified	4	–	5	1	–	8	**18**
Fully shaped	–	–	–	–	1	4	**5**
Total	**26**	**1**	**16**	**2**	**1**	**33**	**79**
Shaping							
Indeterminate	11	–	–	–	–	–	**11**
None	1	1	–	–	–	3	**5**
Grinding	4	–	–	–	–	–	**4**
Flaking	2	–	3	–	–	8	**13**
Pecking	2	–	4	–	–	2	**8**
Grinding, flaking	4	–	–	–	1	8	**13**
Pecking, grinding, flaking	–	–	2	–	–	1	**3**
Pecking, flaking	–	–	1	2	–	8	**11**
Pecking, grinding	2	–	6	–	–	3	**11**
Total	**26**	**1**	**16**	**2**	**1**	**33**	**79**
Texture							
Fine grain	17	1	11	2	1	24	**56**
Medium grain	5	–	3	–	–	8	**16**
Coarse grain	4	–	2	–	–	1	**7**
Total	**26**	**1**	**16**	**2**	**1**	**33**	**79**
Sharpening							
No	13	1	2	–	1	7	**24**
Yes	13	–	14	2	–	26	**55**
Total	**26**	**1**	**16**	**2**	**1**	**33**	**79**

complete breakage of the tools. Rather, it is likely that exhausted or discarded tools were further modified to be useful in construction, for example, by reducing their size to allow them to fit into walls.

Specific grinding locations occurred at two Jackson Lake sites, in four contexts. At LA 37594 metate rests were present in the Transitional Basketmaker Pit Structure 5; a pair of metate bins was present in Extramural Area 2, adjacent to Room 101; and Pit Structure 1 was a mealing room with remains of five bins, four of which were probably active at the time of structure closure. Pit Structure 2 at LA 37595 is also a mealing room with four or five bins. Although ground stone is found in association with these features (Table 20.17)—both complete trough metates in the sample were associated with Pit Structure 2, LA 37595—tools found in situ of use are rare. This is especially true of metates, surely the

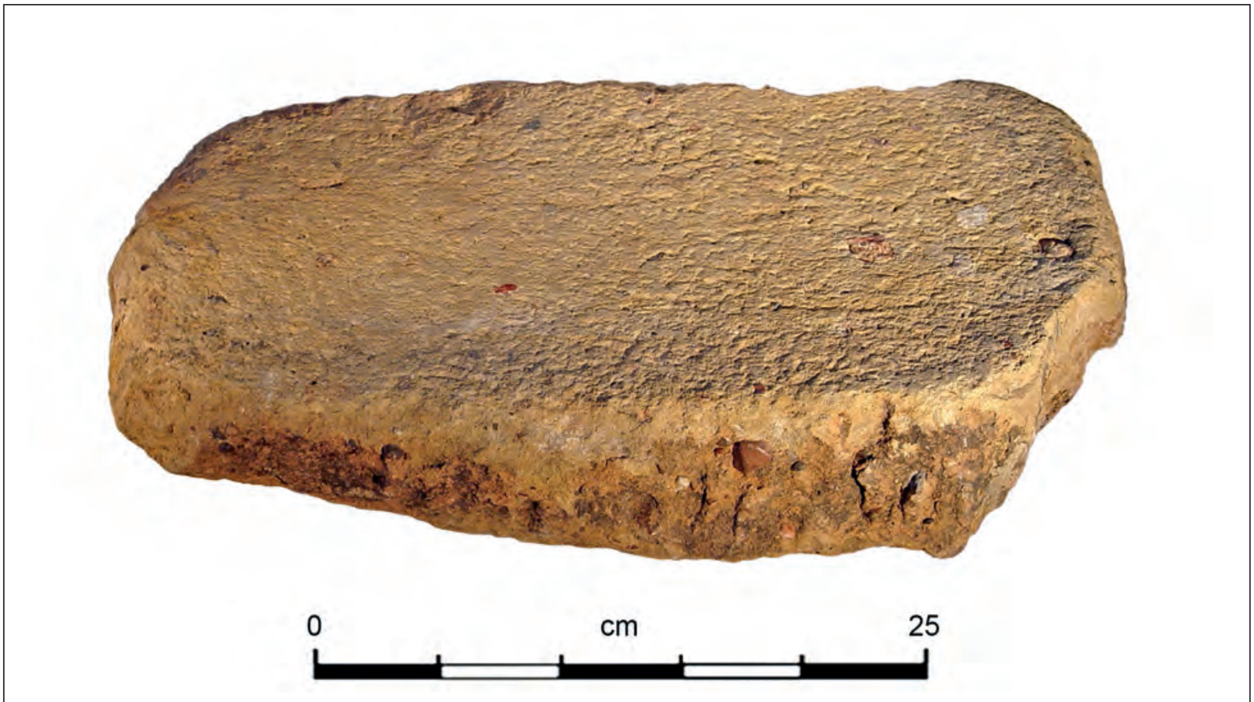


Figure 20.12. Slab metate from LA 37593, Extramural Area 1, Feature 1 (cist). The metate is made from conglomeratic sandstone containing sizable chert pebbles (visible on side and face); the sandstone likely came from the Ojo Alamo formation, which outcrops on Piñon Mesa to the west.

Figure 20.13. Small concave ground stone or "miniature metate" from LA 37593, Room 101, Floor 3.

hardest artifacts to move, but perhaps also the most difficult to produce.

As is true of the general collection, both trough and slab manos were found in association with mealing rooms. Both types of manos are present in disproportional frequencies, but trough manos, especially, occur there in greater frequency than would be expected from other proportions. Slab manos occur more often in surface-room contexts.

Although no specific grinding features were encountered at LA 37593, this site is characterized by a large quantity of ground stone. The fill of Pit Structure 1 is characterized by a large quantity of cobbles, which were probably once incorporated in a building; the large amount of ground stone in the structure, however, is *not* associated with this material, but is predominantly from a substantial floor assemblage consisting of 15 manos as well as shaped slabs, abraders, and lapidary stones, the majority of which are whole. This structure also contained a large number of one-hand manos (n = 7), all of which are associated with the floor, further suggesting a full and perhaps specialized grinding activity area. This site includes a number of large

Table 20.16. Grinding tools (manos and metates), stratigraphic context by completeness; counts and percents.

	Fragment		Thickness Intact		Width and Thickness Intact		Whole		Total	
	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %
Vertical subdivision unknown	–	–	3	1.4%	2	1.3%	2	1.4%	**7**	**1.3%**
Full cut	–	–	6	2.8%	2	1.3%	5	3.6%	**13**	**2.5%**
General structure fill	9	60.0%	41	18.9%	28	18.4%	14	10.1%	**92**	**17.6%**
Upper fill above roof	2	13.3%	54	24.9%	30	19.7%	21	15.2%	**107**	**20.5%**
Lower fill below roof	1	6.7%	3	1.4%	2	1.3%	1	0.7%	**7**	**1.3%**
Roofing material	–	–	23	10.6%	4	2.6%	4	2.9%	**31**	**5.9%**
Extramural fill	–	–	39	18.0%	31	20.4%	13	9.4%	**83**	**15.9%**
Floor fill	1	6.7%	4	1.8%	8	5.3%	8	5.8%	**21**	**4.0%**
Surface or floor	–	–	19	8.8%	21	13.8%	35	25.4%	**75**	**14.4%**
Subfloor fill	–	–	–	–	1	0.7%	5	3.6%	**6**	**1.1%**
Present ground surface	2	13.3%	11	5.1%	8	5.3%	5	3.6%	**26**	**5.0%**
Ground surface stripping	–	–	12	5.5%	11	7.2%	23	16.7%	**46**	**8.8%**
Construction	–	–	2	0.9%	4	2.6%	2	1.4%	**8**	**1.5%**
Total	**15**	**100.0%**	**217**	**100.0%**	**152**	**100.0%**	**138**	**100.0%**	**522**	**100.0%**
% of Total		**2.9%**		**41.6%**		**29.1%**		**26.4%**		

Table 20.17. Grinding tools (manos and metates), type by time-period identified provenience groups; counts and percents.

	Basket-maker III–Pueblo I Pit		Pueblo II Pit Structure		Pueblo II Room		Mealing Room		Pueblo III Pit Structure		Total	
	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %
Manos												
Mano	10	50.0%	23	29.5%	7	35.0%	1	4.2%	47	61.0%	**88**	**40.2%**
One-hand mano	–	–	8	10.3%	2	10.0%	2	8.3%	1	1.3%	**13**	**5.9%**
Two-hand mano	5	25.0%	20	25.6%	1	5.0%	2	8.3%	10	13.0%	**38**	**17.4%**
Two-hand trough mano	–	–	4	5.1%	2	10.0%	5	20.8%	2	2.6%	**13**	**5.9%**
Two-hand slab mano	2	10.0%	10	12.8%	5	25.0%	11	45.8%	6	7.8%	**34**	**15.5%**
Total	**17**	**85.0%**	**65**	**83.3%**	**17**	**85.0%**	**21**	**87.5%**	**66**	**85.7%**	**186**	**84.9%**
Metates												
Metate	1	5.0%	4	5.1%	–	–	–	–	6	7.8%	**11**	**5.0%**
Trough metate	1	5.0%	3	3.8%	2	10.0%	1	4.2%	1	1.3%	**8**	**3.7%**
Ends-open metate	–	–	–	–	–	–	2	8.3%	–	–	**2**	**0.9%**
One-end-open metate	–	–	1	1.3%	–	–	–	–	–	–	**1**	**0.5%**
Slab metate	1	5.0%	5	6.4%	1	5.0%	–	–	4	5.2%	**11**	**5.0%**
Total	**3**	**15.0%**	**13**	**16.7%**	**3**	**15.0%**	**3**	**12.5%**	**11**	**14.3%**	**33**	**15.1%**
Total	**20**	**100.0%**	**78**	**100.0%**	**20**	**100.0%**	**24**	**100.0%**	**77**	**100.0%**	**219**	**100.0%**

One mano and one two-hand slab mano from a Pueblo III room are shown with Pueblo III pit structures.

storage features, including three extramural cists and a large off-chamber cist in Pit Structure 1. Undoubtedly it also included processing features that were outside our project area.

Large Hafted Tools

The 60 tools in the Jackson Lake group include axes, mauls, and tchamahias (Vol. 6, this report, contains Larralde and Schlanger's synthesis chapter on the entire large hafted tool assemblage from the La Plata Highway project). Axes were produced by grinding and chipping in varying combinations, some purely ground in final form, some purely flaked, some both, and some with very little alteration to the cobble form (Figs. 20.14 [a–c], 20.15 [a–e]; Tables 20.18, 20.19). These tools are primarily made of siltstone and igneous rocks. There are a few surprising material presences and absences among these tools. Quartzite, a flakeable, durable material, is virtually absent (used for just one maul), and siliceous materials are completely absent. Conversely, three of 30 axes are sandstone, a material seemingly unsuited for chopping or rooting. Aside from the sandstone axes, 13 are some type of igneous or metamorphic rock, and 14 are siltstone.

Axes

Axes occurred at all the Jackson Lake sites with substantial collections (Table 20.20). Notched axes are much more abundant than grooved ones, reflecting production time and probably curation (Fig. 20.14 [a, b]; Table 20.21). The rarer grooved axes are on average larger than the notched axes (Fig. 20.14 [a]; Table 20.22). Axe breakage seems to be quite consistent (Fig. 20.15 [a–e]), with a large number of axes broken transversely below the hafting notches. It may be that notching of this shape stone weakens the rock in such as a way as to predispose the tools to breaking in this way. Fully ground axes are less common, but on the basis of observation alone, it seems that they are less often broken. It could be that notched axes were used differently or for heavier tasks than the presumably more labor-intensive grooved ones, which would accord with the curation of axes suggested by Larralde and Schlanger (Table 20.21).

It is easy to assume that axes are for cutting trees (Mills 1993:393–394), and indeed their scarcity in Chaco (Breternitz 1997) seems to suggest this. However, Mills (1993:407) concluded that wear on tools we call axes indicated that brush clearing and soil preparation were a common if not predominant use of this tool type. He also found that chopping wood, especially dry wood, led to breakage; smaller axes were more likely for wood and larger ones for soil (Table 20.22). Lengths of broken axes are still more variable than lengths of whole axes (coefficient of variation 26.0 vs. 21.7; Table 20.23).

Mauls

All together, eight mauls were recovered from four different Jackson Lake sites: LA 37592, LA 37594, LA 37595, and LA 60751. Mauls tend to be associated with earlier contexts and, with the exception of LA 37592, all of these sites have clear early components. Five of these items are made of igneous materials (diorite and granite), which is more common in the grooved variety of maul (Fig. 20.16). The three grooved mauls were from Basketmaker III pit structure floors, suggesting that notched mauls may tend to occur later.

Tchamahias

Tchamahias occur in two primary forms: oblong celt-like tools and tanged tools with a much wider blade than tang (Fig. 20.17 [a–d]). A total of 14 tchamahias or tchamahia fragments were recovered from Jackson Lake sites; only four of these are whole. The whole tchamahias suggest material preference for the two types: the broad-bladed, tanged variety seems to be more often black siltstone similar to materials seen frequently in the lithic assemblage; while the celt-shaped tchamahias are more often decorative, multicolored banded hornstone, probably from a quarry near the Four Corners monument (Shelley 1980; Wenker 1999; Adams 2002:179). Note: This hornstone material is generally referred to as "shale" in the present report and is entered as such in Tables 20.11 and 20.18, as well as in other relevant contexts throughout the La Plata Highway project volumes. See additional detail below.

Although most tchamahias are fully shaped and ground, a tool from LA 37595 included with the tchamahias is largely natural in form (Fig. 20.17 [d]). A teardrop-shaped piece of gray siltstone mea-

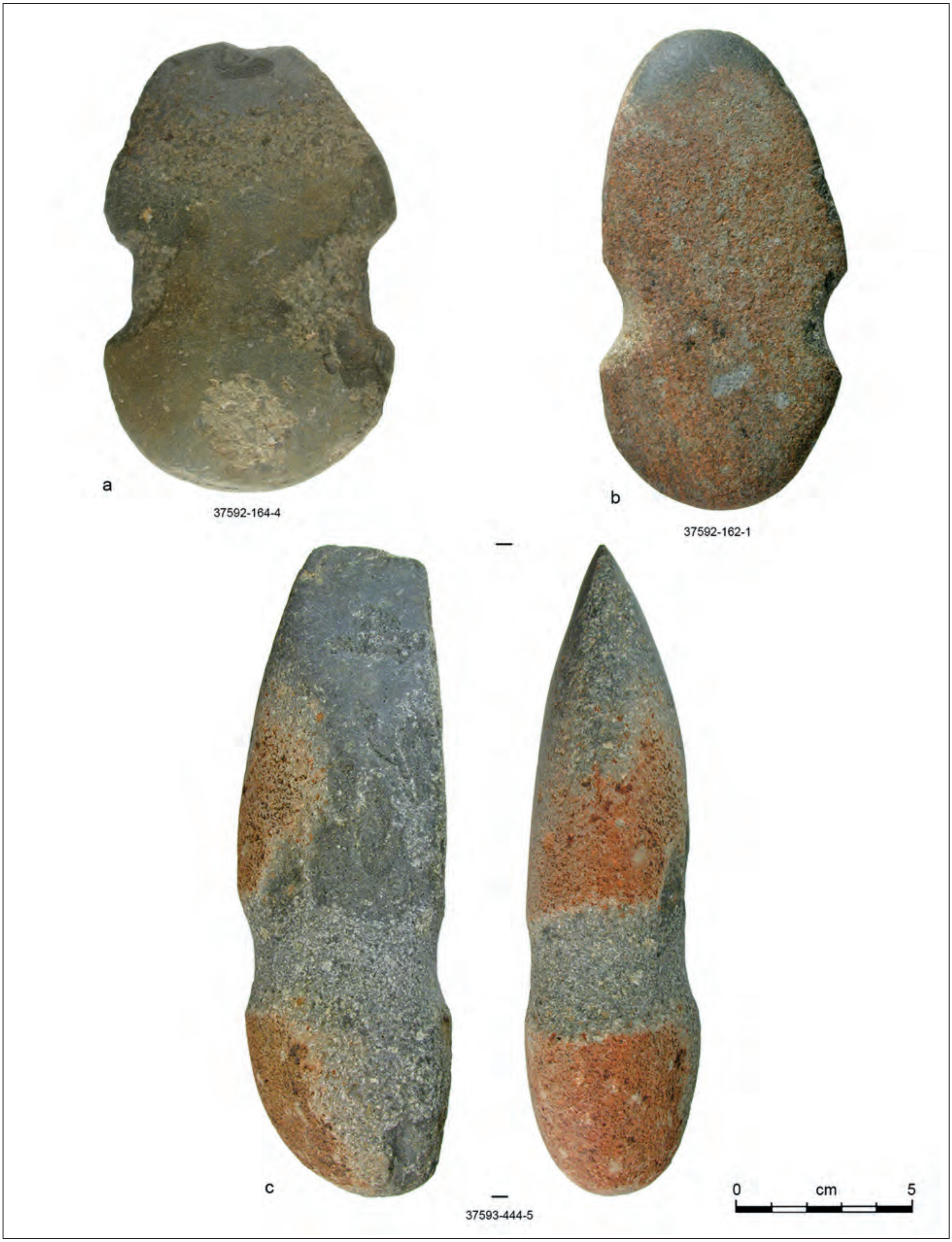


Figure 20.14 [a–c]. Axe production techniques: a. axe shows combined chipping and grooving of notches; b. two-notch axe with minimal shaping of a cobble; (c, two views) is a large, full-grooved axe. Axes "a." and "b." are from LA 37592, Room 201; axe "c." is from LA37593, Extramural Area 1, Feature 2 (major off-chamber cist).

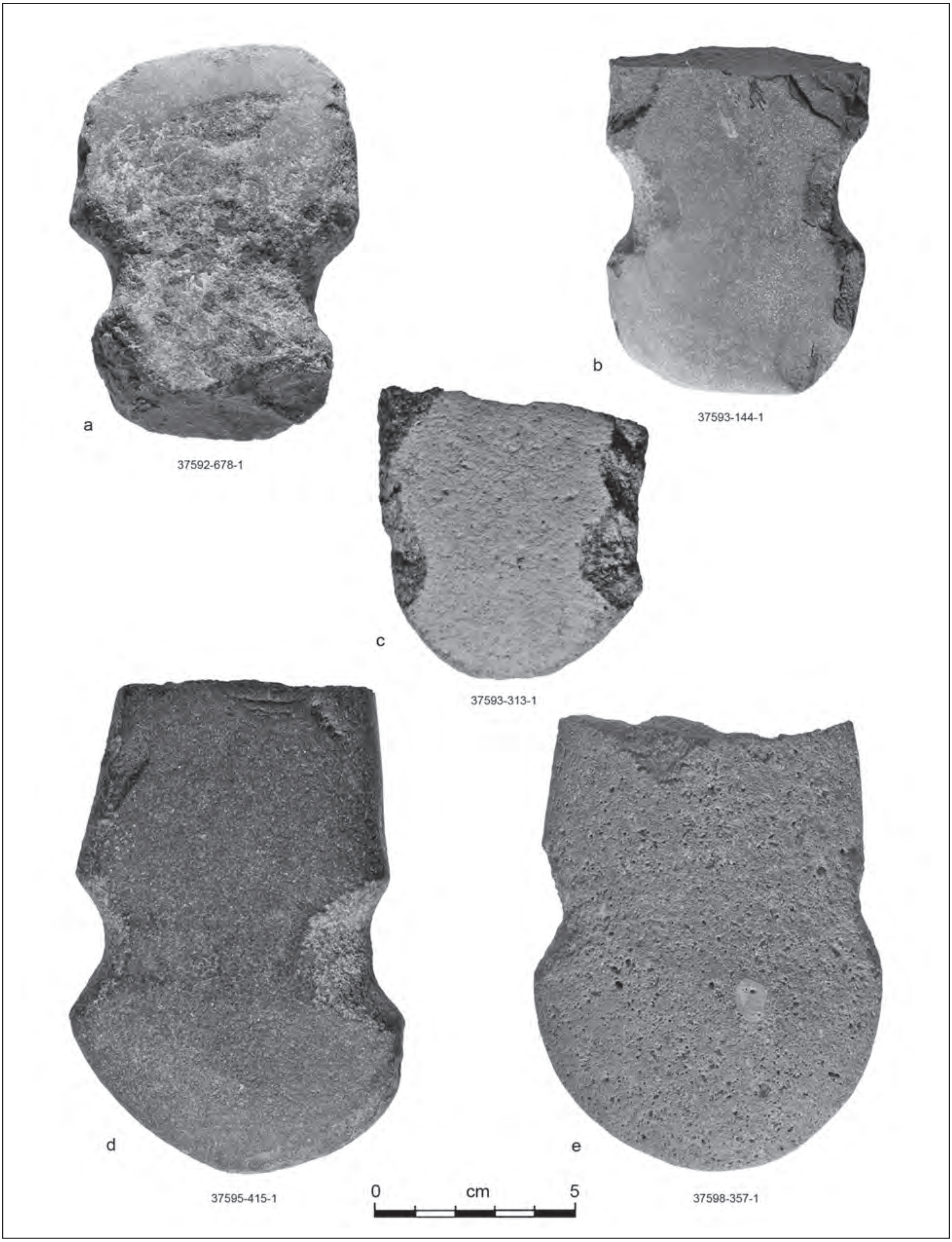


Figure 20.15 [a–e]. Axe breakage examples (note transverse breaks distal to notches): a. ground and chipped axe poll with heavily worn bit, possibly broken and further used (LA37592, Extramural Area 2); b. and c. axes (LA 37593 Extramural Area 1 and Roomblock 2 surface); d. axe (LA 37595, Pit Structure 4 fill); e. axe (LA 37598, Extramural Area 1).

Table 20.18. Large hafted tools (including some flaked stone tools), counts by tool and material types.

	Igneous	Granite	Sandstone	Siltstone	Shale	Metamorphic	Quartzitic Sandstone	Other	Total
Notched maul	1	2	–	1	–	–	1	–	**5**
Grooved maul	–	2	1	1	–	–	–	–	**4**
Weight	1	–	–	–	–	–	–	–	**1**
Axe	–	–	1	3	–	–	–	–	**4**
One-notch axe	1	–	–	–	–	–	–	–	**1**
Two-notch axe	5	3	3	12	–	1	–	–	**24**
Three-fourths grooved axe	1	–	–	–	–	–	–	–	**1**
Full-grooved axe	2	–	–	2	–	–	–	–	**4**
Hoe	–	–	–	–	–	–	–	1	**1**
Notched hoe	–	1	–	–	–	–	–	–	**1**
Tchamahia	–	–	1?	10	3	–	–	–	**14**
Total	**11**	**8**	**6?**	**29**	**3**	**1**	**1**	**1**	**60**

Table 20.19. Large hafted tools, type counts by shaping method.

Tool Type	Grinding	Flaking	Pecking	Grinding, Flaking	Pecking, Grinding, Flaking	Pecking, Flaking	Pecking, Grinding	Total
Notched maul	–	2	1	–	–	1	1	**5**
Grooved maul	–	–	–	–	–	–	4	**4**
Weight	–	–	–	1	–	–	–	**1**
Axe	–	1	1	–	–	1	1	**4**
One-notch axe	–	–	–	–	–	–	1	**1**
Two-notch axe	–	2	1	5	5	3	8	**24**
Three-fourths grooved axe	–	–	–	–	–	1	–	**1**
Full-grooved axe	–	–	1	–	1	–	2	**4**
Hoe	–	1	–	–	–	–	–	**1**
Notched hoe	–	1	–	–	–	–	–	**1**
Tchamahia	7	–	–	6	–	–	1	**14**
Total	**7**	**7**	**4**	**12**	**6**	**6**	**18**	**60**

Includes 3 items from chipped stone analysis.

Table 20.20. Axes, type counts by site.

	LA 37591	LA 37592	LA 37593	LA 37594	LA 37595	LA 37598	LA 60751	Total
Notched maul	–	2	–	2	1	–	–	**5**
Grooved maul	–	–	–	–	1	–	2	**3**
Axe	1	–	–	–	–	2	–	**3**
One-notch axe	–	–	–	1	–	–	–	**1**
Two-notch axe	1	9	5	1	3	4	–	**23**
Three-fourths grooved axe	–	1	–	–	–	–	–	**1**
Full-grooved axe	1	2	1	–	–	–	–	**4**
Total	**3**	**14**	**6**	**4**	**5**	**6**	**2**	**40**

Table 20.21. Axes, type counts by degree of shaping.

	Slightly Modified	Mostly Modified	Fully Shaped	Total
Notched maul	5	–	–	**5**
Grooved maul	1	–	2	**3**
Weight	1	–	–	**1**
Axe	1	1	1	**3**
One-notch axe	1	–	–	**1**
Two-notch axe	14	3	6	**23**
Three-fourths grooved axe	1	–	–	**1**
Full-grooved axe	2	1	1	**4**
Total	**26**	**5**	**10**	**41**

suring 14 by 7 by 1.5 cm, it counts as one of the four whole examples. Most of both faces are waterworn cortex. There is some shaping by grinding along the margins, however, and it resembles a tchamahia more than anything else. The blade end of this artifact has a chip out of it that has been worn. The blade is not sharp, and this tool was not used for any heavy work.

Including this somewhat odd tchamahia from LA 37595, there are only four complete tchamahias from Jackson Lake sites, two from adjacent rooms at LA 37598 or possibly even the same room (Table 20.24). As discussed by Larralde and Schlanger (Vol. 6, this report) and Wenker (1999), the function of tchamahias is widely debated, probably because, as they conclude, these tools served several functions, from agriculture to weaponry to ceremony. One of the whole artifacts from Jackson Lake is a good example of one of two main tchamahia types (from LA 37593: Fig. 20.17 [b]). This type has a wide blade and a narrower haft and is usually made of dark siltstone. These tools seem more likely to have been field implements. This tool is similar to two found at the Box B site on the south side of the San Juan, although that assemblage also includes a tanged example made of hornstone (Larralde 1991:119; see Vierra and Sinclair [1994:105, 107] for a tanged tchamahia made of "shale/slate").

The other, more numerous type are tapered and more often made from beautiful hornstone or "Brushy Basin Silicified Sediment" (Fig. 20.17 [c]; Wenker 1999:7–10) and nicely polished [as noted earlier: in data compilation for this project, however, this material is considered "shale"]. Larralde and Schlanger (Vol. 6, this report) make a case that tchamahias of this variety were weapons, though the one hafted example known was found in a digging-stick cache (Hayes 1976). Clearly, that so few whole tchamahias were found shows that they were being used for *something*. As Larralde and Schlanger (Vol. 6, this report) also point out, many of the pieces of tchamahias found are the butt ends, which made it back to habitations in hafts needing bit replacement.

Jackson Lake tchamahias found whole (in thickness and width) average 13 mm thick; even if the material is brittle, snapping such a stone indicates considerable application of force. Most of the breaks are close to straight across the width of the tool—probably at the base of the haft—suggesting that the break occurred from a prying motion rather than an impact. There are also, however, a surface spall and a triangular fragment from the side of a lovely green-gray hornstone tool, indicating impacts. All of these fragments show that tchamahias saw some use beyond simply resting on an altar; the presence of two complete ones from a room at LA 37598 along with a sandal last palette show that they also had a symbolic function. This association with a sandal last becomes more notable when we note that two other whole tchamahias (out of eight) were found in a vessel with sandal lasts incised through the corrugations in the sealed vent of Pit Structure 1 at LA 37600 (Toll 2013).

Large Hafted Tools: Summary

There are some clear trends in hafted tool occurrence (Table 20.25). Mauls are uniformly early, and axes occur throughout Pueblo II and III in a variety of contexts. Tchamahias, on the other hand, are mostly a Pueblo III phenomenon, especially when we con-

Table 20.22. Axes (whole only), mean dimensions (mm), counts, and weights (g) by type.

	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)
Notched Maul				
Mean	171.80	77.80	45.40	910.00
Count	5	5	5	5
Standard deviation	29.71	4.97	10.97	361.25
Median	171.00	78.00	49.00	750.00
Minimum	131.00	70.00	31.00	600.00
Maximum	214.00	83.00	59.00	1300.00
Grooved Maul				
Mean	130.67	96.00	70.33	1350.00
Count	3	3	3	3
Standard deviation	19.01	25.63	12.10	576.63
Median	130.00	99.00	66.00	1550.00
Minimum	112.00	69.00	61.00	700.00
Maximum	150.00	120.00	84.00	1800.00
Axe				
Mean	186.50	97.00	50.50	1578.00
Count	2	2	2	2
Standard deviation	33.23	32.53	16.26	1183.70
Median	186.50	97.00	50.50	1578.00
Minimum	163.00	74.00	39.00	741.00
Maximum	210.00	120.00	62.00	2415.00
One-notch Axe				
Mean	155.00	86.00	44.00	800.00
Count	1	1	1	1
Two-notch Axe				
Mean	135.42	74.50	34.42	545.33
Count	12	12	12	12
Standard deviation	26.98	8.73	6.88	220.83
Median	132.00	74.50	33.50	550.50
Minimum	95.00	57.00	24.00	137.00
Maximum	197.00	85.00	46.00	950.00
Three-fourths Grooved Axe				
Mean	191.0	106.0	61.0	1550.0
Count	1	1	1	1
Full-grooved Axe				
Mean	173.0	56.0	47.0	650.0
Count	1	1	1	1
Total				
Mean	**150.7**	**80.5**	**44.2**	**852.0**
Count	**25**	**25**	**25**	**25**
Standard deviation	**31.820**	**16.233**	**14.625**	**524.356**
Median	**150.0**	**78.0**	**40.0**	**681.0**
Minimum	**95.0**	**56.0**	**24.0**	**137.0**
Maximum	**214.0**	**120.0**	**84.0**	**2415.0**

Table 20.23. Axes, comparison of broken and whole tools by dimensions.

	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)
Broken				
Mean	104.29	73.79	30.07	398.14
Count	14	14	14	14
Standard deviation	27.15	10.90	8.69	219.66
Median	104.50	80.00	29.50	386.00
Minimum	67.00	55.00	15.00	100.00
Maximum	170.00	88.00	45.00	840.00
Whole				
Mean	148.06	78.59	39.18	747.06
Count	17	17	17	17
Standard deviation	32.11	15.99	10.82	528.19
Median	139.00	78.00	39.00	650.00
Minimum	95.00	56.00	24.00	137.00
Maximum	210.00	120.00	62.00	2415.00
Total				
Mean	**128.29**	**76.42**	**35.06**	**589.48**
Count	**31**	**31**	**31**	**31**
Standard deviation	**36.87**	**13.92**	**10.79**	**448.17**
Median	**126.00**	**80.00**	**34.00**	**550.00**
Minimum	**67.00**	**55.00**	**15.00**	**100.00**
Maximum	**210.00**	**120.00**	**62.00**	**2415.00**

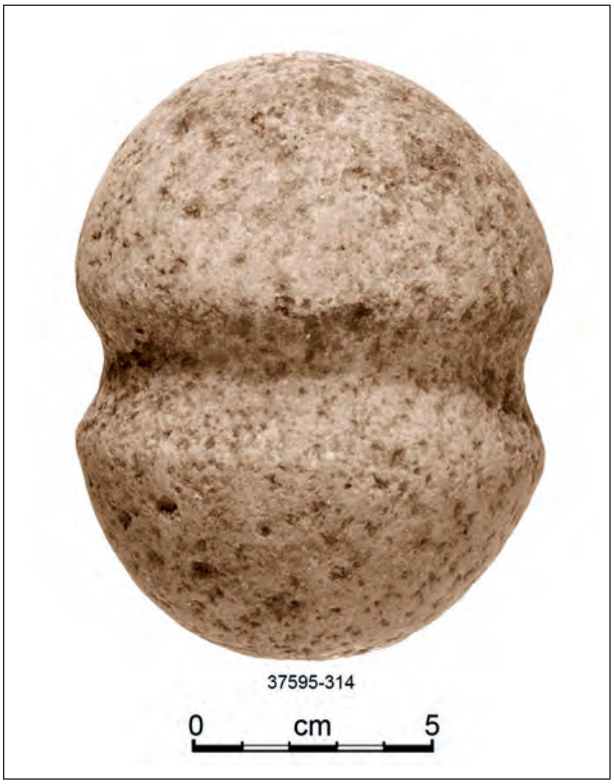


Figure 20.16. Fully shaped and ground diorite or granite maul from LA 37595, Pit Structure 3, a classic Basketmaker III pit house.

sider that the one Pueblo II example is the odd case from LA 37595 discussed above. As usual, most of both tool types were recovered from pit structures.

Other Ground Stone

Other ground stone includes items of unknown function such as "shaped slabs," polishers and abraders, jar covers, anvils and lapidary stones, and rare objects such as ground stone containers, palettes, sandal lasts, shaft straighteners, weights, wedges, and pipes. Given the large numbers of abraders recovered at Chaco (Akins 1997), their infrequency in the La Plata collections is notable. Many specialized abraders at Chaco were used for masonry preparation, an activity that was virtually absent in La Plata residential sites.

Shaped Slabs

This is the second most often used category in the analysis. It is a catchall for modified pieces of stone that cannot be assigned a more specific function. It therefore contains stone modified for building, fragments of grinding tools that cannot be identified, and other used stones of unidentifiable function.

Figure 20.17 [a–d]. Varieties of tchamahias found at Jackson Lake [note the similarity of the worn curve, especially in a.–c.]: a. black siltstone tchamahia (LA 37598, Room 102, surface stripping); b. siltstone, tanged tchamahia (LA 37593, Roomblock 1); c. Brushy Basin (shale) tchamahia (MIAC Catalogue 53240/11; LA 37598, Room 101, Floor 1); d. unusual siltstone example (LA 37595, Pit Structure 1, upper fill).

Table 20.24. Tchamahias, stratigraphic context counts by completeness.

	Fragment	Thickness Intact	Width and Thickness Intact	Whole	Total
Full cut	–	–	1	–	**1**
General structural fill	2	–	–	1	**3**
Upper fill above roof	–	–	4	–	**4**
Floor fill	–	–	1	–	**1**
Surface or floor	–	–	–	1	**1**
Present ground surface	–	1	–	–	**1**
Ground surface stripping	–	–	1	2	**3**
Total	**2**	**1**	**7**	**4**	**14**

Table 20.25. Large hafted tools, type counts by time period.

Tool Type	Basketmaker III–Pueblo I Pit Structure	Pueblo II Pit Structure	Pueblo II Room	Mealing Room	Pueblo III Pit Structure	Pueblo III Room	Total
Notched maul	–	1	–	–	–	–	**1**
Grooved maul	3	1	–	–	–	–	**4**
Weight	–	–	1	–	–	–	**1**
Axe	–	–	–	1	1	–	**2**
Two-notch axe	–	5	2	–	3	–	**10**
Full-grooved axe	–	1	–	–	2	–	**3**
Hoe	–	–	1	–	–	–	**1**
Tchamahia	–	1	–	–	6	1	**8**
Total	**3**	**9**	**4**	**1**	**12**	**1**	**30**

Over 90 percent of shaped slabs are sandstone, with a smattering of other sedimentary rocks and a few igneous. The overall mean weight of shaped slabs is 435 g, but a few large specimens weigh nearly 10 kg. Most of the items in the assemblage are quite small, 64 percent weighing 150 g or less.

The context of nearly half of the shaped slabs is pit structure fill above the roofing material. This shows the constructional nature of many of these items. A fifth are from floors and 15 percent from extramural areas. These items are likely the result of use and, again, construction.

One shaped and burned slab from Room 103 at LA 37593 was coded as a comal during the analysis. It is thin and regular, with pecked and ground faces, and one face is ground especially smooth. The slab is blackened around the edges, and the fine sandstone has been reddened by heat. It is now in three pieces, but in its original form it was probably a larger slab. The blackening of the edges took place after the first breakage of the slab. It is quite conceivable that this stone was used next to the fire, but the nature of the surface does not suggest a comal. Even the smooth face lacks the high, greasy black sheen that characterizes comales. This would be a very early context (Late Pueblo II) for a comal. This room is characterized by an unusual artifact assemblage, including points and minerals, a multipurpose shaped slab possibly used for lapidary work with one pitted and one smooth face, two axes, a subfloor vessel, and two complete manos. The slab may have had a special function, though not as a comal. The room lacks a hearth, so the burning may have occurred in a different location.

Jar Covers

Jar covers are relatively infrequent in the Jackson Lake assemblage, but one is present from a Basketmaker III context at LA 60751, indicating their early use (Table 20.26). These artifacts are shaped, flat stones, usually sandstone, although a couple of siltstone specimens are present. They would have served to reduce evaporation and keep detritus out of vessels' contents. They are usually small enough

Table 20.26. Jar covers, shape counts from five sites (LA 37592, LA 37593, LA 37598, LA 60749, LA 60751).

Site	Indeterminate	Circular	Oval	Subrectangular	Square	Total
LA 37592	2	2	1	–	–	**5**
LA 37593	1	1	2	–	–	**4**
LA 37598	3	–	–	1	–	**4**
LA 60749	1	–	–	–	–	**1**
LA 60751	–	–	–	–	1	**1**
Total	**7**	**3**	**3**	**1**	**1**	**15**

to cover the mouths of pots, rather than bowls, averaging 135 mm long and 11 mm thick. Though they were found in a variety of contexts, they were concentrated on and near floors (Table 20.27).

Anvils and Lapidary Stones

In keeping with the abundance of large stone tools at LA 37593, there were more anvils and lapidary stones there than at the other Jackson Lake sites, including LA 37592. They are split between flat cobbles and slabs, and among sandstone, igneous cobbles, and quartzite, with anvils more likely to be cobbles and lapidary stones sandstone, probably because of the greater durability of cobbles. More types of wear are present on lapidary stones, including grinding and polishing, and secondarily pitting and striations. Anvils have only pitting and battering. Ten of 17 anvils and lapidary stones are whole, evenly split between the two types. The average shape of both is oblong; lapidary stones are larger and considerably heavier. A carefully shaped, nearly square (125 by 115 by 50 mm) piece of sandstone from LA 37594 Room 103 has worn concavities on one face (coded lapidary stone), a pitted and ground opposite face (coded anvil), and large pits in one edge (coded pitted pounding stone).

Table 20.27. Jar covers, stratigraphic context counts by material type.

	Sandstone	Siltstone	Total
General structural fill	–	1	**1**
Upper fill above roof	3	–	**3**
Roofing material	–	1	**1**
Extramural fill	1	–	**1**
Floor fill	1	–	**1**
Surface or floor	5	–	**5**
Subfloor fill	1	–	**1**
Sealed floor feature	1	–	**1**
Ground surface stripping	1	–	**1**
Total	**13**	**2**	**15**

"Solitaires"

Six artifact types occur only once or twice in the assemblage (Table 20.28). These are all intriguing artifacts, and it is somewhat odd that some are so rare.

Shaft Straightener. There is only a portion of one shaft straightener, but the projectile points show that arrows were in use for hundreds of years and at all sites.

Sandal Last. Sandals would have been used throughout the occupation, but there is only one sandal last. But were sandal lasts really for making sandals? (See Cattanach 1980:289–291; Judd 1954:281–282; Rohn 1971:241–242). As Cattanach says, these artifacts may have been important for symbolic rather than functional reasons, which fits better with their relative scarcity. Judd (1954:282) also infers a Pueblo III ritual function for these rare artifacts. The example from LA 37598 Room 101 is the only classic example from the whole project (Fig. 20.18). As noted, it is from the same provenience as two other rare items, whole tchamahias, and its special function is further indicated by red pigment stains.

Weight. Another hard-to-identify single item is a notched flat cobble from LA 37594 Room 101, interpreted as a weight. Weighing over 2 kg, it could indeed have held something down, but to be part of a weaving complex or a net system for snaring rabbits, more weights would be required.

Wedge. The single item recorded as a wedge (from LA 37593 Pit Structure 1) is a dense piece of dark igneous rock that has been slightly shaped. Most of its wedge profile is natural; it tapers from 67 to 20 mm thick over its 285 mm length. There is some damage to the thin edge, but the tool has not been heavily used and shows no battering on the poll end. It is certainly wedge-shaped, but its use as a wedge in the modern sense, that is, for splitting or shimming, is questionable. It could as easily be a piece of building stone, although an unusual one.

Palettes. Two palettes were recovered; they are quite different. One is igneous and twice as thick as the other, which is of sandstone. The igneous specimen is a completely unmodified cobble from the fill of LA 37598 Pit Structure 2. It has a 5 by 6 mm area of bright red (7.5R 5/6) pigment on a convex face. The second artifact is more like a conventional palette. It is a thin piece of a fine-grained, tabular sandstone. The unbroken edge is chipped and lightly ground, and one corner suggests that it was square or rectangular. Another hematitic pigment (10R 5/8–6/8) covers much of the surface of this artifact, an area about 12 by 12.5 cm. It appears that the pigment would have been toward the middle of the palette, since pigment is absent around the edges. This artifact was found near the floor of LA 37595 Pit Structure 1.

Jet bowl—sherd or ornament. A jet "bowl sherd" from LA 37592 is a very unusual artifact (Fig. 13.97d). Eric Blinman (personal communication) points out that we would not hesitate to call it a bowl fragment if it were ceramic. The sherd has been drilled, presumably to turn it into a pendant (see the ornament section, below). Such a jet bowl would have been created by careful grinding and polishing.

Table 20.28. Rare ground stone artifact types from five sites (LA 37592, LA 37593, LA 37594, LA 37595, LA 37598); summary table.

	Provenience	Type	Material	Length (mm)	Length Dimension	Width (mm)	Width Dimension	Thickness (mm)	Thickness Dimension	Weight (g)
LA 37592	Pit Structure 1	bowl or basin	jet	28.0	incomplete	28.0	incomplete	5.0	complete	3.0
LA 37593	Pit Structure 1	wedge	sandstone	283.0	complete	97.0	complete	72.0	complete	2800.0
LA 37594	Other Structure 2	shaft straightener	sandstone	88.0	incomplete	50.0	incomplete	47.0	complete	229.0
LA 37594	Room 101	weight	igneous	263.0	complete	133.0	complete	65.0	complete	2100.0
LA 37598	Room 101	sandal last	sandstone	186.0	incomplete	146.0	complete	9.0	complete	494.0
LA 37594	Pit Structure 5	pipe	tuff	59.0	complete	23.0	complete	4.0	complete	18.0
LA 37595	Pit Structure 1	palette	sandstone	173.0	incomplete	100.0	incomplete	22.0	complete	470.0
LA 37598	Pit Structure 2	palette	igneous	176.0	complete	119.0	complete	49.0	complete	1600.0

Ornaments
Laurel Wallace

Ornaments for the Jackson Lake community are mostly included in the ground stone analysis. A separate analysis of all ornaments recovered from the La Plata Highway project was conducted by Laurel Wallace; her findings are reported in Volume 6 of this report. Sixty-eight items classified as ornaments, seven concretions, and a pipe are included in the Jackson Lake ground stone analysis, a total of 76 items (Table 20.29). Over two-thirds of these items are red shale ornaments (mostly fragments) from LA 37592, where it seems likely

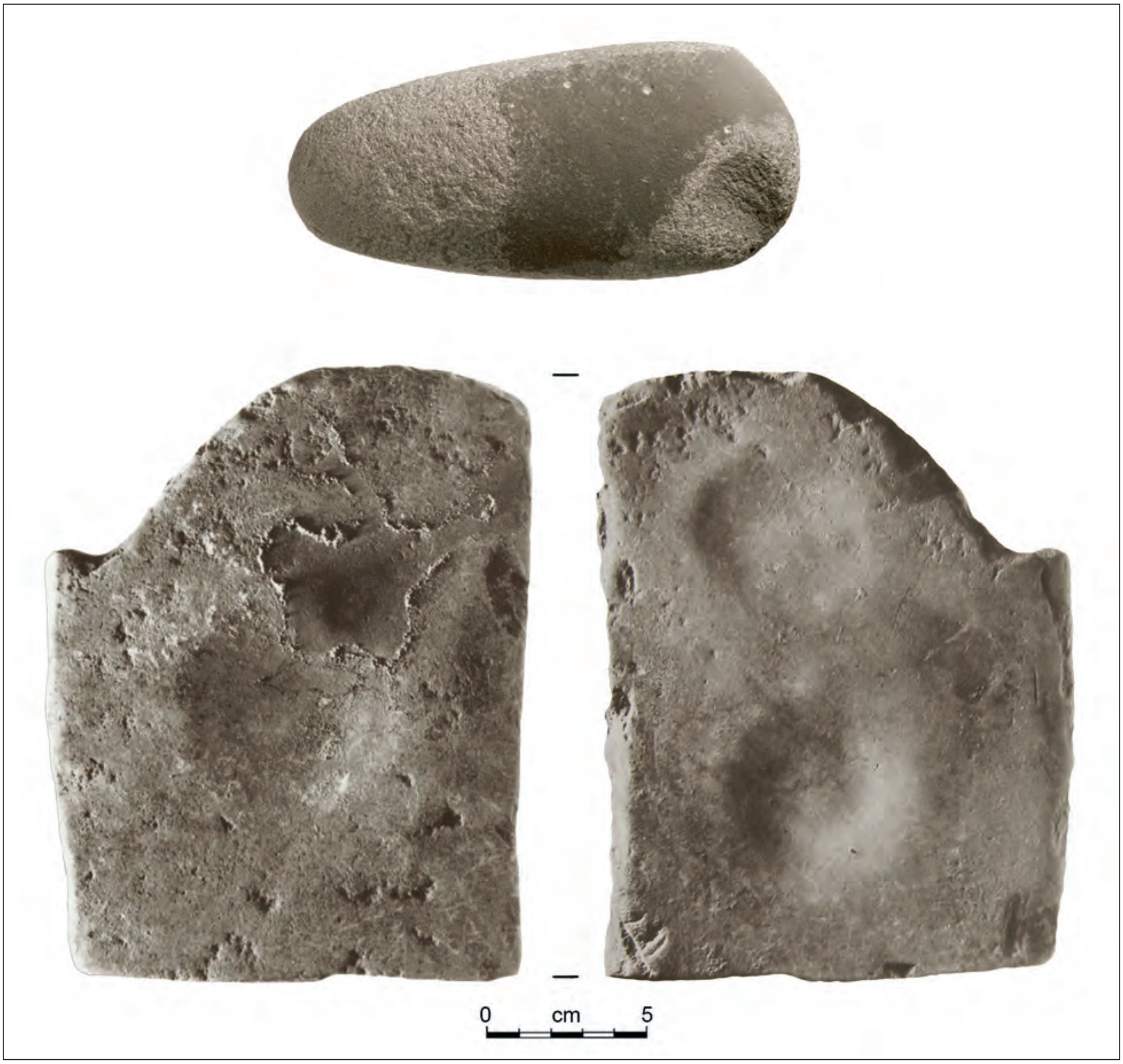


Figure 20.18. LA 37598, Roomblock 1: possible pestle (top; from surface above Room 102), and bottom, both faces of a "sandal last" (from Room 101, Floor 1). Traces of pigment are present in three of the sandal last's depressions, with pink overlying yellow, white and green on top of red, and the last showing some red alone (note: the last was photographed with black-and-white film; pigment is not visible in these photos). These objects were found near the tchamahias in MIAC Catalogue 53241/11.*

that ornament manufacture was taking place (Figs. 13.97a–d; 20.19 [a–d]). There is a single piece of turquoise in the collection, and just three travertine beads. There are more nonlocal ornament materials from the Barker Arroyo sites, but because of the larger quantity of material from Barker Arroyo, the difference between the communities is not statistically significant.

Temporal Analysis

Of the total of 105 ornaments from the Jackson Lake community group (Tables 20.30, 20.31, 20.32, 20.33, 20.34), 58 ornaments from seven sites were found in association with confidently dated temporal components (Table 20.32). The heaviest occupation of the lower La Plata Valley was between AD 1000

Table 20.29. Ornaments and specialized ground stone, material type counts by artifact type.

	Ornament	Pendant	Bead	Pipe	Concretion	Total
Silicified wood	1	–	–	–	–	**1**
Tuff	–	–	–	1	–	**1**
Travertine	–	–	3	–	–	**3**
Sandstone	2	1	–	–	1	**4**
Siltstone	1	1	1	–	–	**3**
Mudstone	–	1	–	–	–	**1**
Shale	26	25	–	–	–	**51**
Quartzite	–	–	–	–	2	**2**
Turquoise	1	–	–	–	–	**1**
Selenite	1	2	–	–	3	**6**
Jet	1	1	–	–	–	**2**
Fossil	–	–	–	–	1	**1**
Total	**33**	**31**	**4**	**1**	**7**	**76**

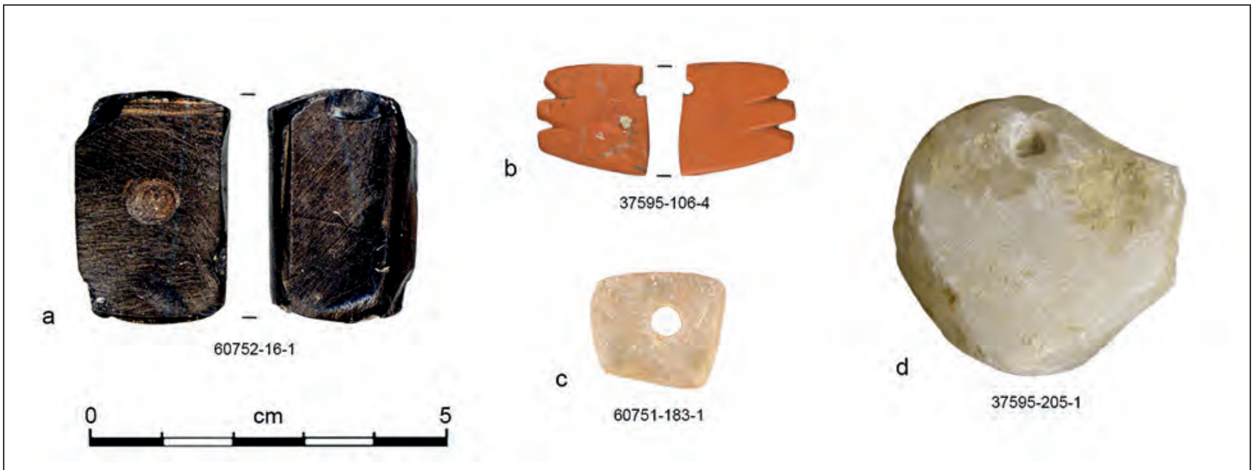


Figure 20.19 [a–d]. Ornaments: a. jet pendant blank with incipient drill hole in one face from LA 60752, Extramural Area 1, surface; b. burned ("red dog") shale pendant from LA37595, Pit Structure 1, upper fill; c. selenite bead from LA 60751, Pit Structure 1, Floor 3, Feature 17; d. partially drilled piece of selenite from LA 37595, Pit Structure 2, upper fill.

20.30. Ornaments, type counts by site.

	LA 37591	LA 37592	LA 37593	LA 37594	LA 37595	LA 37598	LA 60751	LA 60752	Total
Inlay/mosaic/set	–	–	1	–	–	–	4	–	**5**
Pendant blank	–	5	–	–	1	–	–	1	**7**
Bone bead tube	1	10	–	–	–	3	–	–	**14**
Tinkler	3	2	–	–	1	2	–	–	**8**
Manufacturing debris	1	16	1	–	–	6	1	–	**25**
Possible bead debris	–	3	–	–	–	–	–	–	**3**
Fragment	–	2	–	–	–	–	–	–	**2**
Pendant	4	15	5	4	2	–	–	–	**30**
Disc bead	–	–	–	1	3	1	–	–	**5**
Other object	–	1	–	–	1	–	–	–	**2**
Other bead	1	1	–	–	–	–	1	–	**3**
Disc	–	–	1	–	–	–	–	–	**1**
Total	**10**	**55**	**8**	**5**	**8**	**12**	**6**	**1**	**105**

Table 20.31. Ornaments, artifact material types, counts by site and material groups.

	LA 37591	LA 37592	LA 37593	LA 37594	LA 37595	LA 37598	LA 60751	LA 60752	Total
Stone, Mineral									
Travertine	–	–	–	–	3	–	–	–	**3**
Sandstone	–	2	1	–	–	–	–	–	**3**
Siltstone	–	–	–	1	–	1	–	–	**2**
Shale, red	2	36	–	2	2	6	–	–	**51**
Metamorphic, nfs	–	–	–	1	–	–	–	–	**1**
Turquoise	–	–	1	–	–	–	–	–	**1**
Selenite	–	–	–	–	1	–	6	–	**7**
Jet	–	2	–	–	–	–	–	1	**3**
Pottery									
Pueblo II–III black-on-white	–	1	–	–	–	–	–	–	**1**
Pueblo III black-on-white	2	–	–	–	–	–	–	–	**2**
Polished white	1	–	1	–	–	–	–	–	**2**
Mesa Verde Polished White	–	–	1	–	–	–	–	–	**1**
Mesa Verde Deadmans Black-on-red	–	–	1	–	–	–	–	–	**1**
Mesa Verde Black-on-red	–	1	–	–	–	–	–	–	**1**
Bone, Shell									
Small mammal	–	4	–	–	–	–	–	–	**4**
Medium mammal	1	–	–	–	–	–	–	–	**1**
Lepus californicus	3	2	–	–	1	2	–	–	**8**
Aves	–	2	–	–	–	2	–	–	**4**
Meleagris gallopavo	1	4	–	–	–	1	–	–	**6**
Shell, nfs	–	–	–	1	1	–	–	–	**2**
Olivella dama	–	1	–	–	–	–	–	–	**1**
Total	**10**	**55**	**8**	**5**	**8**	**12**	**6**	**1**	**105**

nfs = not further specified

Table 20.32. Ornaments, by site and time period; counts and percents.

	Early Basket-maker III		Basket-maker III		Mid Pueblo II		Late Pueblo II		Early Pueblo III		Late Pueblo III		Total	
	AD 600		AD 600–725		AD 1000–1075		AD 1075–1125		AD 1125–1180		AD 1200–1300			
Site	**N**	**Row %**	**N**	**Row %**	**N**	**Row %**	**N**	**Row %**	**N**	**Row %**	**N**	**Row %**	**N**	**Col. %**
LA 37591	–	–	–	–	–	–	–	–	1	11.1%	8	88.9%	**9**	**15.5%**
LA 37592	–	–	–	–	–	–	–	–	2	8.3%	22	91.7%	**24**	**41.4%**
LA 37593	–	–	–	–	–	–	3	100.0%	–	–	–	–	**3**	**5.2%**
LA 37594	1	20.0%	–	–	4	80.0%	–	–	–	–	–	–	**5**	**8.6%**
LA 37595	–	–	–	–	7	100.0%	–	–	–	–	–	–	**7**	**12.1%**
LA 37598	–	–	–	–	7	87.5%	–	–	1	12.5%	–	–	**8**	**13.8%**
LA 60751	–	–	2	100.0%	–	–	–	–	–	–	–	–	**2**	**3.4%**
Total	**1**	**1.7%**	**2**	**3.4%**	**18**	**31.0%**	**3**	**5.2%**	**4**	**6.9%**	**30**	**51.7%**	**58**	**100.0%**

Table 20.33. *Ornaments, morphology and material, provenience contexts for three Mid Pueblo II sites (LA 37594, LA 37595, LA 37598).*

Morphology	LA 37594	LA 37595	LA 37598	Total Count	Total Column %
Pendant blank	–	1 selenite (construction deposit)		1	5.6%
Bone bead tube	–	–	1 turkey tarsometatarsus (roof fall)	1	5.6%
Bone tinkler	–	–	2 jackrabbit tibia (trash fill)	2	11.1%
Manufacturing debris	–	–	3 burned shale (2 mixed	3	16.7%
			fill, 1 collapsed masonry)		0.0%
Pendant	2 burned shale, 1 marine shell	2 burned shale (1 mixed		5	27.8%
	(2 mixed fill, 1 unknown)	fill, 1 roof fall)			0.0%
Disc bead	1 siltstone (architectural element)	3 travertine (1 mixed fill,	1 siltstone (cultural fill)	5	27.8%
		1 floor association, 1 roof fall)			0.0%
Indeterminate fragment	–	1 marine shell (mixed fill)		1	5.6%
Total	**4**	**7**	**7**	**18**	**100.0%**
Percent of total	**22.2%**	**38.9%**	**38.9%**		**100.0%**

* mixed fill = cultural and natural deposit.

and 1300, and the number and type of ornaments recovered from this period reflect the variety and frequency of components excavated during the La Plata Highway project.

Early Basketmaker III (pre–AD 600). One burned quarztitic sandstone pendant fragment was found in the roof fall of a pit structure at the northern end of LA 37594. As determined by associated brown wares, house form, and ^{14}C dates, this is the earliest structure excavated during the project.

Basketmaker III (AD 600–725). The pit structure at LA 60751 contained two selenite ornaments. One item was a cube-shaped manufacturing debris fragment, and the other was a large square bead rubbed with red pigment (Fig. 20.19 [c]). Both items came from cultural fill in the pit structure. The bead came from a pit feature (Feature 17) in Floor 3. The similar nearby pit structure at LA 37595 contained little material and no ornaments.

Middle Pueblo II (AD 1000–1075). This period was one of the best represented in the valley, associated with three sites at this community (Table 20.33). Disc beads and pendants were the most numerous artifacts dating to this period (each n = 5; 27.8 percent), as was the use of locally found burned shale (7 items; 38.9 percent). Imported materials such as travertine (n = 3; 16.7 percent) and marine shell (n = 2; 11.1 percent) represent a relatively high percent overall of imported materials used. All but two items were associated with deposits indicating loss or discard patterns (n = 16; 89 percent, including mixed fill, cultural fill, trash, construction, architectural element, roof fall, and collapsed masonry). Ornaments came from pit structures (72.2 percent), extramural area features and fill (16.7 percent), and rooms (11.1 percent).

Late Pueblo II (AD 1075–1125). LA 37593 is the sole representative of this temporal component. One turquoise inlay came from a de facto association with Floor 2 of Room 103, a provenience containing distinctive artifacts from other material classes, including projectile points, azurite, and an effigy vessel. Also in Room 103 was a burned shale manufacturing debris fragment, found in collapsed masonry. A burned shale pendant was found in the roof dirt of Pit Structure 1.

Early Pueblo III (AD 1125–1180). Three sites

Table 20.34. Ornaments, morphology and material, provenience contexts for two Late Pueblo III sites (LA 37591, LA 37592).

Morphology	LA 37591	LA 37592	Total	
			Count	Col. %
Pendant blank	–	2 burned shale, 1 sandstone (trash fill)	**3**	**10.0%**
Manufacturing debris	1 burned shale (trash fill)	6 burned shale (3 mixed fill, 3 trash fill)	**7**	**23.3%**
Possible bead debris	–	3 burned shale (mixed fill)	**3**	**10.0%**
Modified item	–	2 burned shale (trash fill)	**2**	**6.7%**
Pendant	2 Pueblo III black-on-white	1 Pueblo II–III black-on-white, 1 jet	**9**	**30.0%**
	1 polished white (trash fill)	4 burned shale (trash pit)		
Other bead	1 medium mammal (trash fill)	–	**1**	**3.3%**
Bone bead tube	–	1 turkey tibiotarsus (trash fill)	**1**	**3.3%**
Bone tinkler	3 jackrabbit tibia (trash fill)	1 jackrabbit tibia (trash fill)	**4**	**13.3%**
Total	**8**	**22**	**30**	**100.0%**
% of Total	**26.7%**	**73.3%**		**100.0%**

with a total of four ornaments represent this time period. One turkey tibiotarsus bone bead tube from Floor 1 of Pit Structure 1 (de facto refuse) at LA 37591 was recovered. LA 37592 had one burned shale manufacturing debris fragment from the bench of Pit Structure 1 (de facto refuse) and a sandstone doughnut-shaped concretion from the mixed fill in the vent tunnel of the same structure. One burned shale manufacturing debris fragment was found at LA 37598 in cultural fill from Room 101, Floor 1.

Late Pueblo III (AD 1200–1300). LA 37591 and LA 37592 represent this temporal component with over half (51.7 percent) of all ornaments from the Jackson Lake community. Pendants were most numerous (nine items, 30 percent), with manufacturing debris prominent as well (seven items, 23.3 percent). LA 37592 had the majority of ornaments (22 items, 73.3 percent) and strong indication of burned shale ornament manufacture (Table 20.34). Of the pendant blanks, manufacturing debris, possible bead debris, modified items, and pendants found at the site, 17 out of 20 items (85 percent) were made from locally sourced burned shale. A sandstone file was also found at this site, along with several pendants with curved interior edges requiring the use of such a file. Only two pieces of jet were recovered from Jackson Lake community sites, one a remarkable drilled pendant made from a jet bowl (Fig. 13.97d), also from the Pit Structure 1 midden. Jet is found in coal seams, and coal seams are present in the valley, but it is not known if ornament-quality jet is obtainable there. No definitely imported materials were noted in this component. Ornaments came mostly from trash fill at both sites (80 percent), with less from mixed cultural and natural fill (20 percent). All of the items from LA 37591 came from Pit Structure 1 trash fill. All of the ornaments from LA 37592 came from Pit Structure 1, 22.7 percent from mixed fill, and 77.3 percent from the midden in the upper structure fill.

Summary: Ornaments

For all time periods at Jackson Lake, ornaments come primarily from deposits indicating loss or discard patterns (90.8 percent). Locally sourced materials were used predominantly through all time periods. Mid Pueblo II (AD 1075–1125) was the sole component with imported materials (marine shell and travertine). Using the more general dates of the Pecos Classification for the La Plata Valley, imported materials were found in nearly all time periods from AD 600 to 1300. The Pecos Pueblo II period (AD 1000–1150) is noted for the most variety in ornament type and material use, reflecting the numerous occupations in the valley at that time.

Ornaments were typically found in pit structure fill, regardless of time period. From the Mid Pueblo II component through the Late Pueblo III component, where surface rooms are present, pit structures are still the predominant trash and mixed-fill context in which ornaments were found (72.2–100 percent).

Ground Stone Tools at Jackson Lake: Conclusions

In the generally earlier Dolores assemblages and in Chaco assemblage contemporaneous with the majority of the La Plata material, trough metates are virtually the only form found (Schelberg 1997; Phagan 1988:188). In contrast, our analysis of the La Plata Valley ground stone shows that slab metates and manos are far more abundant. In terms of whole identified manos, there are 48 slab manos and 13 trough manos. There is clearly a steady replacement of trough metates by slab metates (Table 20.35), but here it starts much earlier and is different from the later adoption of slab metates in these nearby areas. The Jackson Lake sample exaggerates this apparent trend: in the whole project sample, the ratio is 3:1 slab to trough metates by Late Pueblo III, but in the Jackson Lake sample of well-dated specimens, no trough metates are present after Mid Pueblo II. Assuming that these differences are not classificatory, there are several possible reasons for these differences. It could be that the predominance of raw materials in cobble form made the creation of trough metates more difficult, and use of thinner slabs of sandstone led to earlier use of slab metates. More abstractly, it may be that greater productivity in the better-watered, warmer setting of the La Plata led to an earlier conversion to presumably more efficient slab metates.

Manos are almost all of the two-hand type, and identifiable mano forms also favor the slab system over the trough. While most manos were undoubtedly for grinding corn, there is enough variability in size and form to indicate that this morphological group had other functions as well. A good example of this are two pairs of well-shaped and -used "manos" that are much shorter than the average size range for two-hand manos. Both pairs of these tools come from proveniences that contain other unusual artifacts and are likely to represent special functions.

The ground stone industry at Jackson Lake was

Table 20.35. Grinding tools (manos and metates), type counts by time period.

	Early Basket-maker III	Basket-maker III	Mid Pueblo II	Late Pueblo II	Early Pueblo III	Late Pueblo III	Total
Manos							
Mano	8	2	27	15	11	36	**99**
One-hand mano	–	–	9	7	1	–	**17**
Two-hand mano	2	3	25	7	11	10	**58**
Two-hand trough mano	–	–	9	4	–	2	**15**
Two-hand slab mano	–	2	20	9	6	2	**39**
Two-hand loaf mano	–	–	–	1	–	–	**1**
Total	**10**	**7**	**90**	**43**	**29**	**50**	**229**
Trough forms	–	–	9	4	–	2	**15**
Slab forms	–	2	20	11	6	3	**42**
Metates							
Metate	1	–	2	3	2	4	**12**
Trough metate	–	1	4	2	1	–	**8**
Ends-open trough metate	–	–	1	–	–	–	**1**
One-end-open trough metate	–	–	1	–	–	–	**1**
Slab metate	–	1	8	2	2	5	**18**
Total	**1**	**2**	**16**	**7**	**5**	**9**	**40**
Trough Forms	–	1	6	2	1	0	**10**
Slab Forms	–	1	8	2	2	5	**18**
Total	**11**	**9**	**106**	**50**	**34**	**59**	**269**

remarkably diverse in materials and forms, and some of the artifacts produced required skill and perseverance to produce. While it may be that artifacts such as "hornstone" tchamahias were acquired from specialists (Shelley 1980; Wenker 1999; Larralde and Schlanger, Vol. 6, this report), it is likely that axes and grinding tools were produced by local artisans from local materials. Materials for metates were perhaps opportunistically available as large cobbles on terraces, but for the most part these bulky items had to be searched out and transported. Metate discard throughout the pueblo record is notable in that these largest of implements are so rarely left in situ. Presumably because of their labor investment value and their symbolic significance, they were usually removed and apparently taken away. In many senses, then, the ground stone complement of the artifact assemblage represents more labor input than the more visible chipped stone complement.

21 Faunal Remains

H. Wolcott Toll

Not counting human remains and eggshell, nearly 15,000 pieces of bone were recovered and analyzed from the Jackson Lake sites. Six of the sites account for most of the faunal sample, and LA 37592 accounts for nearly two-thirds of it (Table 21.1). A wide variety of species were identified, with a few elements of less common species such as wolf, turtle, weasel, and owl, and larger groups of some amphibians and reptiles from whole individuals, probably deposited after sites and structures had been abandoned (Table 21.1). The great majority of elements come from a few species that were probably mostly used for subsistence: jackrabbit and cottontail, deer, and turkey (Table 21.2). Some of the turkey counts also include articulated individuals from deconsecration contexts at pit structure closure, but many are also from disposal contexts. The dog remains are also mostly from a few articulated individuals.

Large "meat package" species—elk, antelope, and bighorn sheep— are very uncommon, except for a large number of bighorn horn core fragments placed as one unit, likely a special context, in a cist at LA 37592 (Table 21.1). A few bighorn cranial and long bone elements were also recovered from the Pit Structure 1 midden along with the only pronghorn elements (a scapula and a radius). Elk remains are absent in the Jackson Lake sites. Reflecting differences in immediate site environs, prairie dogs, very abundant at Pueblo Alto (Akins 1987:453, 460), are a very small component of the assemblage and unlikely to be a major part of the "small mammal" group here.

Intraspecies distribution of elements provides information on body part use and transport. Table 21.4 show elements placed into larger categories (all carpals, pelvis elements, etc.) using bone that is at least half present in the collection. The turkey elements are fairly similar to the distribution of elements in individual turkeys. That is, there are many wing and foot elements, and the meat-bearing long bones are similar in frequency from site to site. This again relates to the presence of whole individuals in some contexts, as well as the likelihood of processing and perhaps raising birds on individual sites.

Among the deer elements, there is some indication of a preference for metapodials and scapulae for tools (Tables 21.5, 21.6), although most body parts are represented in the deer and undifferentiated artiodactyl large-mammal group (Table 21.4). If portions of deer were being transported from more distant locations, more long-bone elements and foot elements, and fewer cranial and vertebral elements would be expected. In addition to being attached to meat packages, leg and foot bones were especially useful for tools. Thus, these unmatched counts suggest that deer meat was being brought in off the bone (Table 21.4; Akins 1985:361).

Each of the major groups probably accounts for the majority of elements that could not be as specifically identified. Thus, "small mammal" probably consists mostly of rabbits, "large mammal and artiodactyl" mostly deer, "medium mammal" most likely dog, and "aves" mostly turkey. Because these elements lack characteristics that allow more exact identification, they possibly include some other species, but probability says they mostly belong to those major groups. In some of the tables these generic groups are combined with their likely specific group (Tables 21.4, 21.5, 21.7).

Especially in later contexts (post-AD 1100), turkey is a very important part of the faunal assemblage (Tables 21.7, 21.8). The birds may have had a ceremonial use, as can be seen when whole individuals were placed in pit structures at closure

Table 21.1. Faunal remains, taxa counts by site.

	LA 37591	LA 37592	LA 37593	LA 37594	LA 37595	LA 37598	LA 60751	Total
Prairie dog	7	47	1	3	1	4	–	**63**
Rock squirrel	7	19	1	–	1	–	–	**28**
Small squirrel	3	21	4	4	–	2	–	**34**
Pocket gopher	8	26	5	1	5	4	–	**49**
Ord's kangaroo rat	–	104	–	–	–	–	–	**104**
Banner-tailed kangaroo rat	–	–	195	–	–	–	–	**195**
Mouse	–	9	22	119	66	6	–	**222**
Northern grasshopper mouse	–	3	–	–	18	1	–	**22**
Woodrat	5	48	1	–	–	–	–	**54**
Porcupine	–	–	1	–	–	–	–	**1**
Rodent	–	1	6	–	–	2	–	**9**
Cottontail rabbit	207	510	10	26	33	28	7	**821**
Jackrabbit	219	293	13	24	37	38	1	**625**
Rabbit	–	1	–	–	–	–	–	**1**
Raccoon	–	1	–	–	–	–	–	**1**
Badger	–	–	–	3	–	–	–	**3**
Weasel and allies	1	–	2	–	–	–	–	**3**
Bobcat	–	1	–	–	–	–	–	**1**
Gray fox	3	1	–	–	–	–	–	**4**
Dog	–	2	–	–	157	–	–	**159**
Gray wolf	–	1	–	–	4	–	–	**5**
Dog, coyote, wolf	8	25	10	268	30	1	–	**342**
Dog, coyote, fox, wolf	1	2	3	–	3	–	–	**9**
Deer	18	302	47	23	53	33	11	**487**
Pronghorn	–	2	–	–	–	–	–	**2**
Big-horned sheep	–	39	–	1	–	–	–	**40**
Artiodactyl	2	86	11	2	83	2	–	**186**
Medium artiodactyl	–	3	–	–	–	–	–	**3**
Mammal	7	520	69	14	18	15	14	**657**
Small mammal	311	1769	112	107	156	66	–	**2521**
Medium–large mammal	94	257	25	16	164	24	–	**580**
Large mammal	51	748	184	79	89	63	5	**1219**
Canada goose	–	1	–	–	–	–	–	**1**
Waterfowl	–	1	–	–	–	–	–	**1**
Quail	6	7	–	–	–	1	–	**14**
Quail, partridge	–	1	–	–	–	–	–	**1**
Mourning dove	–	4	–	–	–	–	–	**4**
Jay, magpie, crow	7	6	–	–	–	–	–	**13**
Rough-legged hawk	–	–	124	–	–	–	–	**124**
Sparrow hawk	1	–	–	–	–	–	–	**1**
Great-horned owl	–	4	–	–	–	–	–	**4**
Turkey	316	2151	20	31	116	108	–	**2742**
Bird	235	1572	117	40	41	81	–	**2086**
Box turtle	–	2	–	–	–	–	–	**2**
Whiptail lizard	–	–	–	–	22	–	–	**22**
Nonvenomous snake	–	105	6	–	18	–	–	**129**
Bullsnake	–	–	7	–	–	–	–	**7**
Rattlesnake	–	514	–	–	–	–	–	**514**
Toad and frog	4	166	46	3	52	–	–	**271**
Fish	–	1	–	–	–	–	–	**1**
Sucker	–	1	–	–	–	–	–	**1**
River carpsucker	4	–	–	–	–	–	–	**4**
Bigmouth carpsucker	–	1	–	–	–	–	–	**1**
Marine or freshwater shell	–	1	–	1	3	–	–	**5**
Total	**1525**	**9379**	**1042**	**765**	**1170**	**479**	**38**	**14,398**

Table 21.2. Faunal remains, major faunal group by site; counts and percents

	Cottontail Rabbit		Jackrabbit		Deer		Turkey		Total	
Site	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %
LA 37591	207	25.3%	219	34.7%	71	3.7%	551	11.4%	**1048**	**12.8%**
LA 37592	508	62.0%	293	46.4%	1136	58.5%	3715	77.1%	**5652**	**68.8%**
LA 37593	10	1.2%	13	2.1%	242	12.5%	135	2.8%	**400**	**4.9%**
LA 37594	26	3.2%	24	3.8%	104	5.4%	70	1.5%	**224**	**2.7%**
LA 37595	33	4.0%	37	5.9%	225	11.6%	157	3.3%	**452**	**5.5%**
LA 37597	–	–	2	0.3%	15	0.8%	1	0.0%	**18**	**0.2%**
LA 37598	28	3.4%	38	6.0%	98	5.0%	188	3.9%	**352**	**4.3%**
LA 60744	–	–	1	0.2%	4	0.2%	–	–	**5**	**0.1%**
LA 60749	–	–	4	0.6%	32	1.6%	2	0.0%	**38**	**0.5%**
LA 60751	7	0.9%	1	0.2%	16	0.8%	–	–	**24**	**0.3%**
Total	**819**	**100.0%**	**632**	**100.0%**	**1943**	**100.0%**	**4819**	**100.0%**	**8213**	**100.0%**

Deer and large mammal, and turkey and Aves combined.

of the structure, a practice referred to as deconsecration (Gillespie 1976:67, 152; Hill 2000). Dogs were used in a similar fashion, but less often than turkeys. From modern uses of turkey, we assume that turkey equals food, but this was not necessarily the case earlier (Akins 1985:326, 368–369).

Turkey husbandry is of great interest, and eggshell is a clue to its presence, though a problematic one (Tables 21.9, 21.10; Akins 1985:374). Other avenues to distinguishing domestic from wild individuals are studies of body size and age distribution (Akins 1987:375–377; Hargrave 1965), but to date the results of these attempts are largely discredited. Size and morphology studies have not been pursued with this collection. Neonate and juvenile turkeys do occur in the large sample from LA 37592, but three-fourths of the remains there and nearly all of the age-identifiable turkey elements from the other Jackson Lake sites are from mature birds. Three percent of identified turkey elements are from fetal or neonatal birds, and less than 1 percent of the general bird category (less than 2 percent of total bird remains). The frequency of juvenile turkey or Aves elements is even less (0.8 percent).

Eggshell was recovered in greatly varying quantities from all sites with substantial subsurface deposits, including the Basketmaker structure at LA 60751 (Table 21.10). Given the increased frequency of turkey in late deposits, the purely AD 1000s or earlier dates of LA 37595 make the disproportionate occurrence of eggshell there noteworthy (Tables 21.9, 21.10). Most of this LA 37595 eggshell was recovered from the roof material and floors of a single pit structure (Table 21.10). At other sites in both Mid Pueblo II and Pueblo II–III contexts eggshell was more evenly distributed among exterior, rooms, and pit structures. This could relate to both locus of rearing and use of turkey eggs for ritual, or just to collection and preservation differences (Akins 1985:374–377). The remains, then, show the whole life span of turkeys, but no pens such as those found at Mesa Verde or other direct evidence of domestication and cultivation were encountered.

Other birds, including raptors, are very uncommon in the site assemblages (Table 21.1). An articulated Harris hawk was buried with an older man at LA 37593; the ceremonial suggestiveness of this burial led us to name the site Thundermaker. The only other raptor element in Jackson Lake sites is a sparrow hawk radius from LA 37591. The large faunal assemblage from LA 37592 contains no raptor elements. This scarcity of raptor elements seems anomalous; some examples may have been placed in the Aves group.

Modified Bone

Animal bone was an important tool and ornament material (Tables 21.11, 21.12). Awls were the primary tool type made from bone, but they came in many varieties (Tables 21.5, 21.13, 21.14; Figs. 21.1 [a–f], 21.2 [a–c], 21.3 [a–c], 21.4 [a–b], 21.5 [b]). Coarse-point awls were most numerous, followed by fine- and medium-point awls. The variety and abundance of awls indicates a range of activities from leatherwork to weaving. Since we have almost

Table 21.4. Faunal remains, bone elements counts by major faunal group.

Bone Elements	Small Mammal	Large Mammal	Cottontails	Jackrabbits	Canids	Deer *	Turkey **	Total
Indeterminate	4	4	0	0	0	0	16	**24**
Indeterminate fragment	178	104	0	0	0	0	237	**519**
Long bone fragment	1906	864	0	0	0	4	1201	**3975**
Plate, blade fragment	209	156	0	0	0	7	424	**796**
Cancellous tissue	5	22	0	0	0	0	15	**42**
Tooth fragment	1	8	0	0	9	1	0	**19**
Cranial fragment	22	7	0	0	0	0	24	**53**
Antler	0	1	0	0	0	0	0	**1**
Horn core	0	78	0	0	0	0	0	**78**
Cranial (undifferentiated)	0	0	0	0	0	0	67	**67**
Cranial complex	9	4	0	0	3	0	9	**25**
Anterior half of vault	1	0	0	0	0	0	0	**1**
Cranial (anterior)	60	1	42	17	11	11	32	**174**
Cranial (posterior)	48	1	61	39	4	5	45	**203**
Mandible	85	2	83	43	14	13	28	**268**
Undifferentiated tooth	19	5	14	3	38	14	0	**93**
Indeterminate tooth	35	4	6	1	0	0	0	**46**
Vertebra	2	20	1	2	87	1	27	**140**
Atlas (C1)	4	0	2	3	5	3	7	**24**
Axis (C2)	4	0	1	1	2	1	10	**19**
Cervical vertebra	23	1	1	5	18	9	165	**222**
Thoracic vertebra	19	2	7	12	17	27	19	**103**
Lumbar vertebra	53	7	26	22	8	35	1	**152**
Sacral vertebra	3	2	1	0	0	0	1	**7**
Sacrum	6	0	1	2	2	1	1	**13**
Caudal vertebra	50	0	0	0	9	0	29	**88**
Sternebra sternum	0	0	0	1	5	1	61	**68**
Rib	199	99	27	28	108	16	462	**939**
Ossified cartilage	0	0	0	0	10	0	86	**96**
Clavicle	11	0	4	0	0	0	0	**15**
Scapula	24	3	69	56	11	39	61	**263**
Innominate	45	2	87	45	4	23	60	**266**
Humerus	33	1	51	46	10	33	99	**273**
Radius	24	0	51	43	10	30	83	**241**
Ulna	19	1	42	36	8	13	67	**186**
Radio, ulna	2	0	0	0	1	0	1	**4**
Carpal	0	4	0	0	5	21	37	**67**
Metacarpal	0	0	6	13	13	19	0	**51**
Phalanx (manus)	0	0	1	1	0	2	0	**4**
Long bone	0	0	0	0	5	0	1	**6**
Femur	51	0	58	57	8	22	64	**260**
Patella	0	0	1	0	0	1	3	**5**
Tibia	44	2	116	98	15	21	5	**301**
Fibula	4	0	3	1	3	0	35	**46**
Tibiofibula	2	0	0	1	0	0	0	**3**
Tarsal	15	2	15	24	2	12	1	**71**
Metatarsal	40	0	37	22	1	24	0	**124**
Phalanx (pes)	7	0	4	4	0	1	3	**19**
Sesamoid	0	2	0	0	8	10	1	**21**
Baculum (os penis)	0	0	0	0	1	0	0	**1**
Carpal or tarsal	0	1	0	0	0	0	0	**1**
Ossified tendon	0	0	0	0	0	0	285	**285**
Vestigial phalanx	0	1	0	0	0	6	0	**7**
Metapodial	10	15	0	1	4	13	0	**43**

Table 21.4 (continued)

Bone Elements	Small Mammal	Large Mammal	Cottontails	Jackrabbits	Canids	Deer *	Turkey **	Total
Vestigial metapodial	0	2	0	0	0	10	0	**12**
Phalanx	18	8	1	5	34	58	0	**124**
Coracoid	0	0	0	0	0	0	65	**65**
Furculum	0	0	0	0	0	0	19	**19**
Carpometacarpus	0	0	0	0	0	0	66	**66**
Specialized wing phalanx	0	0	0	0	0	0	111	**111**
Synsacrum	0	0	0	0	0	0	8	**8**
Tibiotarsus	0	0	0	0	0	0	164	**164**
Tarsometatarsus	0	0	0	0	0	0	130	**130**
Phalanx	0	0	0	0	0	0	399	**399**
Ungual phalanx, claw	0	0	0	0	8	0	69	**77**
Pygostyle	0	0	0	0	0	0	1	**1**
Caudal vertebra	13	0	0	0	0	0	8	**21**
Pelvis	0	0	0	0	0	0	2	**2**
Fused lumbar	0	0	0	0	0	0	4	**4**
Total	**3307**	**1436**	**819**	**632**	**501**	**507**	**4819**	**12021**
Eggshell	0	0	0	0	0	0	1151	**1151**

* The deer column includes positively identified deer and artiodactyl.

** The turkey column includes turkey and likely turkey (Aves).

Table 21.5. Deer and turkey bone, elements counts by bone tool type.

	Fine-point Awl	Coarse-point Awl	Pin	Projectile Point	Splinter Awl	Medium-point Awl	Complex Awl	Spatulate	Spatulate Fragment	Total
Deer, Large Mammal										
Indeterminate fragment	1	–	–	–	–	–	1	–	–	**2**
Long-bone fragment	17	21	3	1	7	10	–	–	3	**62**
Rib	–	–	–	–	–	1	–	–	–	**1**
Humerus	1	1	–	–	–	–	–	4	1	**7**
Radius	3	1	–	–	–	–	–	–	–	**4**
Ulna	–	2	–	–	–	–	–	–	–	**2**
Metacarpal	–	2	–	–	–	–	–	–	–	**2**
Femur	–	–	–	–	–	–	–	1	–	**1**
Tibia	–	2	–	–	–	1	–	–	–	**3**
Metatarsal	3	4	–	–	–	1	–	–	–	**8**
Metapodial	–	7	–	–	–	1	–	–	–	**8**
Tibiotarsus	5	1	–	–	1	1	–	–	–	**8**
Tarso-metatarsus	2	1	–	–	–	–	–	–	–	**3**
Total	**32**	**42**	**3**	**1**	**8**	**15**	**1**	**5**	**4**	**111**
Turkey										
Long-bone fragment	1	–	–	–	2	1	–	–	–	**4**
Humerus	1	–	–	–	–	–	–	–	–	**1**
Radius	3	–	–	–	–	–	–	–	–	**3**
Tibiotarsus	5	1	–	–	1	1	–	–	–	**8**
Tarso-metatarsus	2	1	–	–	–	–	–	–	–	**3**
Total	**12**	**2**	**–**	**–**	**3**	**2**	**–**	**–**	**–**	**19**

Table 21.6. Deer bone, elements counts by site.

	LA 37591	LA 37592	LA 37593	LA 37594	LA 37595	LA 37597	LA 37598	LA 60744	LA 60749	LA 60751	Total
Cranial	–	3	3	1	1	–	–	–	–	3	**11**
Mandible	–	3	1	–	2	–	2	–	–	–	**8**
Tooth	–	8	2	–	1	–	–	1	–	–	**12**
Vertebra	–	21	4	1	–	–	2	–	1	–	**29**
Rib	–	2	–	–	–	–	–	–	–	–	**2**
Scapula	–	13	12	–	1	–	–	–	–	–	**26**
Pelvis	2	1	1	–	–	1	1	–	–	–	**6**
Humerus	–	6	1	–	–	–	2	–	–	–	**9**
Radius	–	–	–	–	2	1	2	–	–	–	**5**
Ulna	–	–	1	–	–	–	2	–	–	–	**3**
Carpal	1	32	–	–	5	–	2	–	–	–	**40**
Femur	–	2	–	–	1	–	–	–	–	–	**3**
Tibia	–	2	–	–	–	–	1	–	–	–	**3**
Metapodial	–	10	–	–	3	–	1	–	–	–	**14**
Phalanx	2	32	4	2	4	–	4	–	–	–	**48**
Total	**5**	**135**	**29**	**4**	**20**	**2**	**19**	**1**	**1**	**3**	**219**

Elements 50 percent or greater present.

Table 21.7. Faunal assemblage, counts by site and time period.

Site	Early Basket-maker III	Basket-maker III	Mid Pueblo II	Late Pueblo II	Early Pueblo III	Late Pueblo III	Total
LA 37591	–	–	–	–	203	1235	**1438**
LA 37592	–	–	131	–	1234	5037	**6402**
LA 37593	–	–	279	392	184	42	**897**
LA 37594	21	–	497	–	–	–	**518**
LA 37595	–	30	1033	–	–	–	**1063**
LA 37598	–	–	188	156	20	–	**364**
LA 60749	–	–	–	–	44	–	**44**
LA 60751	–	25	–	–	–	–	**25**
Total	**21**	**55**	**2128**	**548**	**1685**	**6314**	**10,751**

Table 21.8. Major faunal groups, counts by time period.

	Large Mammal	Cottontail Rabbit	Jackrabbit	Canid	Deer	Turkey	Total	Eggshell
Early Basketmaker III	–	–	3	–	–	–	**3**	–
Basketmaker III	11	8	2	–	2	1	**24**	4
Mid Pueblo II	245	65	72	457	95	268	**1202**	685
Late Pueblo II	157	9	9	2	32	167	**376**	27
Early Pueblo III	80	62	45	4	46	958	**1195**	74
Late Pueblo III	551	477	347	23	191	2566	**4155**	73
Total	**1044**	**621**	**478**	**486**	**366**	**3960**	**6955**	863

"Deer" includes deer and artiodactyl; "turkey" includes turkey and Aves.

Table 21.9. Turkey bone, elements counts by site.

	LA 37591	LA 37592	LA 37593	LA 37594	LA 37595	LA 37598	LA 60749	Total
Cranial elements	21	77	–	2	–	–	1	**101**
Mandible	3	10	–	–	–	1	–	**14**
Vertebra	8	103	–	1	3	8	–	**123**
Sacrum	3	38	–	–	–	–	–	**41**
Rib	17	45	–	–	1	1	–	**64**
Scapula	5	24	1	–	–	–	–	**30**
Pelvic elements	2	21	–	–	15	1	–	**39**
Humerus	3	39	–	–	–	2	–	**44**
Radius	7	38	1	1	1	7	–	**55**
Ulna	3	25	1	1	1	–	–	**31**
Carpal	1	52	–	2	36	2	–	**93**
Femur	1	20	–	–	–	1	–	**22**
Tibia	2	–	–	–	–	–	–	**2**
Fibula	2	14	–	–	–	–	–	**16**
Articular	2	6	–	–	–	–	–	**8**
Corcoid + furculum	5	26	2	–	1	–	–	**34**
Tibiotarsus	4	42	1	–	–	3	–	**50**
Tarsometatarsus	4	45	–	–	2	4	–	**55**
Phalanges	107	432	1	1	39	29	–	**609**
Total	**200**	**1057**	**7**	**8**	**99**	**59**	**1**	**1431**

Only elements at least 50% present.

no products that would have come from any bone tools, all uses are inferential. Other less common tool categories include spatulates (or bone scrapers; Figs. 21.5 [a], 21.6 [a–b], 21.7 [a–b]); and scapula scoops, all eight of which were recovered from LA 37592 Pit Structure 1 (Table 21.11). The scapula scoops are an extremely intriguing tool group in which each blade end is clearly worn to some degree, some very heavily. The edges seem too thin for working soil, but they could have been used for shelling corn, for example.

The occurrence of bone tools or manufacturing debris follows the overall occurrence of faunal bone at the sites fairly closely (Table 21.11). Small deviations include fewer tools and less debris than perhaps expected at LA 37592, more debris at LA 37595, and more tools at LA 37598 (Table 21.15). None of these differences is sufficient to suspect greatly different activity levels at the respective sites. The well-preserved in situ awl assemblage from the bench of Pit Structure 2 at LA 37598 is indicative of where bone tools were probably used. Caches of awls occur with some regularity in pit structure fills, including Pit Structure 1 at LA 37592 (Fig. 13.52). These could be another type of structure-closure placement, or they could result from placement of tool kits in pit structure roofs, or both. Over half of awls were made from large-mammal bones, and the rest are divided between small mammal and turkey (Figs. 21.1, 21.2, 21.3, 21.4; Table 21.14).

Bone beads were also recovered occasionally (Figs. 21.1 [f], 21.8 [a–c]; Table 21.12). Jackrabbit tibia tinklers were found at a number of sites (Table 21.12); they did not occur in groups large enough to have made a jangling fringe.

Processing

All of the turkey and large mammal can be assumed to come from the inhabitants' use. Thermal alteration of elements is an indicator of food debris. While jackrabbit elements show the highest percentage of thermally altered bone, large mammal and deer have the highest percentage of heavily altered specimens (Table 21.16). In keeping with the idea that some turkeys were not intended for or used as food, thermal alteration is less evident in turkey elements and nearly absent in canids. In spite of their small body size, which might make elements more prone to heat alteration, cottontails show a low amount of discoloration. It is unclear whether processing by boiling is evident in ancient

Table 21.10. Eggshell, study units/stratigraphic contexts by site; counts and percents.

	LA 37592		LA 37593		LA 37594		LA 37595		LA 37598		LA 60749		LA 60751		Total	
	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %
Study Unit																
Surface room	138	48.6%	2	8.3%	12	8.8%	–	–	11	36.7%	–	–	–	–	**163**	**14.2%**
Roomblock	–	–	–	–	–	–	–	–	1	3.3%	–	–	–	–	**1**	**0.1%**
Pit structure	128	45.1%	1	4.2%	116	84.7%	549	100.0%	18	60.0%	–	–	4	12.1%	**818**	**71.1%**
Extramural area	18	6.3%	21	87.5%	9	6.6%	–	–	–	–	92	100.0%	29	87.9%	**169**	**14.7%**
Total	**284**	**100.0%**	**24**	**100.0%**	**137**	**100.0%**	**549**	**100.0%**	**30**	**100.0%**	**92**	**100.0%**	**33**	**100.0%**	**1151**	**100.0%**
Stratigraphic Type																
Ground surface stripping	2	0.7%	–	–	–	–	–	–	–	–	–	–	–	–	**2**	**0.2%**
Vertical subdivision unknown	–	–	–	–	11	8.0%	–	–	–	–	–	–	–	–	**11**	**1.0%**
General structure fill	2	0.7%	2	8.3%	–	–	–	–	10	33.3%	–	–	–	–	**16**	**1.4%**
Upper fill above roof	75	26.4%	1	4.2%	–	–	–	–	15	50.0%	–	–	–	–	**91**	**7.9%**
Lower fill below roof	–	–	–	–	–	–	1	0.2%	–	–	–	–	–	–	**1**	**0.1%**
Roofing material	–	–	–	–	–	–	211	38.4%	2	6.7%	–	–	3	9.1%	**216**	**18.8%**
Extramural fill	12	4.2%	21	87.5%	9	6.6%	–	–	1	3.3%	92	100.0%	29	87.9%	**164**	**14.2%**
Floor fill	70	24.6%	–	–	–	–	55	10.0%	1	3.3%	–	–	–	–	**126**	**10.9%**
Surface or floor	123	43.3%	–	–	117	85.4%	270	49.2%	1	3.3%	–	–	1	3.0%	**512**	**44.5%**
Subfloor fill	–	–	–	–	–	–	12	2.2%	–	–	–	–	–	–	**12**	**1.0%**
Total	**284**	**100.0%**	**24**	**100.0%**	**137**	**100.0%**	**549**	**100.0%**	**30**	**100.0%**	**92**	**100.0%**	**33**	**100.0%**	**1151**	**100.0%**

LA 37591 not included; low eggshell count (2).

Table 21.11. Bone tools, type counts by site

	LA 37591	LA 37592	LA 37593	LA 37594	LA 37595	LA 37598	LA 60751	Total
Indeterminate tool	4	24	1	2	2	1	2	**36**
Indeterminate point awl	4	12	2	2	4	2	–	**26**
Fine-point awl	7	18	–	–	5	2	–	**32**
Coarse-point awl	4	11	6	5	3	14	–	**43**
Pin	–	3	–	–	–	–	–	**3**
Projectile point	–	–	–	–	–	1	–	**1**
Splinter awl	3	4	–	–	–	1	–	**8**
Medium-point awl	1	13	–	–	–	–	–	**14**
Complex awl	–	1	–	–	–	–	–	**1**
Spatulate	–	4	–	–	–	1	–	**5**
Spatulate fragment	1	1	1	–	–	1	–	**4**
Complex tool	–	2	–	–	–	–	–	**2**
Shuttle	–	–	–	1	–	–	–	**1**
Scoop	–	8	–	–	–	–	–	**8**
Total	**24**	**101**	**10**	**10**	**14**	**23**	**2**	**184**
Total % of tools	**13.0%**	**54.9%**	**5.4%**	**5.4%**	**7.6%**	**12.5%**	**1.1%**	
Total % of fauna	**10.0%**	**65.0%**	**7.0%**	**5.0%**	**8.0%**	**3.0%**	**3.0%**	

Table 21.12. Bone ornaments, type counts by site.

	LA 37591	LA 37592	LA 37593	LA 37594	LA 37595	LA 37598	Total
Bone tube	1	9	1	–	–	–	**11**
Bone bead	1	–	–	–	–	1	**2**
Shell bead	–	1	–	–	–	–	**1**
Bone tube bead	1	5	–	–	–	–	**6**
Bone bead fragment	–	5	–	–	–	2	**7**
Shell pendant	–	–	–	1	–	–	**1**
Tinkler	3	2	–	–	1	2	**8**
Total	**6**	**22**	**1**	**1**	**1**	**5**	**36**

Table 21.13. Bone awls, type counts by major faunal group.

	Deer	Mammal	Small Mammal	Medium–large Mammal	Large Mammal	Turkey	Total
Indeterminate-point awl fragment	6	1	6	2	11	–	**26**
Fine-point awl	3	2	3	2	10	12	**32**
Medium-point awl	2	1	7	–	2	2	**14**
Coarse-point awl	17	–	3	1	20	2	**43**
Pin	–	–	–	–	3	–	**3**
Projectile point	–	–	–	–	1	–	**1**
Splinter awl	–	–	1	3	1	3	**8**
Complex awl	–	–	–	–	1	–	**1**
Total	**28**	**4**	**20**	**8**	**49**	**19**	**128**

Aves and turkey combined, deer and artiodactyl combined, rabbits and small mammal combined.

Table 21.14. Bone awls, mean bone awl lengths (mm) and counts by awl type.

	Mean (mm)	Count	Standard Deviation	Minimum	Maximum
Indeterminate-point awl	67.5	16	57.4	20.0	241.0
Fine-point awl	110.8	21	64.9	17.0	267.0
Medium-point awl	73.3	9	55.1	17.0	185.0
Coarse-point awl	86.2	28	34.7	6.0	168.0
Pin	107.7	3	25.7	78.0	124.0
Projectile point	29.0	1	–	29.0	29.0
Splinter awl	65.8	6	13.3	52.0	85.0
Complex awl	103.0	1	–	103.0	103.0
Total	**86.2**	**85**	**51.2**	**6.0**	**267.0**

bone, and boiling is a likely processing method, especially for cottontails. Thermal alteration of bone as an indication of food use is difficult to identify because the bone may also have been discarded in a fire. Heavily blackened bone is more likely to be a result of deposition than of cooking. Comparing the context of wild major meat, and secondary tool species—cottontails, jackrabbits, and deer—the occurrence of specimens is remarkably similar across various fill types (Tables 21.11, 21.17), in spite of differences in element size. This suggests processing of these species was similar.

Faunal Remains at Jackson Lake: Summary

Around 10 percent of the total faunal bone count is from animals that are likely to have been naturally deposited, probably after the features were no longer in use. Another 10 percent is accounted for by jackrabbits and cottontail rabbits, some of which may have been naturally deposited, but most of which probably came from the occupation of the site. Some species are especially abundant at particular sites. LA 37591 stands out as having a disproportional number of jackrabbit and cottontail elements, deer elements are especially numerous at LA 37593 and LA 37595, and turkey at LA 37592 and 37598. So many variables can influence these counts that it is not possible to attribute great significance to these concentrations, but they do indicate trends.

Except for LA 37598, the sites with faunal assemblages are near one another and nearly contiguous. Faunal bone from Mid Pueblo II (mid-1000s) is more dispersed among several locations, while the latest material is primarily from LA 37592 and LA 37591, which could have been the same settlement but are now divided by the highway (Tables 21.7, 21.8). Of particular relevance is the lateness and size of the LA 37592 assemblage, which fits well with the large quantity of turkey remains there.

Figure 21.1 [a–f]. Bone awls and awl fragments [a–e], bead [f], from LA 37591, Pit Structure 1, Layer 2.

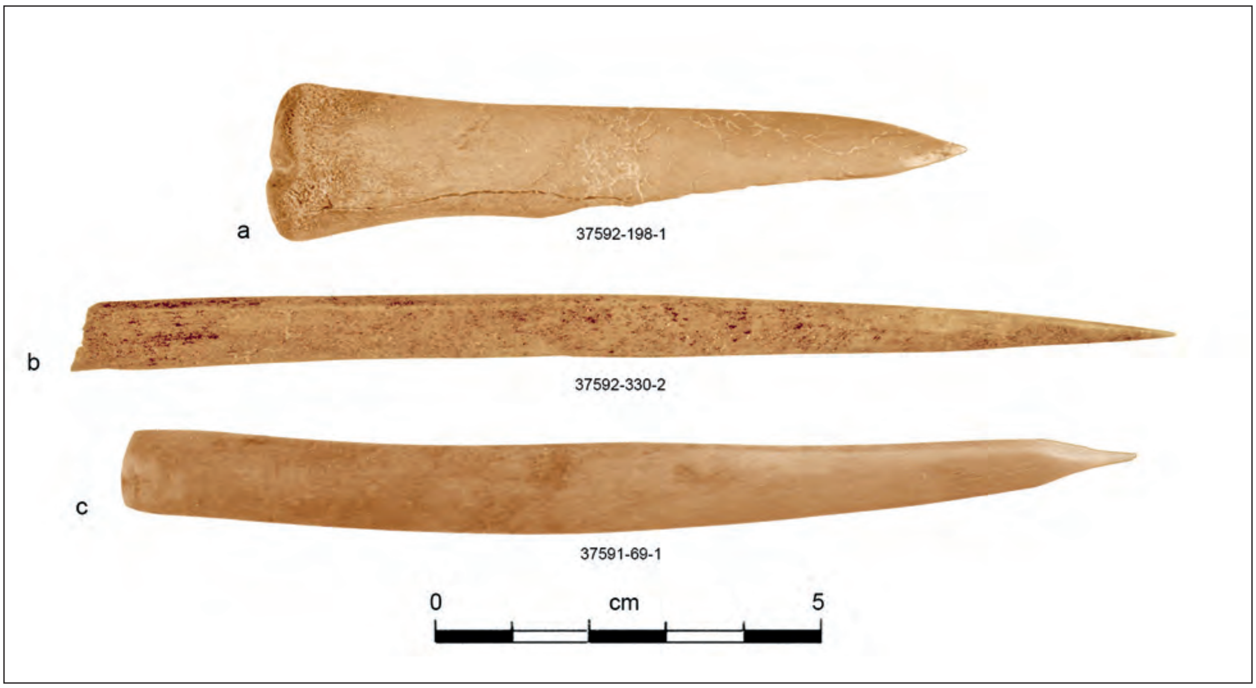


Figure 21.2 [a–c]. a. Coarse-point awl, deer metatarsal, from LA 37592, Room 201, Floor 3, Feature 2 (pit); b. medium awl, mammal bone, from the southwest quadrant fill of LA 37592, Pit Structure 1; c. fine-point awl from LA 37591, Pit Structure 1, Floor 1.

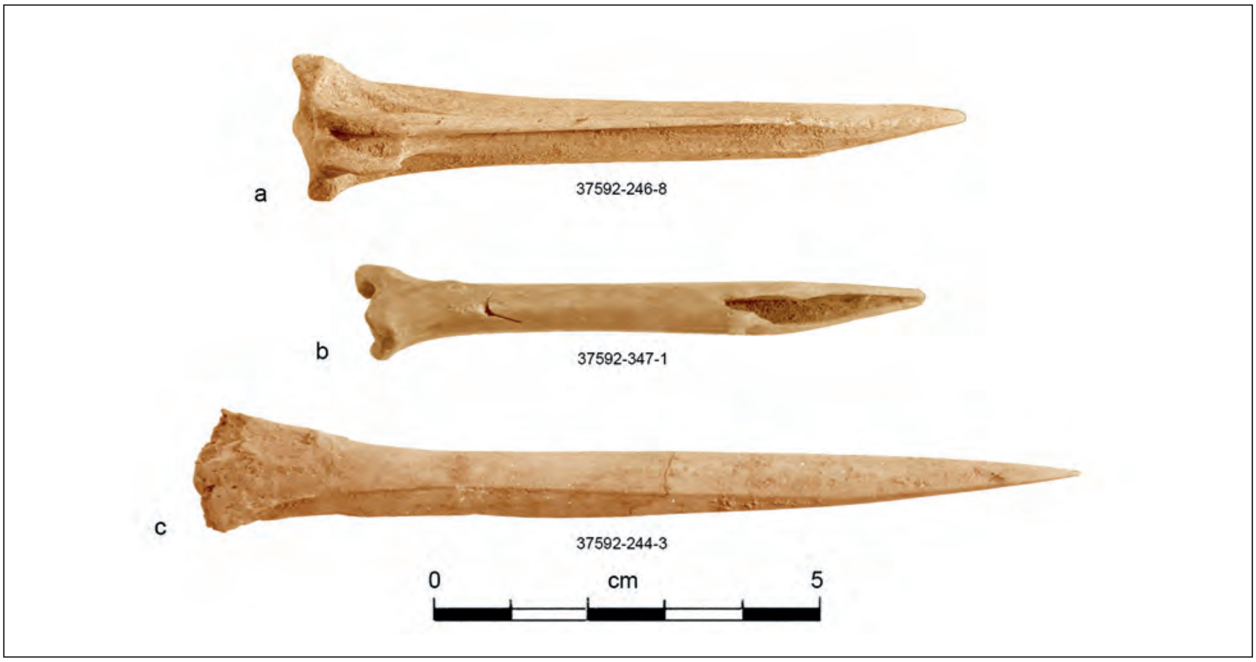


Figure 21.3 [a–c]. Bone awls. LA 37592, Pit Structure 1: a. Turkey tarsometatarsus coarse-point awl (89 mm); b. Layer 16, jackrabbit tibia, indeterminate point (75 mm); c. Midden Layer 4, split turkey tibiotarsus, fine-point awl (115 mm).

Figure 21.4 [a, b]. Bone awls. LA 37592, Pit Structure 1: a. Layer 23, highly polished deer metapodial, medium-point awl; b. Midden Layer 3, turkey tibiotarsus, fine-point awl.

Figure 21.5 [a, b]. [was 21.5a] a. LA 37592, Pit Structure 1, Layer 26, wolf humerus spatulate (184mm; the olecranon has been enlarged, possibly for suspension); b. LA 37595, Pit Structure 1, Layer 1, deer metapodial, coarse-point awl (115 mm).

Figure 21.6 [a, b]. LA 37592, Pit Structure 1, Floor 1: top [a]. deer humerus spatulate, two views; from a younger deer (it has healthier joints) than other examples from the same floor (see Fig. 21.7); bottom [b]. deer metacarpal, preform (shows grooving in preparation for splitting).

Figure 21.7. Two views of same deer humerus spatulate (note pathology around humeral head) from LA 37592, Pit Structure 1, Floor 1, Feature 8 (niche).

Table 21.15. Modified bone, manufacturing debris type, counts by site.

	LA 37591	LA 37592	LA 37593	LA 37594	LA 37595	LA 37598	LA 60744	Total
Longitudinal waste	–	1	–	–	–	–	–	**1**
Transverse waste	–	–	–	–	3	–	–	**3**
Multiple cuts, groove waste	1	–	–	–	1	–	–	**2**
Broken waste (polished, grooved)	–	6	2	–	–	–	1	**9**
Waste (multiple, striae)	1	4	2	–	2	1	–	**10**
Drilled	–	–	–	–	–	1	–	**1**
Pigment	–	1	–	–	–	–	–	**1**
Waste (polished, striae)	4	18	–	–	3	1	–	**26**
Indeterminate preform	–	4	–	1	1	2	–	**8**
Total	**6**	**34**	**4**	**1**	**10**	**5**	**1**	**61**
% of debris	**9.84%**	**55.74%**	**6.56%**	**1.64%**	**16.39%**	**8.20%**	**1.64%**	
% of fauna	**10.0%**	**65.0%**	**7.0%**	**5.0%**	**8.0%**	**3.0%**	**0.0%**	

Figure 21.8 [a–c]. Bone beads. LA 37592: a. Pit Structure 1, Midden Layer 5, highly polished bead with scoring at one end, probably for breaking the bone section (60 mm); b. Subroom 202. LA 37591: c. Pit Structure 1 floor, note nicely polished and finished ends (74 mm).

Table 21.16. Thermal alteration to bone, type by major faunal group; counts and percents.

	Large Mammal		Cottontail		Jackrabbit		Canid		Deer		Turkey		Total	
	N	Col. %	N	Col. %	N	Col. %	N	Col. %	N	Col. %	N	Col. %	N	Col. %
None	1017	70.8%	654	79.9%	438	69.3%	495	98.8%	379	74.8%	4226	87.7%	**7209**	**82.7%**
Light (tan, brown)	168	11.7%	123	15.0%	145	22.9%	1	0.2%	78	15.4%	341	7.1%	**856**	**9.8%**
Graded, light to heavy	107	7.5%	13	1.6%	16	2.5%	2	0.4%	10	2.0%	62	1.3%	**210**	**2.4%**
Heavy (black)	54	3.8%	15	1.8%	21	3.3%	1	0.2%	30	5.9%	128	2.7%	**249**	**2.9%**
Graded, heavy to calcined	44	3.1%	6	0.7%	2	0.3%	1	0.2%	2	0.4%	38	0.8%	**93**	**1.1%**
Calcined	46	3.2%	8	1.0%	10	1.6%	1	0.2%	8	1.6%	24	0.5%	**97**	**1.1%**
Total	**1436**	**100.0%**	**819**	**100.0%**	**632**	**100.0%**	**501**	**100.0%**	**507**	**100.0%**	**4819**	**100.0%**	**8714**	**100.0%**

Table 21.17. Deer and rabbit bone, by stratigraphic contexts; counts and percents.

	Cottontail Rabbit		Jackrabbit		Deer		Large Mammal and Artiodactyl		Total	
	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %
Extramural fill	75	12.8%	48	12.3%	48	11.2%	183	17.5%	**354**	**14.4%**
Upper fill above roof	383	65.2%	246	63.1%	288	67.1%	677	64.6%	**1594**	**65.0%**
Lower fill below roof	2	0.3%	5	1.3%	4	0.9%	3	0.3%	**14**	**0.6%**
Roofing material	18	3.1%	15	3.8%	16	3.7%	28	2.7%	**77**	**3.1%**
Floor fill	32	5.5%	23	5.9%	25	5.8%	58	5.5%	**138**	**5.6%**
Surface or floor	77	13.1%	53	13.6%	48	11.2%	99	9.4%	**277**	**11.3%**
Total	**587**	**100.0%**	**390**	**100.0%**	**429**	**100.0%**	**1048**	**100.0%**	**2454**	**100.0%**

22 Archaeobotanical Remains: Summary and Interpretation

Pamela J. McBride and Mollie S. Toll

The distribution of flotation and macrobotanical samples by time period reflects the occupation history of the Jackson Lake area (Table 22.1). The Mid Pueblo II and the combined Pueblo II–III periods saw intensification of settlement in the Jackson Lake community; we have more sites and more components of sites to examine and compare from this vibrant era. We have fewer samples from, and hence know less about, periods when the La Plata Valley was initially occupied (Early and Classic Basketmaker III in the AD 500s and 600s) and gradually depopulated (Early Pueblo III, with little from later Pueblo III). A summary of Jackson Lake archaeobotanical remains by time period and site is followed by a discussion of temporal, functional, and taxonomic questions.

Archaeobotanical Remains by Period

Early Basketmaker III. The sole structure dating to this early period in the La Plata Highway project is Pit Structure 5 at LA 37594 (Chapter 10). Food plant remains include weedy annuals (goosefoot, cheno-ams, mustard family, and pepperweed) and maize fragments (found on the structure floor, in two cists, and in an extramural ash pit). Two metate rests found in the northeast quadrant of Structure 5 and several subfloor storage cists found near the metate activity area attest to the importance of corn agriculture during the early Basketmaker period. We hoped to address potentially significant changes in corncob morphometrics between this early Basketmaker site and ensuing Late Basketmaker and Puebloan time periods, but corncobs were not recovered at LA 37594. Stored corn may have been removed along with metates prior to abandonment. Collections from early sites in the region do exist, however, and are used later to discuss broad patterns of maize morphometrics over time.

Carbonized remains from roofing samples indicate that structure and antechamber roofs were likely constructed of juniper, piñon, and cottonwood/willow. This same trio of wood taxa was also found on Floor 1, in cists, the central hearth, and postholes, probably due to collapse of the roof on to the floor when the structure was burned at abandonment. Floor fill of the antechamber was scant, but the superstructure construction material seems to match the main chamber. Common reedgrass and grass stems, likely used as roof-closing material, round out the assemblage of riparian species and locally available trees and shrubs used for fuel and construction material.

Basketmaker III. Two sites, LA 37595 and LA 60751, had components from the Basketmaker III era. Pit Structure 3 at LA 37595 was bisected by the construction of a Pueblo II pit structure, reducing contexts that were clearly Basketmaker. LA 60751 contributes most to our understanding of Basketmaker III subsistence. The pit structure at LA 60751 was well preserved by a layer of collapsed burned roofing material, sealing artifacts on the floor and the bench and providing a clear date for the assemblage. Evidence for annual plant use consisted of goosefoot, pigweed, and winged pigweed seeds, identified at both LA 37595 and LA 60751; and mustard, purslane, spurge, and groundcherry only at LA 60751. Groundcherry fruits (distant cousins of tomatoes, peppers, and eggplants) were eaten fresh or boiled to make a condiment (Castetter 1935). Groundcherry was important enough to the Tewas to be named in songs with corn, pumpkin,

Table 22.1. Flotation and macrobotanical samples, counts by site, provenience, and time period.

Site	Provenience	Flot			Macrobotanical	
		Full	Scan	Wood	Wood	Other
Early Basketmaker						
LA 37594	Pit Structure 5	9	2	9	20	0
	extramural pit	1	2	0	0	0
	Total	**10**	**4**	**9**	**20**	**0**
Basketmaker III						
LA 37595	Pit Structure 3	5	1	1	1	0
LA 60751	Pit Structure 1	12	26	12	52	31
	Total	**17**	**27**	**13**	**53**	**31**
Mid Pueblo II						
LA 37589	surface room	1	1	0	0	0
	Extramural Area 1	1	1	0	0	0
LA 37592	Feature 5, storage cist	2	3	1	3	0
	Feature 7, fire pit	0	0	0	1	0
LA 37593	Pit Structure 1	3	5	1	2	0
	Extramural Areas 1, 3	0	3	0	1	0
LA 37594	Pit Structure 1	3	0	3	2	0
	Roomblocks 1, 2	6	3	7	11	3
	EA2, Feature 2, probable cist	0	0	0	4	0
	Extramural Areas 1,2,3,4	7	3	0	8	2
LA 37595	Pit Structures 1, 2, 4	11	9	5	32	15
LA 37598	Pit Structure 2	2	13	2	0	0
	Rooms 102, 201, 202	2	1	0	5	0
	Extramural Areas 1, 2	4	2	3	0	0
	Total	**42**	**44**	**22**	**69**	**20**
Pueblo II–III						
LA 37590	extramural hearth	1	1	1	0	0
LA 37591	Pit Structure 1	2	1	1	0	0
	extramural	2	4	0	0	0
LA 37592	Feature 6, fire pit	1	0	0	0	0
	Pit Structure 1	6	10	5	12	0
	Extramural Areas 2, 3, 4	10	2	9	9	0
LA 37593	Roomblock 1	0	8	2	4	0
	Extramural Area 1	0	2	2	2	0
LA 37598	Pit Structure 1	7	3	6	0	0
	Room 102	0	0	0	1	0
	Extramural Area 3	1	0	1	0	0
LA 60744	grids	2	0	0	0	0
LA 60745	extramural shallow pit	0	1	0	0	0
LA 60749	pit structure	0	4	2	1	0
	extramural	0	2	1	0	1
	Total	**32**	**38**	**30**	**29**	**1**
Pueblo III						
LA 37591	Pit Structure 1 midden	1	0	1	0	0
LA 37592	Pit Structure 1 midden	6	0	4	0	0
	Rooms 201, 202, 203	9	3	3	7	0
LA 37593	Extramural Area 1	0	1	0	1	0
LA 37598	Roomblock 1	7	5	4	0	0
	Total	**23**	**9**	**12**	**8**	**0**
Total		**114**	**118**	**77**	**159**	**52**

and cotton (Robbins et al. 1916:59). Tobacco seeds recovered from roof fall and features at LA 60751 are early evidence of ritual activity at La Plata sites. Corn was recovered from the floor, general fill, and an ash pit in Pit Structure 3 at LA 37595; and from roof fall, Floor 2 contact, and several Floor 2 and 3 features at LA 60751. Again, lack of measurable cobs keeps us from comparing Basketmaker corn with ensuing occupations at La Plata, or with other San Juan Basin Basketmaker populations.

Evidence of perennial plant use was limited to two samples with seeds of hedgehog cactus and one of marsh elder at LA 60751. Hedgehog cactus fruits, valued for their relatively high sugar content, were eaten fresh, made into a conserve, or baked (Castetter 1935:26). Marsh elder, on the other hand, is known chiefly as an obscure medicinal and not as a significant food resource (Murphey 1959:42). Grass seeds were identified in the central hearth and other features at LA 60751.

A fairly intact section of roof matting included reedgrass stems along with cottonwood/willow sticks and grass leaves, giving us a pretty good idea of the composition of roof closing material. Macrobotanical and flotation remains from roof-fall contexts suggest that vigas and roof support beams were usually juniper or cottonwood, with closing material of willow and juniper twigs, cattail stems, common reedgrass stems, and grass leaves. Another component of LA 60751 roof-fall deposits was yucca fiber, possibly cordage used to tie supplies to the roof. In addition, seven fragments of three-ply cordage were found on the southwest quadrant of Floor 2. Wood from postholes at both sites was predominately juniper; the main support posts at LA 60751 were juniper (Chapter 11). Juniper, rabbitbrush, oak, cottonwood/willow, and sagebrush charcoal were recovered from thermal features.

Closely following the earlier pattern at LA 37594, Basketmaker III subsistence activities focused on corn agriculture, while gathered plant foods included annual and grass seeds, and cactus and ground cherry fruits. Tobacco makes its first appearance in our samples in this time period, although it is found in earlier contexts elsewhere in the Four Corners area (Adams and Toll 2000:152–155). In terms of number of occurrences within the project sample, the *Nicotiana* counts are highest at this Basketmaker site.

Mid-Pueblo II. Occupations associated with this period were found at several Jackson Lake sites (LA 37592, LA 37593, LA 37594, LA 37595, LA 37598, and LA 60745). The Mid Pueblo II is characterized by a broad increase in the number of samples with corn. The presence of unburned squash seeds (LA 37594, LA 37595) attests to good preservation conditions as well as more extensive agricultural utility. Widespread annuals include amaranth, purslane, mustard, goosefoot, and cheno-ams. Tobacco was recovered from a broad range of sites and proveniences. Particularly at LA 37595, uncharred tobacco seeds were found in multiple structure and feature types: floors, mealing bins, entry step, roofing material, ventilator shaft. Uses that could account for such general interior distribution include ritual closing of the structure. Tobacco plants hung to dry from roof beams could also disperse seeds broadly within the structure as ripening capsules pop open along four sutures, releasing their myriad tiny seeds.

Grass remains were scarce and included grass-family seeds recovered from an extramural hearth at LA 37594. Ricegrass, an important late spring resource, was found at LA 37595 near the entry to the Pit Structure 2 mealing room, and at LA 37593 in Pit Structure 1 in the hearth, the major off-chamber cist, and the southeast quadrant of Floor 1.

Evidence for the consumption of cactus and yucca fruits was present as seeds of hedgehog cactus (LA 37594 and LA 37595) and banana yucca (LA 37595). Yucca leaf fragments were encountered in the hearth of Room 101 at LA 37594. The archaeologically elusive but presumably important piñon nutshell was found in floor fill of Pit Structure 1 at LA 37595. Unburned piñon nutshell was also recovered in roofing material and the vent shaft of the same pit structure.

The Mid Pueblo II period sees a marked increase in evidence for cultivated crops together with a drop in annuals and grasses. Though a slight increase in perennial plant ubiquity occurs, clearly the focus is on farming, rather than collecting wild plants. The prevalence of unburned tobacco at two sites of this era may indicate a shift to more centralized, organized ritual behavior. Wood use is very similar to previous occupations, still targeting juniper as the primary wood resource. Several local shrubby taxa appear that were not encountered in Basketmaker III samples but were found in Pueblo II contexts, including Mormon tea (*Ephedra* sp.), serviceberry (*Amelanchier* sp.), antelope brush (*Purshia* sp.), mountain mahogany (*Cercocarpus* sp.), and oak (*Quercus* sp.).

Pueblo II–III. Making a clear distinction between Pueblo II and Pueblo III deposits was often not possible because of mixed deposits or the lack of definitive dates. Two-thirds of sites in the Jackson Lake sector have components placed in this joint period. Corn continues to be the primary subsistence plant documented in flotation samples. The diversity of annual taxa (four in all) is the same as in the Mid Pueblo II, including all of the same taxa except mustard. Winged pigweed (found in Basketmaker III samples) was present in samples from various extramural pits and thermal features at LA 37591, LA 37592, and LA 37598, as well as the Pit Structure 1 hearth at LA 37598. Perennials include hedgehog cactus seeds (LA 37592, LA 37598, and LA 60744), greasewood (*Sarcobatus* sp.) seeds at LA 60744, and yucca seeds from the pit structure tunnel at LA 37598. Recoveries of four-wing saltbush fruits from pit structure floor fill at LA 37598 and seeds from an extramural fire pit at LA 37592 likely illustrate firewood residue rather than food debris, based on their perfect correlation with saltbush-dominated charcoal assemblages. Grasses (particularly ricegrass) were found more broadly than in previous time periods. Tobacco's presence at LA 37592 (Floor 3 ash pits) and at LA 37598 (Pit Structure 1 tunnel, pit, and floor fill) indicates a continued role in ritual life. Incidental appearances of evening primrose and groundcherry seeds may reflect minor food or medicinal uses.

Maize was the only domesticate recovered in flotation samples, contrasting with the large number of squash seeds found along with maize remains in Mid Pueblo II contexts. Annual, perennial, and grass use is consistent with the preceding period. Tobacco is present, but far from the prevalence apparent in Mid Pueblo II samples. Wood use is also similar to that of the previous time period, focusing on juniper, but with slightly more piñon use. The number of shrubby taxa was equal to that present in Mid Pueblo II samples. Saltbush comprised the highest percentage by weight of nonconifer wood taxa and is particularly abundant in the pit structures at LA 37592 (central hearth) and LA 37598 (floor). Rabbitbrush (*Chrysothamnus* sp.) was the one shrub wood that was not present in earlier-occupation assemblages.

Pueblo III. This component could be distinguished at four of the Jackson Lake sites, although at two of the sites, Pueblo III is represented by only one flotation sample. Maize is present at all sites. Burned squash rind in the pit structure midden at LA 37591 was the only evidence of other cultivars at Pueblo III sites. LA 37592, the site with the largest Pueblo III component and the most samples, naturally exhibited the greatest diversity of plant taxa. Weedy annuals, grasses, groundcherry, and hedgehog cactus were recovered. Tobacco seeds were found in midden fill of the pit structure and in Room 201.

Wood exploitation mirrors that found in all previous time periods. Juniper comprises the largest single wood component (38 to 45 percent of the wood assemblages at the two sites with more than one sample). Cottonwood/willow and saltbush are the next most abundant taxa, each with likely importance as roofing material. The limited data suggest that the Pueblo III subsistence regime was similar to previous occupations of the Jackson Lake area, but population relocations prior to the abandonment of the area is apparent in the small number of sites in the project area with Pueblo III components.

Function by Provenience

Thermal Features

Hearths and fire pits are the most numerous (Table 22.2) and predictably produced the greatest taxa diversity. Taxa that were processed in fire pits and hearths were nearly identical. The majority of fire pits were extramural and were probably for summer cooking use, while interior hearths were used to provide heat and process edible plants in the colder months. The nearly identical archaeobotanical assemblages from both feature types argues that similar foods were prepared during the year. The presence of spring and summer ripening seeds and fruits (ricegrass, goosefoot, and groundcherry) in interior hearths suggests these taxa were stored for winter use. Though most commonly used fresh or mashed as a condiment, we know that groundcherry berries were also dried and stored, and sometimes ground into meal (Harrington 1967 [1916]:252).

Four Jackson Lake heating pits contained evidence of only two food plants: purslane and the

Table 22.2. Plant remains, percent occurrence of taxa by thermal feature type.

	Ash Pits	Fire Pits	Roasting Pits	Heating Pits	Hearths
Feature type (count):	**8**	**14**	**2**	**4**	**17**
Taxa, Annuals:					
Cheno-Am	25%	–	–	–	12%
Goosefoot	–	21%	+	–	47%
Mustard	25%	7%	–	–	–
Pepperweed	–	–	–	–	6%
Pigweed	–	21%	–	–	25%
Purslane	–	14%	+	50%	18%
Winged pigweed	–	14%	+	–	29%
Taxa, Cultivars:					
Maize	50% c, 13% cfr., 13% g, 38% k	93% c, 14% g, 7% cob, 29% k	–	100% c, 25% cfr., 25% g, 25% k	82% c, 6% g, 6% cob, 6% cfr., 41% k
Taxa, Grasses:					
Grass family	38%	7%	–	–	18%
Ricegrass	13%	14%	–	–	12%
Taxa, Other:					
Evening primrose	–	7%	–	–	6%
Groundcherry	–	–	–	–	6%
Mallow family	–	7%	–	–	6%
Nightshade family	13%	–	–	–	–
Taxa, Perennials:					
Four-wing saltbush	–	14%	–	–	6%
Juniper	–	7% leaf, 14% twig	+ leaf, twig	–	12% leaf, 18% twig
Yucca	–	7% mc	–	25% leaf	–
Total Taxa Count	**6**	**12**	**4**	**3**	**14**

c = cupule, cfr. = cob fragment, g = glume, k = kernel, mc = male cone

ubiquitous corn, together with one recovery of yucca leaf. It is difficult to determine whether this meager assemblage should be attributed to sampling effect, or to more specialized use. At Chaco's Pueblo Alto, fire pits and heating pits, though "highly differentiated in terms of size, morphology, and fuel composition, appear to have been used in very similar ways," but at Chaco village sites 29SJ 627 and 29SJ 629, heating pits consistently show fewer carbonized remains of economic plants (Toll 1985:266). Generally, the fill of ash pits is more completely combusted debris from fire pits and hearths, and hence we expect to see a reduced selection of the fire pit/hearth taxonomic remains. Note that Jackson Lake ash pits contained cheno-ams (which tend to be fragmentary, highly burned and distorted seeds, not reliably distinguishable as goosefoot vs. pigweed). Though feature size and morphology of roasting pits suggests the possibility of specialized processing, archaeobotanical records of this feature type rarely treat us to definitive evidence of how this feature type was utilized. The two Jackson Lake roasting pits contained remains of widespread economic annuals (goosefoot, purslane, winged pigweed) and juniper, but not corn.

Coniferous wood exploitation in interior and exterior thermal features appears to be very similar, with a slightly higher percent presence of juniper in exterior features (Fig. 22.1). The shrub wood assemblage is far more diverse from interior thermal features (13 taxa) than for exterior features (5 taxa). Saltbush and sagebrush seem to have been used to a greater extent as fuel in exterior features. The use of cottonwood/willow for construction is supported by the marked differences in percent presence of this taxon category from interior versus exterior thermal features. The high presence of cottonwood/willow from interior features probably reflects some fallen roof-fall debris. Cottonwood/willow also comprised a sizable proportion of intact roof fall found at LA 60751.

Interior versus Exterior Features

If we look at interior compared to exterior features without regard to feature type, we see that the number of taxa recovered from interior features is far greater than that recovered from exterior features (Fig. 22.2). Pertinent factors include the protection of structure walls, resulting in better preservation of plant material than from interior contexts, and differential levels of storage activity. Both factors no doubt pertained, but the preservation effect of walls and roofs should not be underestimated. The disparity in taxa diversity between pit structures and antechambers versus surface rooms (Table 22.3) is probably more a function of sample size differences (86 of the 151 samples from pit structures and antechambers contained carbonized plant remains, compared to only 23 of the 46 samples from surface rooms) than of any real functional difference. In terms of sheer occurrence, the difference between rooms and pit structures is not statistically significant, but there

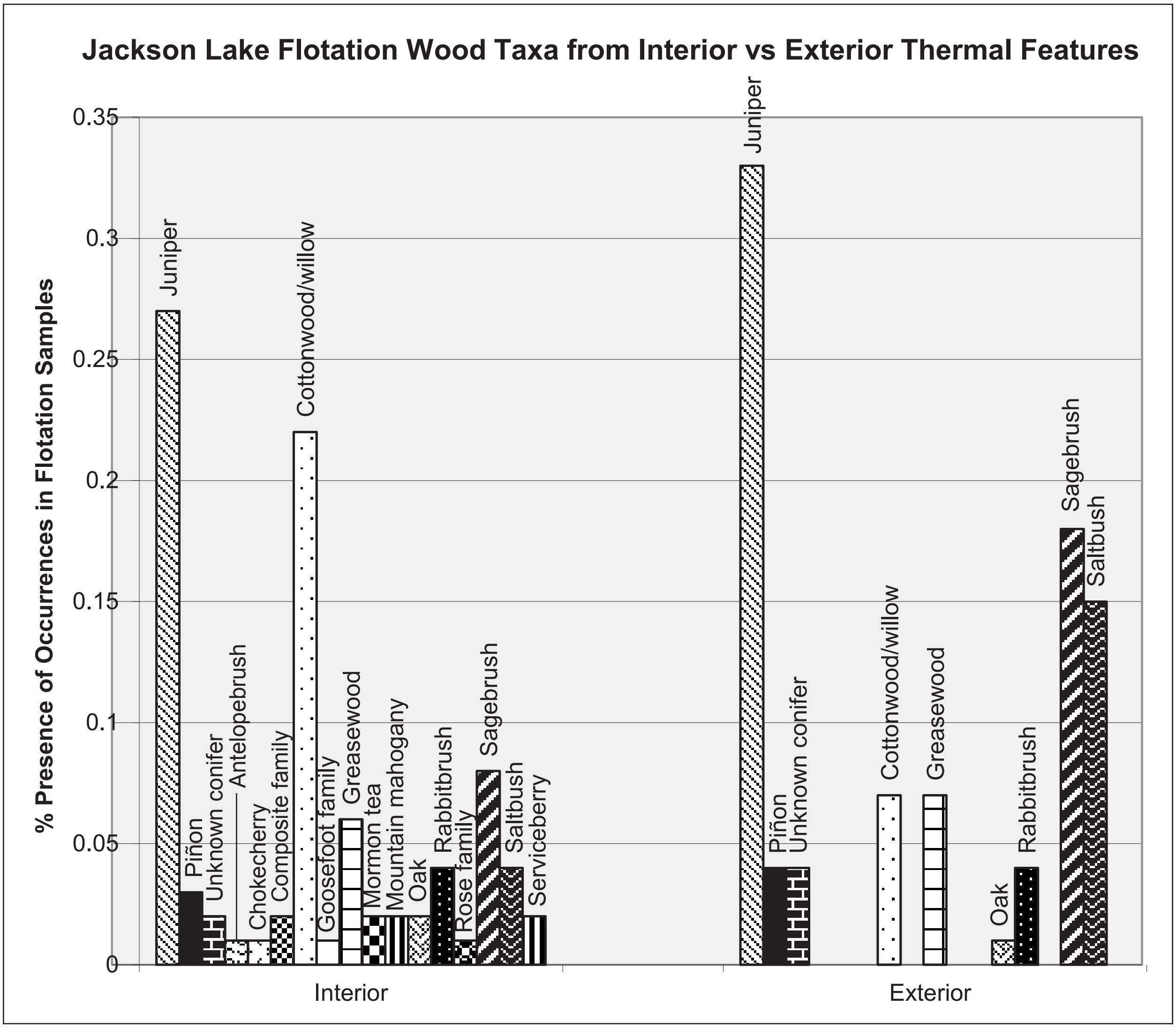


Figure 22.1. Wood taxa derived from flotation samples taken at Jackson Lake sites, interior vs exterior thermal features.

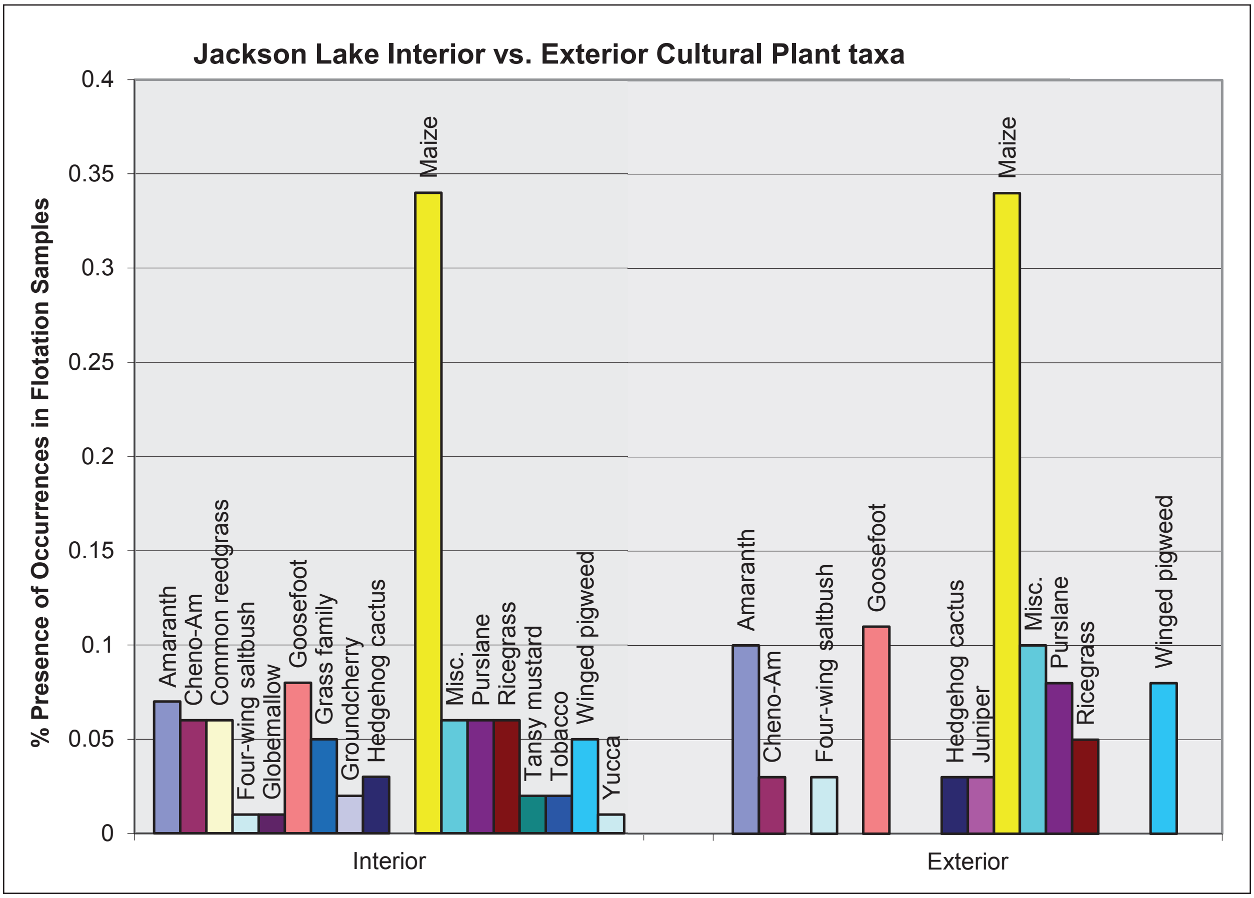


Figure 22.2. Cultural plant taxa derived from flotation samples taken at Jackson Lake sites, interior vs exterio

is a greater diversity of taxa in the pit structures. It would be tempting to suggest, based on the handful of annual seeds and the high percentage of maize found in surface rooms, that the primary function of surface rooms was sleeping and storage of these commodities. However, both surface and subsurface rooms contain similar features. Windes (1987b:271, 315; Windes 1993:273–278) found that heating pits were ancillary to hearths in small sites at Chaco Canyon. He has suggested that they were individual sources of heat for sleepers (Windes 1993:278). This use is also possible for these pits in Jackson Lake surface rooms in the colder months.

In both pit structures and surface rooms, juniper and cottonwood/willow clearly predominate in terms of widespread utilization, reflecting selection for both fuel and construction purposes. Several shrubby wood taxa that occur in pit structures are absent from surface rooms, including greasewood, oak, plum/cherry, serviceberry, and a rare occurrence of antelope brush, which, again, probably is a function of sample size rather than a pattern of shrub wood use (Table 22.4).

In considering the distribution of botanical taxa in interior vs. exterior proveniences, we should pay special attention to the composition of roofs, and materials hung from and stored in roofs. Of the 44 macrobotanical samples that represent roof fall, the three most common plant remains were juniper wood, found in 86 percent of samples; cottonwood/willow wood, present in 52 percent of samples; and common reedgrass stems, identified in 36 percent of samples. Clearly, all three were important elements of roofing materials. Grass and yucca leaves and mountain mahogany, sagebrush, and sumac wood were found in a single sample, while yucca fiber and juniper bark were identified in two samples. The occurrence of squash seeds in five roof-fall samples indicates the fruits could have been stored on or hung from the roof. Jackson Lake wood from

Table 22.3. Plant remains, percent occurrence of taxa in features from pit structures and antechambers compared to features in surface rooms.

	Pit Structures and Antechambers	Surface Rooms
Total Samples:	**151**	**46**
Samples with Charred Remains:	**86 (57%)**	**23 (50%)**
Feature Type and Quantity of Each:	7 ash pits, 1 bench, 1 bin, 3 cists, 1 fire pit, 9 hearths, 2 major off-chamber cists, 1 mealing bin, 2 mealing collection basins, 1 non-vent tunnel, 7 pits, 3 postholes, 3 pot rests, 1 trash pit	5 hearths, 3 heating pits, 2 fire pits, 4 pits, 1 storage facility, 1 subfloor vessel
Taxon	**Percent**	**Occurrence**
Annuals:		
Cheno-Am	14%	–
Goosefoot	17%	13%
Marsh elder	1%	–
Mustard	5%	–
Pepperweed	1%	–
Pigweed	1% capsule, 14%	26%
Purslane	10%	26%
Spurge	1%	–
Stickleaf	1%	–
Tobacco	5%	–
Winged pigweed	9%	22%
Cultivars:		
Maize*	60% c, 10% g, 2% cob frag., 18% k	91% c, 13% g, 4% cob, 4% cob frag., 22% k
Squash	1% rind	–
Grasses:		
Common reedgrass	14% stem	–
Dropseed grass	–	4%
Grass family	12% caryopsis, 1% stem	4% floret
Ricegrass	19%, 2% embryo	–
Other:		
Evening primrose	1%	–
Groundcherry	3%	4%
Mallow family	2%	–
Mustard family	1%	–
Nightshade family	1%	–
Perennials:		
Banana yucca	1%	–
Four-wing saltbush	1% fruit, 1% seed	–
Globemallow	2%	–
Hedgehog cactus	7%	4%
Juniper	17% leaf, 6% twig	4% % cone, 13% twig
Pine	1% bark	–
Piñon	1% conescale, 1% nutshell	–
Prickly pear cactus	1%	–
Saltbush	1% leaf	–
Yucca	1% leaf	4% leaf
Total No. of Taxa	**31**	**11**

Number of samples = number with cultural plant remains (total number of samples).
c = cupule, g = glume, k = kernel
* Maize: Entries in this row may be read, e.g., as follows: "60% c, 10% g" indicates that, of the samples with charred maize remains, 60% contained cupules and 10% contained glumes. Note: the percentages in these cells do not add up to 100%.

Table 22.4. Wood taxa, percent occurrence of conifers and nonconifers in features from pit structures and antechambers compared to features in surface rooms.

	Pit Structures and Antechambers	**Surface Rooms**
Total Samples	**53**	**18**
Feature Type	**9 hearths, 6 ash pits, 2 cists, 2 major off-chamber cists, 7 pits, 1 non-vent tunnel, 2 pot rests, 1 bin, 3 mealing bins, 1 mealing collection basin**	**5 hearths, 1 cist, 2 fire pits, 2 heating pits, 2 pits, 2 storage facilities**
Conifers		
Juniper	96%	100%
Mormon tea	6%	–
Piñon	19%	17%
Unknown conifer	6%	6%
Nonconifers		
Antelopebrush	2%	–
Composite family	4%	–
Cottonwood/willow	60%	78%
Greasewood	21%	–
Mountain mahogany	–	11%
Oak	6%	–
Plum/cherry	6%	–
Rabbitbrush	6%	22%
Rose family	–	6%
Sagebrush	32%	22%
Saltbush family	2%	6%
Saltbush/greasewood	25%	33%
Serviceberry	11%	–
Unknown nonconifer	32%	44%
Total taxa	**12 (16)**	**8 (11)**

contexts defined as lower fill below roof fall, roof fall, or construction material was dominated by juniper and riparian (cottonwood/willow) categories (Fig. 22.3). Piñon and juniper use for construction increases in our sample from Basketmaker III to Mid Pueblo II, and shrub use increases by 39 percentage points. Use of cottonwood/willow remains fairly consistent during the two occupations, indicating its primary use in roof construction.

Taxonomic Questions

Ceremonial Plant Use

Burned and unburned tobacco occurrence is presented by site and feature type in Table 22.5. Two pipes were found at the earliest occupied site, LA 37594, but no identified tobacco. Later in the Basketmaker III period, LA 60751 exhibits good evidence of tobacco plant parts, but no pipes. There were several occurrences of tobacco at LA 37592, but pipes were not present in excavated units. Tobacco was most likely smoked ceremonially and pipes used at LA 60751 could very likely have been retained by their owners at abandonment of the site or were buried in a spot that was not discovered during data recovery. This was probably not the only way in which tobacco was used ceremonially, since reed cigarettes, for example, are well documented. The recovery of unburned tobacco on floors and in features at all sites except LA 37591 and LA 37594 indicates tobacco offerings could have been part of structure closing or decommissioning rituals. As Table 22.5 shows, there is, in fact, no provenience in which pipes and tobacco co-occurred.

The archaeological record of tobacco recovery in the Southwest is clearly affected by a history of differential recovery and recognition: "sporadic earlier recoveries of tobacco remains were largely dependent on researchers' encountering assemblages

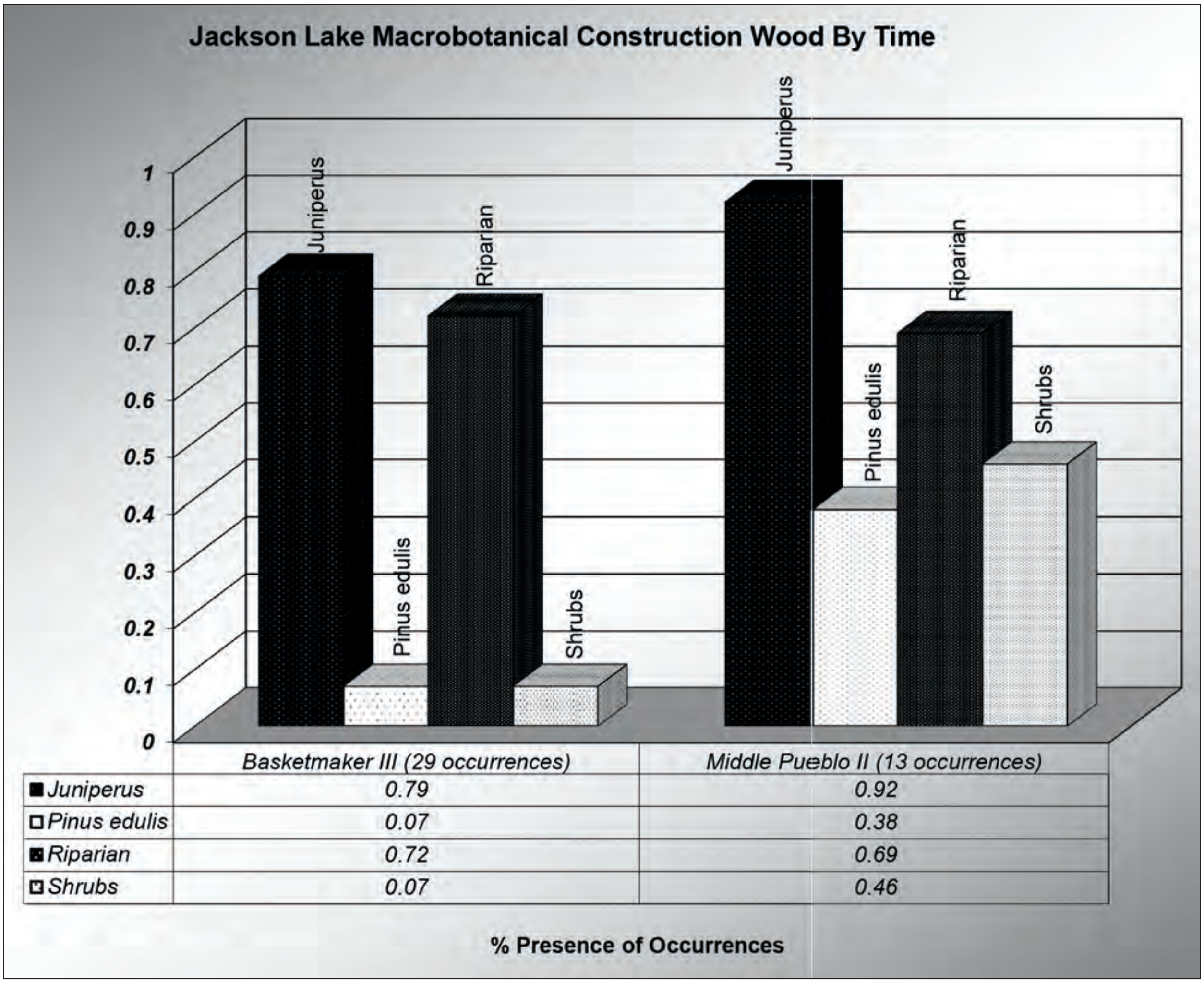


Figure 22.3. Construction wood from Jackson Lake sites, graph of type by occurrence by cultural period.

in situations of exceptional preservation, whereas flotation has allowed the recovery of the tiny seeds even when they occur in very low frequencies and/or situations of poor preservation" (Adams and Toll 2000:152). With continued consistent use of flotation and training of analysts to recognize the seeds as small as 0.4 mm, masquerading as sand grains, we can expect the record of prehistoric use of tobacco to be more pervasive.

Cultivars

The distribution of maize cobs suggests changing patterns of food preparation and fuel use. In the Mid Pueblo II period, the majority of cobs were found in pits or cists, while in the Pueblo II–III and Pueblo III periods, most cobs are from middens or thermal features (Table 22.6). Of particular note are the 14 cobs from the Pueblo III fire pit in Room 201 at LA 37592. Perhaps—as varieties of maize that were more robust and suited to roasting were developed and grown, or farmers were increasingly successful at growing corn to maturity—not only were more cobs processed by roasting, but the larger shelled ears were increasingly used for fuel.

Distinguishing between cobs with intact glumes, partially eroded glumes, and no glumes (Tables 22.7, 22.8, 22.9) allows the reader to examine cob morphometric differences not affected by the degree of postdepositional erosion. When glumes are present, cob diameter is greater, and cupules are registered as wider because widths are measured

Table 22.5. Presence of pipes and tobacco by feature types, site, and time period.

Site	LA 37594	LA 60751	LA 37595	LA 37593	LA 37598	LA 37592	LA 37591
Occupations Associated with Tobacco	Early Basket-maker III, Mid Pueblo II	Basket-maker III	Mid Pueblo II	Mid Pueblo II	Mid Pueblo II, Pueblo II–III	Pueblo II–III, Pueblo III	Pueblo III
Ash receptacle	–	u	–	u	–	u	–
Bin	–	c, u	–	–	–	–	–
Cist	–	–	–	–	u	–	–
Floor	1 Basketmaker III tuff pipe	u	u	u	–	u	–
Floor fill	–	–	u	–	–	u	–
General fill	–	–	–	–	–	–	c
Hearth	–	–	–	u	–	–	–
Major off-chamber cist	–	–	–	–	u	–	–
Mealing collection basin	–	–	u	–	–	–	–
Non-ventilator tunnel	–	–	–	–	u	–	–
Pit	–	c, u	–	–	–	u	–
Posthole	–	c, u	–	–	u	–	–
Pot rest	–	u	–	–	–	–	–
Roofing material	–	u	u	–	–	–	–
Trash pit	–	–	u	–	–	–	–
Upper fill above roof fall	–	–	1 plain gray pipe	1 plain gray pipe, 1 Pueblo II–III black-on-white pipe	u	u	–
Vent shaft	–	–	u	–	–	–	–
Extramural	1 Pueblo III polished black-on-white pipe	–	–	1 polished white pipe	–	–	–

c = charred, u = uncharred

from glume to glume. Rachis segment lengths are generally comparable between cobs with intact and partially eroded glumes, while cupule height is generally shorter with the absence of glumes.

During the Mid Pueblo II and Pueblo III occupations, most of the cobs are 10- or 12-rowed, but in the Pueblo II–III period, 8-rowed cobs dominate the assemblage (Table 22.10). This is probably not a true shift, but most likely reflects the small sample size and the fact that half of the six 8-rowed cobs were questionable regarding exact row number assignment because of irregular row configuration or the presence of undeveloped rows. The presence of irregular row configurations can be a clue to maize-growing conditions. Irregular rows frequently develop in the base or tip portions of a maize ear, but in the body of the ear they are often a sign of moisture and/or mineral stress. Irregular rows may also be the result of "poor pollination or kernel abortion, often attributable to stressful environmental conditions during flowering and grain forming stages" (Muenchrath and Salvador 1995). Early agronomic studies by Denmead and Shaw (1960) and Robins and Domingo (1953) demonstrated that moisture, temperature, and mineral stress affect reduction in size of the plant as a whole, as well as the ear, and often result in irregular row configuration and undeveloped kernel rows. This suggests that drought conditions extant during the early AD 1100s had some impact on agricultural success. Only 13 percent of the Jackson Lake cobs display undeveloped rows,

Table 22.6. Zea mays (cob) remains, specimen counts by time period, site, and feature/stratigraphic context

Occupation	Mid Pueblo II										
Site	LA 37593			LA 37594					LA 37595		
Provenience	Extramural Area 1			Room 101	Room 104	Room 201	Extramural Area 2	Extramural Area 3	Pit Structure 1		Pit Structure 4
Feature/ Stratigraphic Context	Major Storage Cist	Major Storage Cist	Cist	Central Hearth	Trash Pit	Pit 7	Pit 10	Major Storage Cist 3	Vent Shaft	Roofing Material	Pit 3
Measurable cob specimens	1	3	3	2	1	12	1	1	1	2	1

Occupation	Pueblo II–III			
Site	LA 37592	LA 37593		LA 37598
Provenience	Extramural Area	Pit Structure 1		Pit Structure 2
Feature/ Stratigraphic Context	Fire Pits 1, 3, 9	Dumping Episode	Roofing Material	Pit 2
Measurable cob specimens	10	2	1	1

Occupation	Pueblo III									
Site	LA 37591			LA 37592						
Provenience	Pit Structure 1 Midden			Pit Structure 1		Room 201			Room 202	
Feature/ Stratigraphic Context	Layer 1	Layer 2	Layer 4	Midden in Upper Fill	Bench	Floor Fill	Pot Sunk in Foor 1	Fire Pit or Roasting Pit, Floor 2	Hearth, Floor 1	Hearth, Floor 3
Measurable cob specimens	3	4	1	33	1	1	1	14	4	2

Table 22.7. Zea mays cob morphometrics (mm) for Mid Pueblo II sites (LA 37593, LA 37594, LA 37595), by kernel rows count and type.

Kernel Rows (count)	Row Type	Intact Glumes	Glume	Rachis Segment	Partially Eroded	Cupule	Rachis Segment	No Glumes	Cupule	Cupule
		Cob Diameter (mm)	Width (mm)	Length (mm)	Cob Diameter (mm)	Width (mm)	Length (mm)	Rachis Diameter (mm)	Width (mm)	Height (mm)
LA 37593										
10	straight	–	–	–	8.9	4.8	3.6	–	–	–
8	straight	–	–	–	7.5	5.1	2.7	–	–	–
8	straight	–	–	–	–	–	–	9.2	6.6	3.2
10	straight	–	–	–	–	–	–	7.8	4.2	2.9
12	undeveloped	–	–	–	13.2	7.7	3.8	–	–	–
10	straight	–	–	–	18.5	7.9	5.3	–	–	–
14	undeveloped	–	–	–	13.9	5.6	3.2	–	–	–
LA 37594										
12	straight	12.0	6.0	2.5	–	–	–	–	–	–
12	straight	–	–	–	11.4	4.9	2.5	–	–	–
12	straight	–	–	–	13.8	6.4	3.7	–	–	–
12	straight	–	–	–	–	–	–	10.3	5.3	–
10	straight	14.1	6.4	2.2	–	–	–	–	–	–
10	straight	–	–	–	–	–	–	10.3	5.8	–
12	straight/ undeveloped	–	–	–	12.1	5.3	3.1	–	–	–
12	straight/ undeveloped	–	–	–	–	–	–	13.0	5.8	2.8
10	straight	–	–	–	–	–	–	13.6	6.7	3.2
10	straight	–	–	–	–	–	–	9.6	5.0	2.6
10	straight	–	–	–	–	–	–	10.0	6.1	3.1
10	straight	–	–	–	–	–	–	13.7	6.7	2.6
10	straight	–	–	–	–	–	–	8.9	5.1	2.2
10	straight	9.9	5.6	3.0	–	–	–	–	–	–
10	irregular	15.1	6.9	2.9	–	–	–	–	–	–
4	straight	7.8	6.1	2.9	–	–	–	–	–	–
12	straight	–	–	–	13.2	6.1	3.5	–	–	–
LA 37595										
10	straight	–	–	–	–	–	–	12.4	5.7	3.0
12	straight	11.9	5.4	2.4	–	–	–	–	–	–
12	straight	–	–	–	10.8	5.5	3.1	–	–	–
8	straight	–	–	–	10.4	6.1	3.0	–	–	–
Percentage and Average										
4% 4-row	4% irregular	11.8	6.1	2.7	12.2	5.9	3.4	10.8	5.7	2.3
10% 8-row	82% straight	–	–	–	–	–	–	–	–	–
46%10-row	7% straight/ undeveloped	–	–	–	–	–	–	–	–	–
36% 12-row	7% undeveloped	–	–	–	–	–	–	–	–	–
4% 14+-row	–	–	–	–	–	–	–	–	–	–

Table 22.8. Zea mays cob morphometrics (mm) for Pueblo II–III sites (LA 37592, LA 37593, LA 37598), by kernel rows count and type.

Kernel Rows (count)	Row Type	Partially Eroded	Cupule	Rachis Segment	No Glumes	Cupule	Cupule
		Cob Diameter (mm)	Width (mm)	Length (mm)	Rachis Diameter (mm)	Width (mm)	Height (mm)
LA 37592							
8	straight	–	–	–	6.6	5.2	3.6
8	straight	–	–	–	6.9	4.8	3.0
10	straight	7.3	4.7	2.7	–	–	–
12	irregular	11.8	5.6	3.1	–	–	–
?	?	11.6	6.2	3.9	–	–	–
8	straight	8.4	6.7	4	–	–	–
8?	undeveloped	7.7	5.3	3.3	–	–	–
8?	undeveloped	–	–	–	6.7	6.4	2.7
8?	irregular	11.6	7.1	3.3	–	–	–
12	straight	–	–	–	11.8	5.9	3.3
LA 37593							
12	straight	15.7	6.1	2.1	–	–	–
12	straight	–	–	–	11.1	4.0	1.5
10	straight	12.8	6.1	3.8	–	–	–
LA 37598							
10	spiral	–	–	–	11.6	4.0	1.8
Percentage and Average							
46% 8-row	15% irregular	10.9	6.0	3.3	9.1	5.1	2.7
23% 10-row	8% spiral	–	–	–	–	–	–
31% 12-row	62% straight	–	–	–	–	–	–
	15% undeveloped	–	–	–	–	–	–

but 18 percent had irregular row configurations. All but three of the cobs with irregular row configurations were associated with the Pueblo III occupation of Jackson Lake.

Measurable kernels came from a large cist in Room 201 at LA 37594, dating to Mid Pueblo II. The individual and average height, width, and thickness of the 42 kernels analyzed are presented in Table 22.11. Such kernel collections are rare, depending on unusual preservation conditions, and we have few comparable assemblages. These data can contribute to future regional and diachronic comparisons as more measured archaeological specimens become available.

Although there was an abundance of squash seeds from LA 37595, only three of the eighteen Jackson Lake samples with squash seeds yielded whole seeds suitable for measuring, one from the floor fill of Pit Structure 1, LA 37593; another from roofing material; and the third from the vent tunnel in Pit Structure 1 at LA 37595. Two were nearly equivalent in length and width, one measured 18.9 mm long and 10.0 mm wide, while the other measured 18.4 mm long and 9.9 mm wide. The third was slightly larger (20.1 mm long and 10.5 mm wide). Morphometrics of these will be compared with those of regional *Cucurbita* seeds in the La Plata overview discussion. The squash seed distribution is extremely uneven. All three Pueblo II pit structures at LA 37595, a mealing room and two full sized pit structures, contain squash seeds in a variety of contexts, including floor fill, floor features, vent shaft, and roofing, totaling 26 instances. The only other squash seed recovered from any Jackson Lake community site was found in an extramural cist at LA 37594.

Table 22.9. Zea mays cob morphometrics(mm) for Pueblo III sites (LA 37591, LA 37592, LA 37593), by kernel rows count and type.

Kernel Rows (count)	Row Type	Intact Glumes	Glume	Rachis Segment	Partially Eroded	Cupule	Rachis Segment	No Glumes	Cupule	Cupule
		Cob Diameter (mm)	Width (mm)	Length (mm)	Cob Diameter (mm)	Width (mm)	Length (mm)	Rachis Diameter (mm)	Width (mm)	Height (mm)
LA 37591										
10	irregular	10.5	5.1	2.2	–	–	–	–	–	–
10	undeveloped	–	–	–	–	–	–	9.8	5.4	2.7
8	undeveloped	–	–	–	–	–	–	9.8	5.5	2.8
12	irregular	–	–	–	–	–	–	11.6	4.6	3.3
10	straight	–	–	–	–	–	–	10.4	5.2	2.8
12	straight	–	–	–	10.3	5.2	3.0	–	–	–
12	irregular	–	–	–	12.5	6.8	3.2	–	–	–
14	straight	16.9	6.4	3.3	–	–	–	–	–	–
LA 37592										
10	straight	–	–	–	–	–	–	8.3	5.0	3.0
14	irregular	18.4	6.7	3.5	–	–	–	–	–	–
10	straight	10.5	6.0	2.8	–	–	–	–	–	–
10	straight	–	–	–	12.1	5.9	3.1	–	–	–
12	straight	–	–	–	10.6	6.4	2.5	–	–	–
10	irregular	–	–	–	10.5	6.4	2.5	–	–	–
12	straight	13.5	6.6	2.7	–	–	–	–	–	–
12	straight	–	–	–	–	–	–	9.8	5.9	3.3
10	straight	–	–	–	–	–	–	10.4	5.7	3.1
10	straight	–	–	–	–	–	–	10.6	5.7	3.7
8	straight	–	–	–	–	–	–	9.1	5.7	3.1
14?	irregular	–	–	–	14.8	5.3	3.3	–	–	–
14?	irregular	–	–	–	12.8	6.5	3.1	–	–	–
8	straight	–	–	–	9.2	6.0	3.0	–	–	–
10	tesselated	–	–	–	12.3	4.9	3.1	–	–	–
12	irregular	–	–	–	11.7	5.5	3.2	–	–	–
10	straight	–	–	–	12.7	8.1	4.1	–	–	–
12	irregular	–	–	–	13.0	5.1	3.3	–	–	–
10	straight	–	–	–	–	–	–	7.4	4.5	2.5
12	straight	–	–	–	14.8	7.0	3.8	–	–	–
10	straight	–	–	–	–	–	–	8.3	5.1	2.4
12	straight	14.0	5.9	3.1	–	–	–	–	–	–
12	straight	–	–	–	7.6	4.5	2.1	–	–	–
10	straight	–	–	–	8.5	5.1	3.1	–	–	–
12	tesselated	–	–	–	11.6	5.0	4.0	–	–	–
LA 37593										
14	straight	–	–	–	16.2	7.7	3.2	–	–	–
12	straight	–	–	–	15.0	7.1	3.3	–	–	–
12	straight	–	–	–	10.7	5.3	3.4	–	–	–
10	straight	–	–	–	11.2	6.9	4.3	–	–	–
8?	spiral/irregular	–	–	–	9.6	5.1	3.5	–	–	–
10?	irregular	–	–	–	10.7	6.0	2.6	–	–	–
8	irregular	–	–	–	9.7	6.0	2.8	–	–	–
8	irregular	–	–	–	8.5	5.6	3.6	–	–	–
12	straight	–	–	–	13.4	5.8	3.5	–	–	–
14	tesselated	–	–	–	16.3	7.0	3.8	–	–	–
?	?	–	–	–	5.6	4.3	2.7	–	–	–

Table 22.9 (continued)

Kernel Rows (count)	Row Type	Intact Glumes Cob Diameter (mm)	Glume Width (mm)	Rachis Segment Length (mm)	Partially Eroded Cob Diameter (mm)	Cupule Width (mm)	Rachis Segment Length (mm)	No Glumes Rachis Diameter (mm)	Cupule Width (mm)	Cupule Height (mm)
12	irregular	–	–	–	–	–	–	15.7	6.8	2.5
12	undeveloped	–	–	–	–	–	–	12.3	5.2	3.3
14	undeveloped	–	–	–	–	–	–	10.3	5.0	3.1
8	undeveloped	–	–	–	–	–	–	8.9	5.8	2.9
10	straight	–	–	–	–	–	–	9.0	4.8	3.0
8	straight	–	–	–	7.8	5.1	2.0	–	–	–
8	straight	–	–	–	8.7	6.9	3.3	–	–	–
8	spiral	–	–	–	9.5	5.3	3.8	–	–	–
12	irregular	–	–	–	11.9	5.8	3.9	–	–	–
12	straight	–	–	–	9.3	4.6	2.7	–	–	–
10	irregular	19.1	7.2	3.4	–	–	–	–	–	–
10	straight	13.9	7.6	3.1	–	–	–	–	–	–
10	undeveloped	12.5	6.6	3.6	–	–	–	–	–	–
10	straight	–	–	–	10.9	6.3	4.3	–	–	–
10	irregular	–	–	–	9.2	5.3	3.2	–	–	–
10	straight	–	–	–	11.6	6.0	3.8	–	–	–
8	straight	–	–	–	9.4	6.6	3.2	–	–	–
10	straight/ undeveloped	12.5	6.5	3.1	–	–	–	–	–	–
8	straight	–	–	–	8.6	5.3	3.4	–	–	–
8	straight	–	–	–	8.9	5.4	3.0	–	–	–
Percentage and Average										
21% 8-row	16% irregular	14.2	6.5	3.1	11.0	5.9	3.3	10.1	5.4	3.0
30% 12-row	2% spiral/ irregular	–	–	–	–	–	–	–	–	–
38% 10-row	56% straight	–	–	–	–	–	–	–	–	–
	2% straight/ undeveloped	–	–	–	–	–	–	–	–	–
11% 14-row	5% tesselated	–	–	–	–	–	–	–	–	–
	10% undeveloped	–	–	–	–	–	–	–	–	–

Plant Use through Time at Jackson Lake

Taxa diversity doubles from the Early Basketmaker III period to Basketmaker III and remains fairly consistent, with a slight rise in diversity in Pueblo II–III (Table 22.12). Grass occurrence in the two earlier time periods primarily reflects roof-fall materials (common reedgrass and grass family stems), but in the Mid Pueblo II, grass seeds (in particular ricegrass) appear in flotation samples. It is not until the Pueblo III period that dropseed grass is found. Perennials are absent from the limited Early Basketmaker III sample but steadily increase in number and diversity from the four-wing saltbush and hedgehog cactus present in the latter part of the Basketmaker III to a perennial assemblage in the Pueblo III period that not only includes the more common globemallow, juniper twigs and seeds, and hedgehog cactus, but also the illusive piñon nutshell and prickly pear cactus seeds.

Maize was the only cultivar recovered in flotation samples, but numerous unburned squash seeds were found in Mid Pueblo II macrobotanical samples, particularly from LA 37595 roofing ma-

Table 22.10. Zea mays cob morphometrics(mm), compared by site and by time period.

Time Period	Partially Eroded Cobs	Cob Diameter (mm)	Cupule Width (mm)	Cobs with Known Row No.	Row No. Distribution			
					8 or <-Row	10-Row	12-Row	14+-Row
Mid Pueblo II	8	8.7	4.4	28	14%	46%	36%	4%
Pueblo II–III	8	10.9	6	13	46%	23%	31%	–
Pueblo III	38	11	5.9	63	21%	38%	30%	11%
Row Numbers by Site								
Site	**Mean**	**n**	**SD**	**Minimum**	**Maximum**	**Median**		
LA 37591	11.0	8	1.85	8	14	11		
LA 37592	10.2	66	2.12	4	14	10		
LA 37593	10.6	10	1.90	8	14	10		
LA 37594	10.5	17	1.94	4	12	10		
LA 37595	10.5	4	1.91	8	12	11		
LA 37598	10.0	1	–	10	10	10		
Total	**10.4**	**106**	**2.01**	**4**	**14**	**10**		

SD = Standard Deviation

terial. Aside from these Mid Pueblo II occurrences, the only evidence of squash exploitation is in Pueblo III, with one example of rind from a midden. The preponderance of maize over any other cultivar (beans are conspicuously absent from the record) indicates a focus on this particular crop. Indeed, when we compare the ubiquity of plant classes through time, we see an increase in maize ubiquity and a dramatic decrease in annuals that persists until the end of the occupation in the Jackson Lake area (Fig. 22.4). One might conclude that the encouragement of annual volunteers in cultivated fields may have declined through time to prevent them from competing with cultivars for water and nutrients. However, after the initial drastic decline in annuals during the Mid Pueblo II, the percent presence of annuals remains fairly consistent, indicating a persistent strategy of multicropping in agricultural fields through time. Annual weeds may have been more successful than corn during the incipient stages of agriculture in the La Plata Valley and played a more important role in the diet earlier on. As success with agricultural pursuits increased, perhaps fewer annuals were allowed to grow to maturity in fields.

A few temporal wood-use patterns can be seen in Figure 22.5. Juniper increases in Basketmaker III flotation samples and then remains fairly consistent during ensuing time periods, while at the same time piñon decreases from the initial settlement of the area, from 18 percent of total occurrences to a mere 3 percent of total occurrences in Pueblo III samples. This indicates that juniper was always an important fuel and construction wood, whereas piñon may have been more commonly used in the Early Basketmaker III. It may have been depleted by the AD 500s, or stands were never very dense to begin with, or some form of silviculture (as postulated for Chaco Canyon by Windes and Ford 1996) was practiced by the Jackson Lake residents. This is not supported by the archaeobotanical record, because if piñon trees were preserved in order to provide nuts, we would expect to see evidence of piñon nut use, especially during those occupations prior to Pueblo III. However, there was only one incidence of piñon plant parts; cone scales and nutshell were identified in the initial midden deposit in Pit Structure 1 at LA 37592, most likely dating to the beginning of the Pueblo III period. Importantly, nutshell remains appear in the few coprolites preserved in San Juan Basin sites (Minnis 1989; Toll, cited in Clary 1987), offering direct evidence for use of this resource. Piñon and other upland perennial plants provide excellent concentrated calorie sources, and it would be hard to believe that they did not play a critical role in Jackson Lake subsistence.

Table 22.11. Partially charred Zea mays kernel morphometrics (mm), Mid Pueblo II (LA 37594, Room 201 fill/feature).

Length (mm)	Width (mm)	Thickness (mm)
Room 201, Fill below Roof Fall		
8.2	7.0	4.6
8.2	7.3	4.7
8.7	7.0	4.6
6.7	7.5	4.5
6.5	7.8	4.0
6.9	6.6	5.7
7.5	7.0	6.2
6.0	7.2	5.7
7.6	7.0	4.9
8.6	7.3	4.4
–	7.5	4.3
7.7	6.8	4.8
–	7.4	4.1
7.4	7.5	5.1
6.6	6.4	4.8
6.2	6.3	5.8
7.5	6.6	5.2
6.6	8.6	4.8
6.8	7.5	4.3
5.7	7.1	5.2
6.6	6.8	4.6
7.6	7.2	4.4
–	6.6	5.1
8.3	7.5	4.6
7.3	7.0	4.9
–	8.1	4.3
–	7.6	4.1
7.0	6.6	5.4
6.5	6.7	5.4
6.9	6.3	4.9
Room 201, Feature 7 (cist) Fill		
–	7.7	3.8
–	7.4	4.4
–	7.4	4.1
7.7	6.3	5.6
8.3	7.0	5.2
–	6.6	5.8
8.4	7.3	4.0
–	7.4	4.3
8.9	6.7	5.1
–	7.3	4.7
–	8.1	3.8
–	7.0	4.5
7.8	7.1	4.8
Average		
7.3	7.1	4.8

Table 22.12. Flotation results by time period and site.

Period	Site	Samples	Annuals	Grasses	Perennials	Cultivars	Other
Early Basketmaker III	LA 37594	14	Cheno-Am	common reedgrass, grass family stems	–	maize	mustard family
			Goosefoot	grass family seeds	–	–	–
			Peppergrass	–	–	–	–
Basketmaker III	LA 37595	6	Amaranth	grass family	four-wing saltbush	maize	groundcherry
	LA 60751	38	Cheno-Am	common reedgrass stems	hedgehog cactus	–	mallow family
			Goosefoot	–	–	–	nightshade family
			Marsh elder	–	–	–	–
			Mustard	–	–	–	–
			Purslane	–	–	–	–
			Spurge	–	–	–	–
			Tobacco	–	–	–	–
			Tobacco[u]	–	–	–	–
			Winged pigweed	–	–	–	–
Mid Pueblo II	LA 37589	4	Amaranth	grass family	banana yucca	maize	groundcherry
	LA 37592	5	Cheno-Am	ricegrass	globemallow	squash seeds	stickleaf
	LA 37593	11	Goosefoot	–	hedgehog cactus	–	–
	LA 37594	22	Mustard	–	juniper seeds, twigs	–	–
	LA 37595	20	Purslane	–	yucca leaf	–	–
	LA 37598	24	Tobacco[u]	–	–	–	–
Pueblo II–III	LA 37590	2	Amaranth	grass family	four-wing saltbush	maize	borage family
	LA 37591	9	Cheno-Am	ricegrass	greasewood	–	evening primrose
	LA 37592	29	Goosefoot	–	hedgehog cactus	–	groundcherry
	LA 37593	10	Mustard	–	Juniper cones, twigs	–	mallow family
	LA 37598	11	Patata	–	yucca	–	–
	LA 60744	2	Purslane	–	–	–	–
	LA 60745	1	Tobacco[u]	–	–	–	–
	LA 60749	6	Winged pigweed	–	–	–	–
Pueblo III	LA 37591	1	Amaranth	dropseed grass	globemallow	maize	groundcherry
	LA 37592	18	Goosefoot	grass family	hedgehog cactus	squash rind	–
	LA 37593	1	Purslane	ricegrass	juniper seeds, twigs	–	–
	LA 37598	12	Tobacco[u]	–	piñon nutshell	–	–
			Winged pigweed	–	prickly pear cactus	–	–

[u] = uncharred

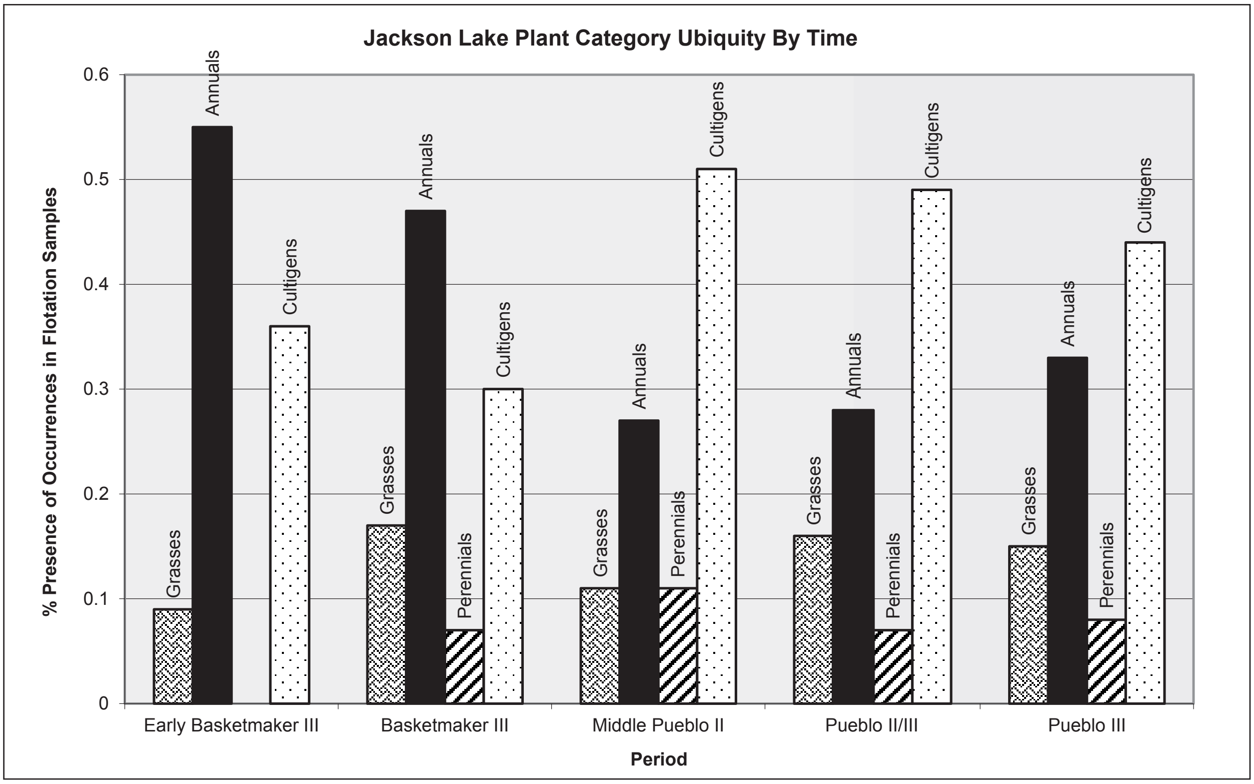


Figure 22.4. Plant categories derived from flotation samples taken at Jackson Lake sites, graph of type by occurrence by cultural period.

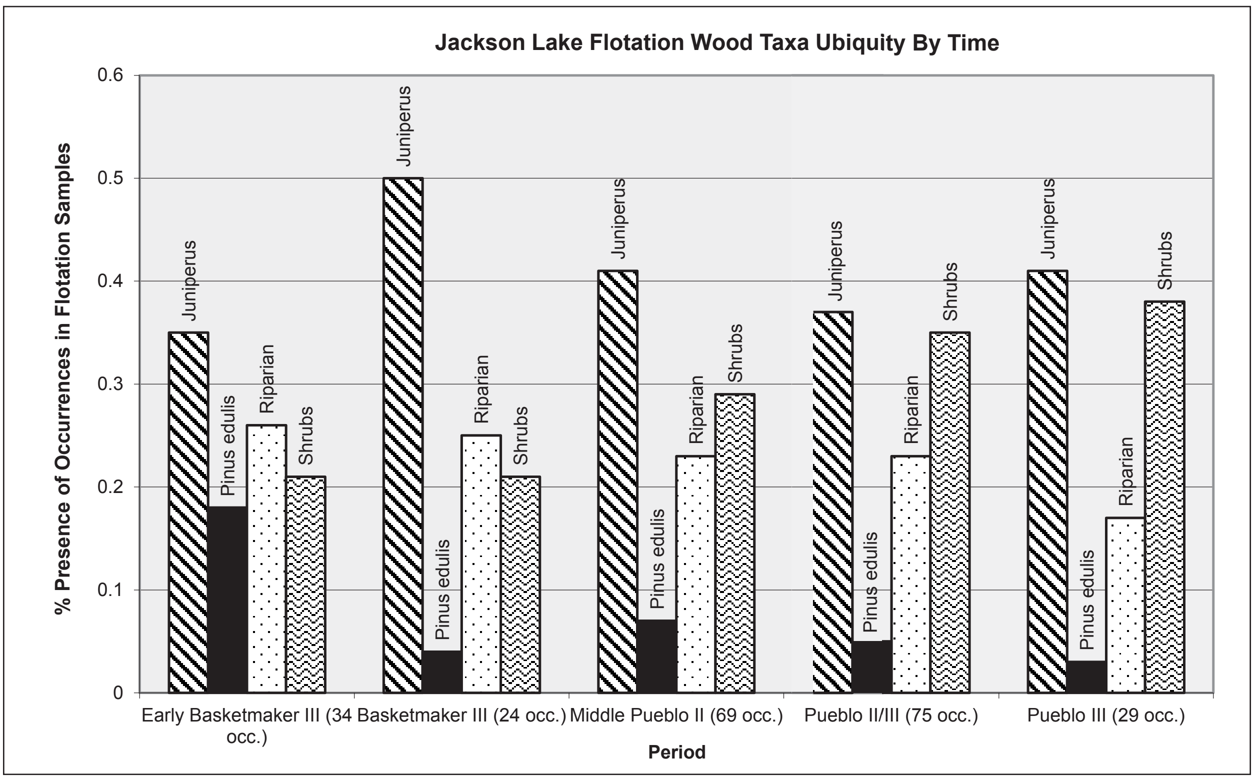


Figure 22.5. Wood taxa derived from flotation samples taken at Jackson Lake sites, graph of type by occurrence by cultural period.

23 Concluding Observations

H. Wolcott Toll

The sites in the Jackson Lake area exhibit a wide variety of behaviors and time periods. Two sequential expressions of the Basketmaker period are present, showing the change in pit structure form. Manifestations from the eighth and ninth centuries are absent, as they are from most of the lower valley, but its reoccupation after AD 1000 is well represented, including specialized mealing rooms and heavily used subterranean structures with concealed storage facilities. Ample exterior storage facilities were also examined, suggesting large production potential as well as the ever-present need to buffer shortfalls. Surface rooms are present but underrepresented due to the proximity over many years of a modern road. Two important deposits of human remains represent two different depositional contexts that we feel have been incorrectly interpreted in the literature as a single phenomenon. Some of these sites were occupied until near the end of the regional occupation, but probably just before, in the early 1200s.

Nine sites of the 16 in the project segment contained clearly datable and sizable artifactual and architectural assemblages (Table 23.1). The sequence of occupation and the sites involved are:

Transitional Basketmaker III (LA 37594)
Classic Basketmaker III (LA 37595, LA 60751)
Early Pueblo I (hiatus)
Mid Pueblo II (LA 37592, LA 37593, LA 37594, LA 37595, LA 37598, LA 60745)
Late Pueblo II (LA 37593, LA 37598)
Early Pueblo III (LA 37591, LA 37592, LA 37593, LA 37598, LA 60749)
Late Pueblo III (LA 37591, LA 37592, LA 37593)

Although the ceramic dating labels include "Late Pueblo III," this implies a post–AD 1200 occupation, which is not strongly indicated by ceramic types and forms. This can be seen in the scarcity of late ceramic types such as Mesa Verde Black-on-white and Mesa Verde Corrugated (Table 1.1). McElmo Black-on-white is far more abundant. The strongest showing of late types is at LA 37591, where Mesa Verde Black-on-white outnumbers McElmo, and Mesa Verde Corrugated is relatively abundant.

Of the nine sites listed above, among the sites with significant numbers of proveniences only two (LA 60749 and LA 60751) appear in only one time segment. The Jackson Lake community was clearly an important location, used regularly, repeatedly, and intensively.

Distinctive Features

The artifacts and structures of the Jackson Lake community fit well within the pre-Hispanic pueblos of the Colorado Plateau. On the scale of the Colorado Plateau, there is nothing unique among the features and artifacts, but there are excellent examples of many structures and processes, including some features that are underreported in the literature.

Early Pit Structure

Pit Structure 5 at LA 37594 was the only such feature excavated during the highway project. It was a shallow (40 cm deep), circular structure with a probable entrance to the south and a roof supported by four posts. Though it had burned and there were multiple wood samples, no tree-ring date was obtained in spite of two attempts by the Laboratory of Tree-Ring Research. The ceramics clearly associated with the structure's use are all polished brown ware (Sambrito Brown), and both the structure and the ceramics place it with little doubt

Table 23.1. Temporal component by site; counts of well-defined, relatively unmixed proveniences.

Site	Transitional Basketmaker III	Classic Basket-maker III	Basketmaker III–Early Pueblo I	Early Pueblo II	Mid Pueblo II	Late Pueblo II	Early Pueblo III	Late Pueblo III	Total
LA 1897	–	–	–	–	3	–	–	–	**3**
LA 37589	–	–	–	–	97	–	–	–	**97**
LA 37590	–	–	–	–	2	–	–	–	**2**
LA 37591	–	–	–	–	–	–	12	5	**17**
LA 37592	–	–	–	–	31	–	129	89	**249**
LA 37593	–	–	–	–	46	49	2	3	**100**
LA 37594	21	–	–	–	92	–	–	–	**113**
LA 37595	–	15	–	–	112	–	–	–	**127**
LA 37598	–	–	–	–	36	8	11	–	**55**
LA 37599	–	–	–	–	347	19	–	–	**366**
LA 37600	–	–	–	–	109	–	4	31	**144**
LA 37601	–	–	–	–	123	63	21	–	**207**
LA 37603	–	–	–	45	–	–	–	63	**108**
LA 37605	–	–	92	–	111	13	8	–	**224**
LA 37606	–	–	–	–	13	–	–	214	**227**
LA 37607	–	–	–	–	85	–	–	–	**85**
LA 60745	–	–	–	–	1	–	–	–	**1**
LA 60749	–	–	–	–	–	–	77	–	**77**
LA 60751	–	211	–	–	–	–	–	–	**211**
LA 65029	–	–	–	–	–	54	–	7	**61**
LA 65030	–	–	–	–	130	7	–	160	**297**
Total	**21**	**226**	**92**	**45**	**1338**	**213**	**264**	**572**	**2771**

Jackson Lake sites are shaded.

in the sixth century. Such structures are becoming increasingly well known in the region, but this was the only example in this project. The style of metate rest in the structure, horseshoe-shaped adobe collars within the main chamber, were also unique for the project in both form and placement.

Earthen Pit Structures

We excavated six deep (2 to 3 m), well-preserved pit structures in the Jackson Lake segment and observed another in profile. These structures all took advantage of the very hard, well-consolidated soil of the fans, which required very little masonry or other reinforcement. One of these structures (LA 37595, Pit Structure 4) was dug through the center of a Basketmaker structure abandoned around 300 years earlier (Pit Structure 3). No retaining wall seems to have been used in the later structure, and it appears that it collapsed into the fill of the earlier structure. Notably—and somewhat mysteriously—a cobble wall was placed in the fill of the Basketmaker structure when a smaller mealing room (Pit Structure 2) was built at about the same time. Though the wall did partially collapse, the smaller structure was better preserved than the larger one, which lacked reinforcement.

Mealing Room Pit Structures

A room type observed several times in the Barker Arroyo segment of the La Plata Highway project as well as in Pueblo II sites in southwest Colorado was present at two of the Jackson Lake sites. These structures tend to have oval floor plans that range 2.5–3 m in the long dimension and 2–2.5 m in width; they are about 1 m deep. They have a row of mealing bins across the middle. They usually date to the 1000s (Mobley-Tanaka 1993, 1997).

Large Storage Cists

During what we commonly think of as Pueblo II and III, storage has been found to take place in masonry surface rooms. As noted repeatedly, our sample of such rooms is thin. Storage in cists behind pit structures is often associated with Basketmaker sites, yet there are numerous examples of this type of feature in the Jackson Lake community in post-Basketmaker contexts (e.g., LA 37592 and LA 37593). It is impossible for us to know in these instances the degree to which these people used cists instead of rooms for storage, but there is at least some suggestion that there was a heavier emphasis on this technique than in other areas.

Large Off-Chamber Cists

The use of large cists opening through pit structure benches suggests a different storage strategy from large cists opening into exterior spaces. Both access and visibility of entrance and exit from such cists is entirely different from those of extramural cists. Only the immediate users of the structure were aware of the use of features opening from inside structures. These features would have been much more difficult to excavate and construct (a horrifying prospect for claustrophobes) than storage cists external to structures. These features are not common in the literature, but they are noted for sites of similar age on the Ute Mountain piedmont northwest of the La Plata Valley (Leonard et al. 2003). This style of storage suggests a greater emphasis on privacy or secrecy about and control of stored materials. These features relied to an extreme degree on the hardness of the soil, and we believe that the difficulty of defining the southeast edge of Pit Structure 1 at LA 37592 resulted from the collapse of the large off-chamber cist in that part of the structure, but perhaps not until after the structure was dismantled.

Rectangular "Roasting Pits": Kilns?

At LA 37592 and LA 37594, large, rectangular, heavily burned pits are similar in size and morphology to kilns studied in the Four Corners (Fuller 1984; Purcell 1993; Swink 1993; Brown et al. 1991:266, 271, 359–360). These pits are different from the kilns in that they are near structures. Neither contains failed vessels, but they are remarkable for their lack of food remains, containing only fuel charcoal. Both contain piñon charcoal, which is uncommon; juniper augmented by shrub wood was the dominant fuel in hearths. Unfortunately, little of the stratigraphy of the feature at LA 37594 remained, but the LA 37592 feature was fully intact. The fill contained a great deal of charcoal and cobbles; the standard fill of kilns includes a bed of coals, kiln furniture rocks, and a layer of smothering dirt.

Shades of Cowboy Wash—and Not

Site 5MT10010, south of Ute Mountain (Leonard et al. 2003), bears some striking similarities to some of the sites in Jackson Lake, especially LA 37592 and LA 37593, as well as LA 37595. Having looked fairly extensively for examples of what we call "major off-chamber cists," I was struck by their scarcity in the literature. At this Ute Mountain site, however, three structures have such features, called "chambers" by their excavators. These features are similar in size, shape, and construction to those at Jackson Lake.

Similarities beyond feature type are evident. The date of the sites is similar: 5MT10010 is Early Pueblo III (AD 1125–1175 in the excavators' scheme). This is somewhat later than LA 37595, but likely to overlap with LA 37593 and LA 37592. Hearth remodeling and shape, with a large upright slab liner on the south edge, are very similar to LA 37592 and LA 37595. Like LA 37592, 5MT10010 has an exterior burned rock–lined feature (1.81 by 1.10 by 0.40 m) very similar to LA 37592 Extramural Area 4 Feature 1 (Leonard et al. 2003:3.7, 3.14, 3.103). As at LA 37595, *Cucurbita* seeds were abundant at 5MT10010. This site, where a coprolite was found to contain human myoglobin, is most famous for its place in the cannibalism literature (Marlar et al. 2000). Thus, its similarity to LA 37592 and LA 37593 continues insofar as disarticulated human remains are present in each of those sites as well. We believe that the remains at LA 37593 were redeposited, but the remains at LA 37592 are more similar to those in the Cowboy Wash site (Martin et al. 2001). While the remains at LA 37592 were intentionally broken up, there is no clear evidence that the object of doing so was cannibalism.

LA 37593 included a pit structure with a large quantity of partially disarticulated human remains in the fill. This deposit was interpreted by Turner and Turner (1999:314–316) as evidence of cannibalism. The more detailed assessment conducted during the project (Martin et al. 2001), however, concluded that a more likely scenario was redeposition of burials disturbed by construction.

Styles of Abandonment

How structures and settlements are abandoned is a rich source of information (Schlanger and Wilshusen 1993). The Jackson Lake sites exhibit a number of aspects illustrating the condition of structures when they were abandoned.

Burning

Only two structures at Jackson Lake were burned, and both are early. One, the earliest structure excavated by the project, is Pit Structure 5 at LA 37594. Thoroughly burned, the floor assemblage suggests a deliberate abandonment: there were few artifacts on the floor, metate supports were empty, and burned material rested on the floor. Although the second burned structure, LA 60751 Pit Structure 1, is also early for the project structures as a group, its probable burning at AD 700 took place about 150 years after the incineration of the LA 37594 house. The assemblage in this structure is quite different. A number of usable, portable, and probably significant artifacts remained on the floor of this building, including Archaic projectile points, a bowl with an anthropomorphic design, a maul, and selenite crystals. Lest we assume that burning of structures is just an early phenomenon, Pit Structure 3 at LA 37595, architecturally similar to LA 60751 Pit Structure 1, was left in a quite different state. There was practically no material in the structure (Toll and Wilson 2000), and it was unburned. We can say, therefore, that while burning a structure may have been more common early on, perhaps because of less reuse of structural elements, perhaps because of changing values, some additional contextual elements also contributed to whether a structure was burned, even at an early date. Although some burning of roof materials is evident in Pueblo II structures, it involved only smaller materials and not wholesale incineration of the structure's wooden elements.

Deconsecration

Sometimes the last act performed at pit structures is to deposit animals in them (Hill 2000; Gillespie 1976:152–153). Clear examples of this practice at Jackson Lake are the turkeys on the floor of LA 37592 Pit Structure 1 and the dog and turkey in the vent of LA 37595 Pit Structure 1. We also encountered it in the Barker Arroyo segment at LA 37605. Although we have a very small sample of surface rooms, it appears from our sample and from the literature that such formal deconsecrations did not take place in surface rooms. This phenomenon took place over a wide area and across most of the Pueblo sequence. Turkeys and young canids were apparently preferred for this practice (Hancock et al. 1988:397–398; Brisbin 1988:363).

Dismantling

As lamented, we have very few tree-ring dates, especially from post-Basketmaker structures. This is because timber was a scarce, possibly even revered resource. Even the latest structures we excavated had had the structural, datable beams removed, almost certainly for reuse elsewhere.

While structures with archaeologically visible deconsecrations were often, probably usually, dismantled—clearly the case of Pit Structure 1 at LA 37595—other structures were apparently just dismantled. Pit Structure 1 at LA 37593 has an interesting floor assemblage with vessels and ground stone and an elaborate postdismantling history with much building material and many burials relocated to the fill. This structure, however, probably went from dismantling to filling without ceremonial deconsecration, at least as far as being archaeologically visible. The placement of so many relocated burials in this structure gives its closing a different significance.

Reoccupation

In the Jackson Lake sample, the two strongest Mid Pueblo II occupations, LA 37595 and LA 37594, are both superimposed on Basketmaker structures, while the later occupations, at LA 37592, LA 37591, LA 37593, and LA 37598, are near but not on top of Basketmaker structures. This is too small a pattern to be significant, but it is suggestive. A practice also seen at Barker Arroyo sites is the placement of formal burials in pit structure fills, another way of restating connection to locations (Toll and Schlanger 1998).

As noted above, the last cultural deposits at LA 37592 indicate that a traumatic event of some sort was the last thing that happened there. Perhaps at the same time, though the timing is unclear, the northern part of one of the rooms was destroyed by flooding from the terrace slopes. Especially if these two ominous events occurred close in time, there would have been ample reason to leave the site.

Community

The highway transect did not intersect any features in the Jackson Lake segment clearly used or intended for public architecture. LA 60746, the elevated site—believed to be a kiva—above the community seems sure to have fulfilled that purpose; LA 111902, the large structure east of LA 37592, is likely as well to have served such a purpose. We know very little about these two sites, but scant surface ceramics suggest that the kiva is earlier (AD 1000s) and the large building later (AD 1100–1250).

As part of the resurvey of this highway segment, we found and recorded LA 60746 as a large pit structure depression on a prominence overlooking the site concentration at the edge of the valley floor. This structure is 11 m in diameter and has evidence of small construction around it. It occupies the entire top of the landform on which it sits (Fig. 23.1). Although its diameter is at the lower end of great kiva size range (Vivian and Reiter 1965:84), it is within the range of 10.1 to 24.7 m and could not have been larger in its commanding location. This possible great kiva, positioned as it is immediately above LA 37591, LA 37592, and LA 111902, pinpoints this location as central to a community, according to a pattern defined by Wilshusen and Wilson (1995:52):

> Great kivas typically are slightly apart from the center of a site, or are centered at a prominent location. . . . In a cross cultural examination of public architecture, ritually specialized structures are often centered in a particular community, but used by members of several interacting communities. The individual communities typically have average populations of approximately 250 individuals.
>
> Simply the act of constructing a large structure such as a great kiva may serve to solidify community organization (Wilshusen 1991:173).

There is a masonry structure associated with the great kiva; it is too small to be a great house, but very likely it was a part of the function of the kiva.

> Communities have important spatial and temporal dimensions, and these constrain what can be considered a community. Communities are places where individuals have regular face-to-face contact, which sets geographic limits on the size of the community. At a specific point in time, commu-

Figure 23.1. LA 60746, a probable Jackson Lake community site or Great Kiva, overlooks sites LA 60749, LA 37592, and LA 111902 and the current agricultural land of the Jackson Lake Wildlife Area. The La Plata River and the East Side Rincon are visible in the mid- and backgrounds.

nities have a definite membership—those people residing within community boundaries. Because community members live in a geographically circumscribed area where they interact on a regular basis, they share the resources within their community catchment. . . . The form, composition, and organization of the community change through time, but this does not mean that the community itself fails to persist (Varien 1999:198).

Perceiving community membership can perhaps be accomplished through evidence for sharing resources. We have designated the Jackson Lake area a community; one way to look at similarity of resources is to examine the grouped lithic material among sites at given times. The broadest number of sites occurs in the Mid Pueblo II (ca. 1050) period, and, of course, we cannot be sure that even components within that time segment were actually contemporaneous. The six sites placed in Mid Pueblo II range from 40 to 829 pieces of chipped stone. The distribution of materials among the components shows a statistically different occurrence of material types at these sites (Table 23.2). Granting contemporaneity, this could be explained in several ways: the sites were not in fact members of a community; or lithic acquisition was a family-by-family activity, and no two households used the same sources, especially at sites such as LA 37598, which is farther from terrace deposits.

Wilson's discussion of the ceramic assemblage from Jackson Lake sites reiterates several themes (Chapter 18, Vol. 2, this report). In spite of arguments for dramatic shifts in affiliation and population elsewhere in the Totah, he sees evidence for long-term continuous occupation and for gradual development of technologies and styles. There were, of course, fluctuations in production and oc-

Table 23.2. Grouped lithic material type by Pueblo II site, with chi-square test results.

	LA 37592	LA 37593	LA 37594	LA 37595	LA 37598	LA 60745	Total
			Chert				
Count	56	22	373	295	262	18	**1026**
Expected Count	54.8	34.8	424.4	270.8	220.7	20.5	**1026.0**
Residual	1.2	-12.8	-51.4	24.2	41.3	-2.5	
			Silicified Wood				
Count	3	10	99	42	63	1	**218**
Expected Count	11.6	7.4	90.2	57.5	46.9	4.4	**218.0**
Residual	-8.6	2.6	8.8	-15.5	16.1	-3.4	
			Quartzite				
Count	17	9	116	62	46	3	**253**
Expected Count	13.5	8.6	104.7	66.8	54.4	5	**253.0**
Residual	3.5	0.4	11.3	-4.8	-8.4	-2.0	
			Siltstone				
Count	31	27	241	130	60	18	**507**
Expected Count	27.1	17.2	209.7	133.8	109	10.1	**507.0**
Residual	3.9	9.8	31.3	-3.8	-49.0	7.9	
Total count	**107**	**68**	**829**	**529**	**431**	**40**	**2004**
			Chi-Square Tests				
	Value	**df**	**Significance (2-sided)**				
Pearson Chi-Square	85.426	15	.000				
No. of Valid Cases	2004						

1 cell (4.2%) has expected count less than 5. The minimum expected count is 4.35.

cupation, but, as in other resource types, local sufficiency is apparent. Rather than being at the whim of other regions, Jackson Lake and the valley were capable of providing ceramics for themselves and quite possibly for other areas. Lithic resources also have a singularly local flavor—exotic stone types are very scarce, but local materials are abundant (Chapters 19, 20, Vol. 2, this report).

The faunal assemblage (Chapter 21, Vol. 2, this report) indicates the region-wide increase in the occurrence of turkey remains through time (Table 21.8). Because of the large samples from two of the latest contexts (LA 37592 and LA 37591), there is an apparent increase in faunal use, but this is mostly a sample-size artifact. Other factors affecting the faunal counts are whole animal deconsecrations (turkeys at LA 37592 and LA 37595, dogs at LA 37594 and LA 37595). The increase in turkey remains is nonetheless real; it is interesting that the occurrence of eggshell is greater in Mid Pueblo II, suggesting a change in turkey keeping or perhaps in the use of eggs. Use of rabbits of both types and larger game, mostly deer, looks to have been constant and consistent through time. Jackrabbits and cottontails occur in remarkably even quantities through time.

Jackson Lake: A Significant Place

Southwestern archaeology has become increasingly aware of the importance placed by early Pueblo peoples on the historical significance of place (e.g., Lekson 2008). The Jackson Lake locality is such a place. A substantial community was there in Transitional Basketmaker times on both sides of the river, at the East Side Rincon and at LA 37594. This was followed by a Classic Basketmaker community with elements on both sides of the river (East Side Rincon, LA 60751, LA 37595). Abandoned during the harsh AD 700s and 800s, the area was reoccupied after AD 1000 with the placement of the hilltop kiva (LA 60746) and the many habitations on the terrace below (LA 37592, LA 37594, and LA 37595 in our sample). The purposeful location of new structures on much earlier features and the placement of burials in dismantled and partially filled pit structures show long-term affinity to the place and the community it represented. They are also illustrative of the modern Pueblo maxim that these places are not "abandoned." The location continued to be occupied through the AD 1100s, and its significance is indicated by the construction of a large building (LA 111902) used probably into the AD 1200s.

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Appendix 1a. Summary: La Plata Valley Sites, All Known Recorders, by NMCRIS Activity Number.

LA No.	Visits	NMCRIS Activity Numbers													
		5550	46539	44949	50468	76082	82468	82511	82513	98940	119143	123790	124978	125083	125996
37588	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–
37589	5	x	x	x	–	x	–	–	–	–	x	–	–	–	–
37590	4	LP-8	–	–	–	x	–	–	–	–	x	–	–	–	–
37591	4	LP-52	–	x	x	–	x	–	–	–	x	–	–	–	–
37592	6	LP-51	–	x	x	–	x	–	–	x	–	x	–	x	–
37593	6	–	–	x	x	–	x	–	–	x	–	x	–	x	–
37594	4	LP-9	–	x	x	–	x	–	–	–	–	x	–	x	–
37595	4	LP-49	–	x	x	–	x	–	–	–	–	x	–	–	–
37596	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–
37597	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–
37598	8	x	x	x	x	–	x	–	–	–	x	x	–	x	–
37599	5	–	–	x	–	–	x	x	x	–	–	–	–	–	x
37600	5	LP-13	–	x	–	–	x	x	x	–	–	–	–	–	x
37601	6	LP-14	–	x	–	–	x	x	x	–	–	–	x	–	x
37603	4	LP-15	–		–	–	x	x	x	–	–	–	x	–	–
37605	4	LP-18	–	x	–	–	x	x	x	–	–	–	–	–	–
37606	4	LP-19	–	x	–	–	x	x	x	–	–	–	–	–	–
37607	4	LP-20	–	x	–	–	x	x	x	–	–	–	–	–	–
37626	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–
60741	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–
60743	2	–	–	–	–	–	x	–	–	–	–	x	–	x	–
60744	–	–	–	–	x	–	x	–	–	–	x	–	–	–	–
60745	2	LP2-5	–	–	x	–	x	–	–	–	x	–	–	–	–
60747	2	LP2-7	–	–	x	–	x	–	–	–	x	–	–	–	–
60749	–	LP2-9	–	–	x	–	x	–	–	–	–	x	–	–	–
60751	3		–	–	x	–	x	–	–	–	–	x	–	x	–
60752	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–
60753	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–
65024	–	–	–	–	–	–	x	x	x	–	–	–	–	–	–
65028	–	–	–	–	–	–	x	x	x	–	–	–	–	–	–
65029	–	–	–	–	–	–	x	x	x	–	–	–	–	–	–
65030	–	–	–	–	–	–	x	x	x	–	–	–	–	–	–
65031	–	–	–	–	–	–	x	x	x	–	–	–	–	–	–
1897	–	–	–	–	–	–	x	x	x	–	–	–	–	–	–
Recorder, inc. OAS report history	–	OAS (as Research Section)	NMDOT	OAS (Lab Notes 316) La Plata Valley	OAS (AN 72) Jackson Lake	OAS (AN 220) Cotton-wood Arroyo	**OAS (AN 242) Jackson Lake & Barker Arroyo**	OAS (AN 69) Barker Arroyo	OAS (AN 71) Barker Arroyo	Game & Fish	Aztec	Aztec	Marron	Aztec	DOE Parametrix

Appendix 1b ⩓ OAS publications history for the La Plata Highway Archaeological Project, with excavated sites listed for each report

Appendix 1b. OAS publications history for the La Plata Highway Archaeological Project, with excavated sites listed for each report.

Year	Report Title	Lab or Archaeology Note (no.)	Author(s)	Sites Excavated by OAS
LA 50337 (pre-project; associated site)				
1993	*The Excavation of a Multicomponent Anasazi Site (LA 50337) in the La Plata River Valley, Northwestern New Mexico*	AN 49	Bradley J. Vierra	LA 50337
Cottonwood Arroyo (not reported in current volumes [AN 242])				
2000	*The Cottonwood Arroyo Group: Testing and Excavation at Five Archaeological Sites on the La Plata Highway*	AN 220	H. Wolcott Toll and Charles A. Hannaford	LA 37588-37590, 37626, 60741
Jackson Lake and Barker Arroyo				
1982	The Recording of Archaeological Sites along the La Plata Highway, San Juan County, New Mexico	Lab Note 283	James W. Lancaster	[*] LA 1897, LA 37591-37603, 37605-37607
1983	The Testing of Archaeological Sites along the La Plata Highway, San Juan County, New Mexico	Lab Note 316	James W. Lancaster	[*] LA 37591-37598, 37602, 37605-37607
1987	*Data Recovery Plan and Research Design for Excavations along the La Plata Highway (NM 170) in the Vicinity of Jackson Lake*	Lab Note 440	H. Wolcott Toll and Charles A. Hannaford	[*] LA 37591-37598
1990	*Resurvey, Survey, and Testing for the Barker Arroyo Segment of the La Plata Highway (NM 170) Project*	AN 69	H. Wolcott Toll, Stephen C. Lent, and Charles A. Hannaford	[*] LA 1897, 37599-37603, 37605-37607, 65024, 65028-65031
1994	*Data Recovery Plan for Excavations along the La Plata Highway in the Barker Arroyo Segment*	AN 71	H. Wolcott Toll and Charles A. Hannaford	LA 1897, 37599-37603, 37605-37607, 65024, 65028-65031
1997	*Resurvey and Recommendations for Archaeological Sites along the La Plata Highway (NM 170) in the Vicinity of Jackson Lake*	AN 72	H. Wolcott Toll and Charles A. Hannaford	[*] LA 37591-37598, 60743-60745, 60747, 60749, 60751-60753
2001	*Totah: Time and the Rivers Flowing—Excavations in the La Plata Valley.* Volume 5 (of 6): Harmony and Discord: Bioarchaeology	AN 242	Debra L. Martin, Nancy J. Akins, Alan H. Goodman, H. Wolcott Toll, and Alan C. Swedlund	LA 1897, 37591-37595, 37598-37601, 37603, 37605, 37606, 60751, 65029-65031
2017	*Totah: Time and the Rivers Flowing—Excavations in the La Plata Valley.* Volumes 1–2 (of 6): The La Plata Highway Archaeological Project–Overview; Jackson Lake Community Sites	AN 242	H. Wolcott Toll	LA 37591-37598, 60743-60745, 60747, 60749, 60751-60753
in prep.; 2020[t]	*Totah: Time and the Rivers Flowing—Excavations in the La Plata Valley.* Volumes 3–4 (of 6): Barker Arroyo Community Sites	AN 242	H. Wolcott Toll	LA 1897, 37599-37603, 37605-37607, 65024, 65028-65031
in prep.; 2020[t]	*Totah: Time and the Rivers Flowing—Excavations in the La Plata Valley.* Volume 6 (of 6): Syntheses	AN 242	H. Wolcott Toll	LA 1897, 37591-37603, 37605-37607, 60743-60745, 60747, 60749, 60751-60753, 65024, 65028-65031
Other La Plata Highway Archaeological Project reports (no sites recorded were determined eligible for Excavation/Data Recovery)				
1982	The Testing of Three Archaeological Sites along the La Plata Highway, San Juan County, New Mexico	Lab Note 301	James W. Lancaster	–
1993	Results of Resurvey and Evaluation of Archaeological Sites in the Dawson Arroyo Segment of the La Plata Highway Project	AN 67	H. Wolcott Toll	–

[*] = sites not excavated by OAS may also be covered in these volumes
[t] = publication date tentative

Appendix 2a. Summary: La Plata Highway Archaeological Project/OAS fieldwork chronology by segment and site, including excavation start/end dates.

Site	Surveyed	Re-surveyed	Tested	Excavated (start–end field recording dates)	Proveniences	Percent
Associated area excavation *(site reported separately, see AN 49:Vierra1993)*						
LA 50337	1981	1985	–	1985	–	–
Cottonwood Arroyo [Segment 1] *(sites reported separately, see AN 220:Toll and Hannaford 2000)*						
LA 37588	1981	1987	1987	–	38	0.43
LA 37589	1981	–	1982	1988	118	1.32
LA 37590	1981	–	1982, 1987	1988	121	1.36
LA 37626	1981	1987	1982, 1987	–	61	0.68
LA 60741	1987	–	1987	–	16	0.18
Total	–	–	–	–	**354**	**3.97**
Jackson Lake [Segment 2]						
LA 37591	1981	1987	1982	**11/17/1988 – 12/23/1988**	46	0.52
LA 37592	1981	1987	1982	**4/25/1988 – 10/7/1988**	797	8.93
LA 37593	1981	1987	1982	**6/14/1988 – 10/27/1988**	674	7.55
LA 37594	1981	1987	1982	**8/25/1988 – 12/15/1988**	454	5.09
LA 37595	1981	1987	1982	**9/10/1988 – 12/21/1988**	227	2.54
LA 37596	1981	1987	1982	**11/17/1988 – 11/29/1988**	15	0.17
LA 37597	1981	1987	1982	**8/9/1988 – 8/23/1988**	112	1.26
LA 37598	1981	1987	1982	**10/12/1988 – 12/20/1988**	513	5.75
LA 60743	1987	–	–	**3/23/1988 – 4/16/1988**	21	0.24
LA 60744	1987	–	–	**3/22/1988 – 4/6/1988**	169	1.89
LA 60745	1987	–	–	**3/23/1988 – 8/16/1988**	66	0.74
LA 60747	1987	–	–	**5/18/1988 – 5/26/1988**	82	0.92
LA 60749	1987	–	–	**4/7/1988 – 5/19/1988**	418	4.68
LA 60751	1987	–	–	**5/26/1988 – 8/18/1988**	427	4.79
LA 60752	1987	–	–	**11/17/1988 – 12/5/1988**	19	0.21
LA 60753	1987	–	–	**8/27/1988 – 9/1/1988**	168	1.88
Total	–	–	–	–	**4208**	**47.14**
Barker Arroyo [Segment 3]						
LA 1897	–	1987	1988	**1916, 10/5/1989 – 10-25-1989**	135	1.51
LA 37599	1981	1987	1982	**7/11/1989 – 11/15/1989, 6/2/1991 – 6/18/1991**	674	7.55
LA 37600	1981	1987	1982	**6/18/1989 – 9/8/1989**	418	4.68
LA 37601	1981	1987	1982	**7/11/1989 – 9/8/1989, 8/19/1991 – 11/8/91**	425	4.76
LA 37602	1981	1987	1982	**6/2/1989 – 6/9/1989**	25	0.28
LA 37603	1981	1987	1988	**4/10/1989 – 6/5/1989**	323	3.62
LA 37605	1981	1987	1982	**11/14/1989 – 12/1/1989, 3/20/1990 – 6/17/1990**	475	5.32
LA 37606	1981	1987	1982	**10/2/1989 – 12/22/1989**	428	4.79
LA 37607	1981	1987	1982	**10/26/1989 –12/6/1989**	194	2.17
LA 65024	1987	–	–	**9/13/1989 – 9/13/1989**	2	0.02
LA 65028	1987	–	1988	**6/6/1989 – 6/6/1989**	129	1.45
LA 65029	1987	–	–	**3/19/1990 – 5/1/1990, 2/18/1991 – 2/27/1991**	293	3.27
LA 65030	1987	–	1988	**4/10/1989 – 7/28/1989**	750	8.40
LA 65031	1987	–	1988, 1989	**8/9/1989 – 8/24/1989**	93	1.04
Total	–	–	–	–	**4364**	**48.9**
Total Proveniences	–	–	–	–	**8926**	**100.0**

Appendix 2b. La Plata Highway Archaeological Project excavation personnel.

1988

Principal Investigator
David Phillips
Field Directors and Site Supervisors
H. Wolcott Toll
Charles Hannaford
Site Supervisors
Peter Bullock
Steve Lent(z)
Yvonne Oakes
Dorothy Zamora
Excavation and Labor Staff
Nancy Akins
Fred Alfred
Pat Alfred
Peter Arena
Leslie Barnhardt
Darrel Beasley
Alphonso Benallie
Roberta Bradley
Merrie Bridges
Peter Bullock
Cindy Bunker
Mona Charles
Eric Dailey
Jimmy Fine
Kate Fuller
Rose Marie Havel
Janet Johnson
Leslie King
Steve Lent(z)
Anthony Martinez
Guadalupe Martinez
Kalay Melloy
Susan Moga
Rodney North
Yvonne Oakes
Steven Post
Luis Vergilio
Laurel Wallace
Richard Walle
Penelope Whitten
Adisa Wilmer
Regge Wiseman
Leonard Yazzie
Dorothy Zamora

1989–1991

Principal Investigator
David Phillips
Field Directors and Site Supervisors
H. Wolcott Toll
Charles Hannaford
Site Supervisors
Mona Charles
Penelope Whitten
Sarah Schlanger
Steve Lent(z)
Excavation and Labor Staff
Fred Alfred
Patrick Alfred
Ramona Avalon
Gerry Bair
Alphonso Benallie
Lorenzo Benallie
Craig Berol
Alvin Bitsue
Eric Blinman
Mark Boatwright
Peter Bullock
Cindy Bunker
David Bunker
Craig Burrel
Mona Charles
Kelt Cooper
Charles Corbett
Earl Cowboy
Eric Dailey
Kellywood Dixon
Amy Dutt
Andy Dutt
Helga Eibl
Laurie Evans
Linda Freedman
Grady Griffith
Charles Hannaford
Janet Johnson
Wolfgang Kainz
Catherine Kemp
Wu Chien Lem
Steven Lent(z)
Tim Martinez
Linda McCargo
Kalay Melloy
Randy Nathan
Rodney North
William Sarracino
Amelia Schaefer
Sarah Schlanger
Larry Sitney
Gary Tinhorn
H. Wolcott Toll
Trish Tomlinson
Laurel Wallace
Penelope Whitten
Leonard Yazzie

* Some individuals served both as excavators and site supervisors

Appendix 3 ⩔ Summary: La Plata Highway Project, OAS Excavation, Sites/Period Components—Features and Structures, Counts by Type

Appendix 3. Summary: La Plata Highway project, OAS excavation, sites/period components—features and structures, counts by type.

Site, Period Components	Rooms	Pit Structure	Mealing Rooms	Cists	Roasting Pits	Burials	Middens	Est. Total Rooms	Est. Total Pit Structures
LA 50337, BM III, Pueblo II-III	7	2	–	–	–	3	–	**13**	**2**
Cottonwood Arroyo									
LA 60741, Archaic?	–	–	–	–	–	–	–	**–**	**–**
LA 37588, P II								**10**	**1**
LA 37589, P II	1	–	–	–	–	–	–	**1**	**–**
LA 37590, P II	–	–	–	–	–	–	–	**–**	**–**
LA 37626, P II		–	–	–	–	–	–	**5**	**–**
Cottonwood sites (5), subtotals:	**1**	–	–	–	–	–	–	**16**	**1**
Jackson Lake									
LA 37591, P III	–	1	–	1	–	–	1	**10**	**1**
LA 37592, P II, P III	3	1	–	2	4	7	1	**10**	**2**
LA 37593, P II-III	3	1	–	3	1	2	1	**10**	**2**
LA 37594, BM III, P II	6	1	1	4	1	1	–	**6**	**3**
LA 37595, BM III, P II	–	3	1	1	1	2	–	**5**	**3**
LA 37596, P II	–	–	–	–	–	–	–	**–**	**–**
LA 37597, P II	–	–	–	–	–	–	–	**5**	**–**
LA 37598, P III	5	3	–	1	1	1	–	**15**	**3**
LA 60743, P II-III	–	–	–	–	–	–	–	**–**	**–**
LA 60744, P II	–	–	–	–	–	–	–	**–**	**–**
LA 60745, P II	–	–	–	–	–	–	–	**5**	**1**
LA 60747, P II	–	–	–	–	–	–	–	**–**	**–**
LA 60749, P II-III	–	1	–	–	–	–	–	**–**	**1**
LA 60751, BM III, PII	–	1	–	–	–	–	–	**–**	**1**
LA 60752, P II	–	0	–	–	–	–	–	**–**	**–**
LA 60753, P II-III	–	–	–	–	–	–	–	**–**	**–**
Jackson sites (16), subtotals:	**19**	**11**	**2**	**12**	**8**	**13**	**3**	**66**	**17**
Barker Arroyo									
LA 65024, P II	–	–	–	–	–	–	–	**–**	**–**
LA 37599, P II	7	4	3	1	5	9	1	**25**	**5**
LA 37600, P II, P III	–	3	3	1	25	6	–	**20**	**7**
LA 37601, P II	6	3	1	4	8	11	2	**30**	**3**
LA 37602, P II-III	–	–	–	–	–	–	–	**–**	**–**
LA 37603, Early P II, P III	–	3	–	1	1	2	1	**20**	**3**
LA 1897, BM III-P III	–	–	–	–	–	–	1	**60**	**10+**
LA 37605, BM III, P II	5	4	–	3	2	5	1	**25**	**5**
LA 65028, P II-III	–	–	–	–	–	–	–	**–**	**–**

Appendix 3 (continued)

Site, Period Components	Rooms	Pit Structure	Mealing Rooms	Cists	Roasting Pits	Burials	Middens	Est. Total Rooms	Est. Total Pit Structures
LA 65029, P II	2	–	–	–	1	1	–	**10**	**2**
LA 65030, P II-P III	2	8	–	1	2	17	1	**30**	**8**
LA 65031, P II-III	–	–	–	–	1	–	–	**–**	**–**
LA 37606, P II, P III	12	1	–	1	–	1	–	**20**	**2**
LA 37607, P II	5	1	–	3	1	–	–	**10**	**1**
LA 37607, Historic	2	–	–	–	–	–	–	**–**	**–**
Barker sites (14), subtotals:	**41**	**27**	**7**	**15**	**46**	**52**	**7**	**250**	**46**
TABLE Totals:	**64**	**43**	**9**	**27**	**54**	**68**	**10**	**332**	**64**

35 sites excavated; table counts show only features that were at least in some part excavated
LA 50337 was found and excavated before the current project; it is an important part of the big picutre but is not included in these counts
Components: Archaic 1, BM III: 5; P II: 26; P II-IIIP III:10; P III: 7; Historic: 1
Note: Room and Pit Structure estimates are especially difficult along the highway

BETA ANALYTIC INC.

MURRY A. TAMERS, PH.D.
JERRY J. STIPP, PH.D.
CO-DIRECTORS

4985 S.W. 74 COURT
MIAMI, FLORIDA
33155 U.S.A.

March 19, 1991

Dr. David A. Phillips
Museum of New Mexico
Lab. of Anthropology, Research Section
P.O. Box 2087
Santa Fe, New Mexico 87504

Dear Dr. Phillips:

Please find enclosed the result on the very small charcoal sample submitted for radiocarbon dating analysis using the AMS (Accelerator Mass Spectrometry) technique. We are also including a printout of the dendrocalibration of the date.

Your charcoal was pretreated the same as the other materials of this sort submitted previously. It was first examined for rootlets. The sample was then given our acid, alkali, acid soakings to get out carbonates and humic acids and was combusted in an enclosed system. The carbon dioxide collected was purified and reacted with hydrogen on a cobalt catalyst to produce graphite. This was applied to a copper target.

The AMS measurements were made in triplicate at the ETH (Eidgenossische Technische Hochschule) university in Zurich. The chemical pretreatments and target material conversion were done at Beta Analytic. In discussing the date in reports or papers, both the Beta- and ETH- numbers should be cited.

This work was billed in advance; I enclose a copy of the invoice. This invoice was only partially paid. The portion for the AMS measurement is still due. Would you discuss this with your purchasing department and have the appropriate payment made. If there are any questions or if you would like to confer on the date, please call us.

Sincerely yours,

Murry Tamers

Murry Tamers, Ph.D.
Co-director

P.S. We are returning the excess sample under separate cover.

TELEPHONE: 305-667-5167 / FAX: 305-663-0964 / BITNET: XNRBET22@SERVAX

BETA ANALYTIC INC.

(305) 667-5167

UNIVERSITY BRANCH
P.O. BOX 248113
CORAL GABLES, FLA. 33124

REPORT OF RADIOCARBON DATING ANALYSES

FOR: David A. Phillips, Jr.
Museum of New Mexico

DATE RECEIVED: December 4, 1990

DATE REPORTED: March 19, 1991

SUBMITTER'S PURCHASE ORDER #

OUR LAB NUMBER	YOUR SAMPLE NUMBER	C-14 AGE YEARS B.P. ±1σ	
Beta-41361 ETH-7326	407-60752-19	2990 +/- 60 BP	(charcoal)

Note: this sample was done using the AMS technique. The reported date has been adjusted by carbon 13 for total isotope effect generated in both nature and during the physical and chemical laboratory procedures. The carbon 13 content was measured concurrently with that of carbon 14 and carbon 12 in the accelerator beam, allowing a precise correction.

These dates are reported as RCYBP (radiocarbon years before 1950 A.D.). By international convention, the half-life of radiocarbon is taken as 5568 years and 95% of the activity of the National Bureau of Standards Oxalic Acid (original batch) used as the modern standard. The quoted errors are from the counting of the modern standard, background, and sample being analyzed. They represent one standard deviation statistics (68% probability), based on the random nature of the radioactive disintegration process. Also by international convention, no corrections are made for DeVries effect, reservoir effect, or isotope fractionation in nature, unless specifically noted above. Stable carbon ratios are measured on request and are calculated relative to the PDB-1 international standard; the adjusted ages are normalized to -25 per mil carbon 13.

BETA ANALYTIC INC.
RADIOCARBON DATING LAB
CALIBRATED C-14 DATING RESULTS

Calibrations of radiocarbon age determinations are applied to convert results to calender years. The short term difference between the two is caused by fluctuations in the heliomagnetic modulation of the galactic cosmic radiation and, recently, the advent of large scale burning of fossil fuels and nuclear devices testing. Geomagnetic variations are the probable cause of medium term differences and long term (greater then 8000 BP) are still unknown.

Radiocarbon dating laboratories have analyzed hundreds of samples obtained from known-age tree rings of oak, sequoia, and Douglas fir. Curves generated from the results depicting the atmospheric carbon content at specific time periods have been incorporated in computer programs. The result of the calibration analysis applicable to your research follows.

(Caveat: these calibrations assume that the material dated was short lived, i.e., living for 20 years like branches, some shells, small plants, a collection of individual tree rings, etc.. For other materials, the "Old Wood Effect" would produce uncertainties; both the maximum and minimum ranges of age possibilities could be overstated by that error source. Also, but less likely, in extreme cases they might even turn out to be understated.)

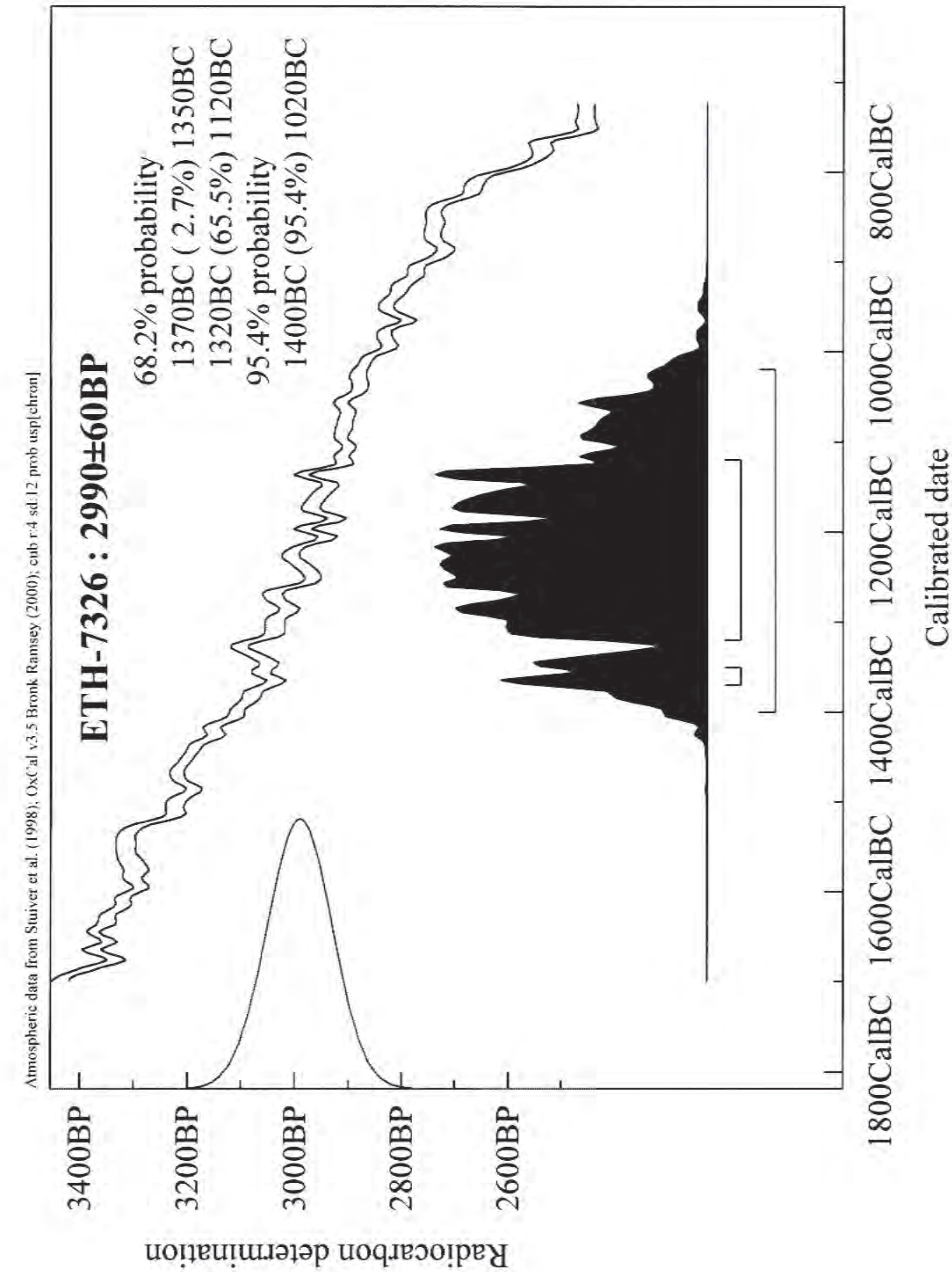
Calibration file: ATM20.14C

```
Beta-41361  ETH-7326
 Radiocarbon Age BP  2990  ±  60
  Calibrated age(s) cal BC  1261
                    cal BP  3210
  cal AD/BC (cal BP) age ranges obtained from intercepts (Method A):
   one Sigma**   cal BC 1376-1345(3325-3294) 1318-1153(3267-3102)
                 1148-1130(3097-3079)
   two Sigma**   cal BC 1410-1030(3359-2979)

   Summary of above ---
   minimum of cal age ranges (cal ages) maximum of cal age ranges:
      one sigma   cal BC 1376 ( 1261) 1130
                  cal BP 3325 ( 3210) 3079
      two sigma   cal BC 1410 ( 1261) 1030
                  cal BP 3359 ( 3210) 2979
```

Reference for dataset used:
Pearson, GW and Stuiver, M, 1986, Radiocarbon, 28, 839-862.

** 1 sigma = square root of (sample std. dev.^{2}+ curve std. dev.^{2})
2 sigma = 2 x square root of (sample std. dev.^{2}+ curve std. dev.^{2})


Atmospheric data from Stuiver et al. (1998); OxCal v3.5 Bronk Ramsey (2000); cub r:4 sd:12 prob usp[chron]
ETH-7326 : 2990±60BP
68.2% probability
1370BC (2.7%) 1350BC
1320BC (65.5%) 1120BC
95.4% probability
1400BC (95.4%) 1020BC
3400BP
3200BP
3000BP
2800BP
2600BP
Radiocarbon determination
1800CalBC
1600CalBC
1400CalBC
1200CalBC
1000CalBC
800CalBC
Calibrated date

BETA ANALYTIC INC.

JERRY J. STIPP, PH. D.
MURRY A. TAMERS, PH. D.
CO-DIRECTORS

4985 S.W. 74 COURT
MIAMI, FLORIDA
33155 U.S.A

December 27, 1990

Dr. David A. Phillips
Museum of New Mexico
Lab. of Anthropology, Research Section
P.O. Box 2087
Santa Fe, New Mexico 87504

Dear Dr. Phillips:

Please find enclosed the result on the very small charcoal sample authorized for radiocarbon dating analysis using the AMS (Accelerator Mass Spectrometry) technique. We hope this date will be useful in your studies. Also included is a printout of the dendrocalibration of the date.

Your charcoal was pretreated the same as the other materials of this sort submitted previously. It was first examined for rootlets. The sample was then given our acid, alkali, acid soakings to get out carbonates and humic acids and was combusted in an enclosed system.

The carbon dioxide collected was purified and then reacted with hydrogen on a cobalt catalyst to produce graphite. This was applied to a copper target. The AMS measurements were made in triplicate at the ETH (Eidgenossische Technische Hochschule) university in Zurich. The chemical pretreatments and target material conversion were done at Beta Analytic. In discussing the date in reports or papers, both the Beta- and ETH- numbers should be cited.

We are enclosing our invoice. Would you forward this to the appropriate office for payment. If there are any questions or if you would like to confer on the date, please call us.

Sincerely yours,

Murry Tamers

Murry Tamers, Ph.D.
Co-director

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(305) 667-5167

UNIVERSITY BRANCH
P.O. BOX 248113
CORAL GABLES, FLA. 33124

REPORT OF RADIOCARBON DATING ANALYSES

FOR: David A. Phillips
Museum of New Mexico

DATE RECEIVED: Authorized Sept. 5, 1990

DATE REPORTED: December 27, 1990

SUBMITTER'S PURCHASE ORDER #

OUR LAB NUMBER	YOUR SAMPLE NUMBER	C-14 AGE YEARS B.P. ± 1σ	
Beta-36021 ETH-6954	407-37592-714	3695 +/- 60 BP	(charcoal)

Note: this sample was done using the AMS technique. The reported date has been adjusted by carbon 13 for total isotope effect generated in both nature and during the physical and chemical laboratory procedures. The carbon 13 content was measured concurrently with that of carbon 14 and carbon 12 in the accelerator beam, allowing a precise correction.

These dates are reported as RCYBP (radiocarbon years before 1950 A.D.). By international convention, the half-life of radiocarbon is taken as 5568 years and 95% of the activity of the National Bureau of Standards Oxalic Acid (original batch) used as the modern standard. The quoted errors are from the counting of the modern standard, background, and sample being analyzed. They represent one standard deviation statistics (68% probability), based on the random nature of the radioactive disintegration process. Also by international convention, no corrections are made for DeVries effect, reservoir effect, or isotope fractionation in nature, unless specifically noted above. Stable carbon ratios are measured on request and are calculated relative to the PDB-1 international standard; the adjusted ages are normalized to -25 per mil carbon 13.

BETA ANALYTIC INC.
RADIOCARBON DATING LAB
CALIBRATED C-14 DATING RESULTS

Calibrations of radiocarbon age determinations are applied to convert results to calender years. The short term difference between the two is caused by fluctuations in the heliomagnetic modulation of the galactic cosmic radiation and, recently, the advent of large scale burning of fossil fuels and nuclear devices testing. Geomagnetic variations are the probable cause of medium term differences and long term (greater then 8000 BP) are still unknown.

Radiocarbon dating laboratories have analyzed hundreds of samples obtained from known-age tree rings of oak, sequoia, and Douglas fir. Curves generated from the results depicting the atmospheric carbon content at specific time periods have been incorporated in computer programs. The result of the calibration analysis applicable to your research follows.

(Caveat: these calibrations assume that the material dated was short lived, i.e., living for 20 years like branches, some shells, small plants, a collection of individual tree rings, etc.. For other materials, the "Old Wood Effect" would produce uncertainties; both the maximum and minimum ranges of age possibilities could be overstated by that error source. Also, but less likely, in extreme cases they might even turn out to be understated.)

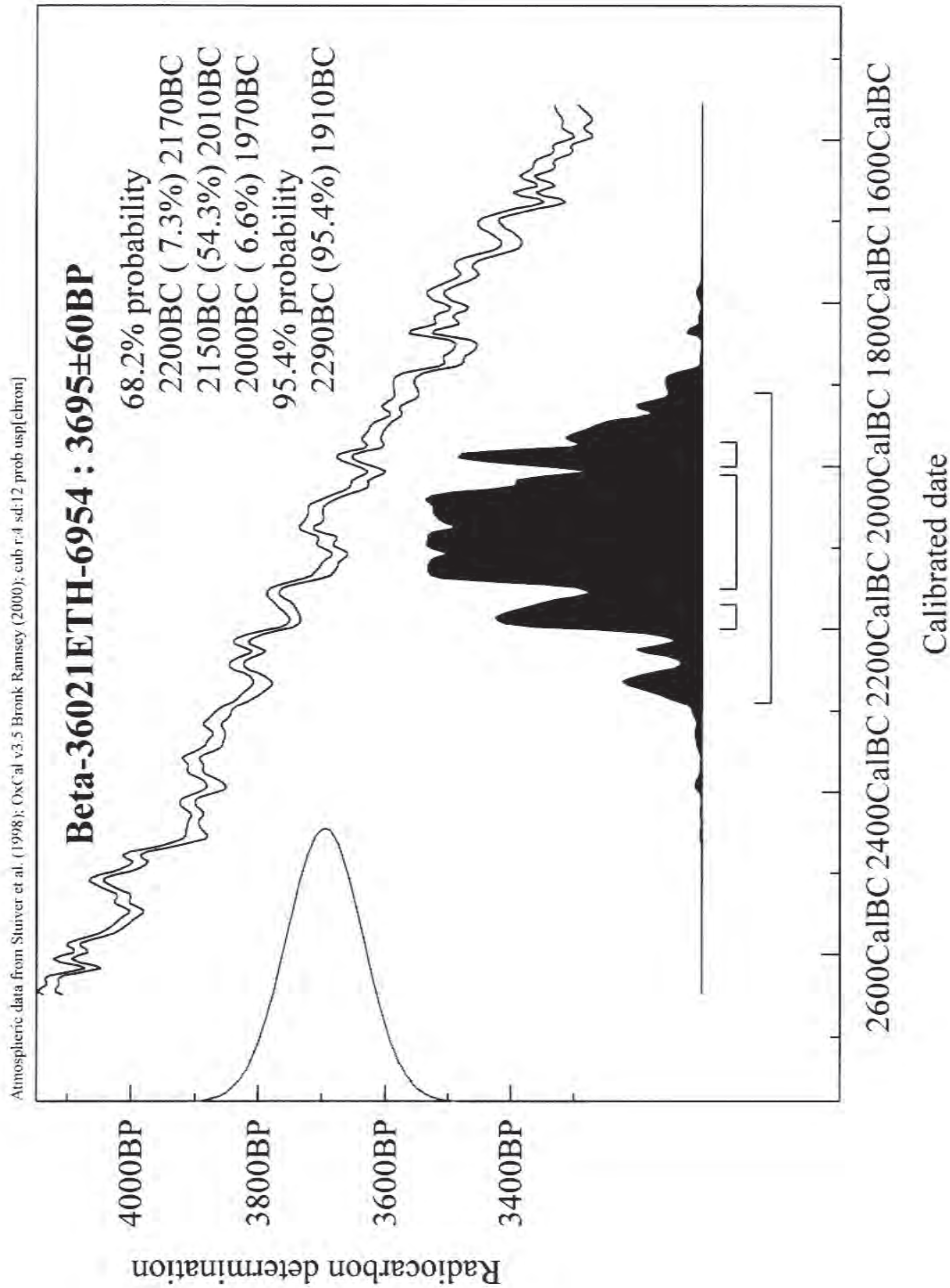
Calibration file: ATM20.14C

```
Beta-36021
 Radiocarbon Age BP  3695  ±  60
  Calibrated age(s) cal BC  2132, 2072, 2046
                    cal BP  4081, 4021, 3995
  cal AD/BC (cal BP) age ranges obtained from intercepts (Method A):
   one Sigma**   cal BC 2194-2158(4143-4107) 2146-2030(4095-3979)
                 1991-1989(3940-3938)
   two Sigma**   cal BC 2290-1930(4239-3879)

   Summary of above ---
   minimum of cal age ranges (cal ages) maximum of cal age ranges:
       one sigma   cal BC 2194 ( 2132, 2072, 2046) 1989
                   cal BP 4143 ( 4081, 4021, 3995) 3938
       two sigma   cal BC 2290 ( 2132, 2072, 2046) 1930
                   cal BP 4239 ( 4081, 4021, 3995) 3879
```

Reference for dataset used:
Pearson, GW and Stuiver, M, 1986, Radiocarbon, 28, 839-862.

** 1 sigma = square root of (sample std. dev.^{2}+ curve std. dev.^{2})
   2 sigma = 2 x square root of (sample std. dev.^{2}+ curve std. dev.^{2})


Atmospheric data from Stuiver et al. (1998); OxCal v3.5 Bronk Ramsey (2000); cub r:4 sd:12 prob usp[chron]
Beta-36021ETH-6954 : 3695±60BP
68.2% probability
2200BC (7.3%) 2170BC
2150BC (54.3%) 2010BC
2000BC (6.6%) 1970BC
95.4% probability
2290BC (95.4%) 1910BC
4000BP
3800BP
3600BP
3400BP
Radiocarbon determination
2600CalBC 2400CalBC 2200CalBC 2000CalBC 1800CalBC 1600CalBC
Calibrated date

OPERATING PROCEDURES FOR

THE LA PLATA HIGHWAY PROJECT

Excavation and Field Lab

Wolky Toll and Eric Blinman
March 1989
Revised March 1990

CONTENTS

[AN 242 NOTE: CONTENTS PAGINATION IS PER THE 1990 DOCUMENT; DUE TO REFLOW FOR THIS REPORT, IT MAY NO LONGER BE ACCURATE]

Figures

Prolegomenon

This document is intended to give excavators on the La Plata project an overview of procedures thus better standardizing notes and forms. The nature of digging in the La Plata Valley is that there is always more to do than we have time for. It is therefore incumbent on ALL of us to continually keep in mind that we need to keep the methods and tools being used in line with the information being retrieved. This is a continuous process of adjustment, so just keep in mind:
EFFICIENCY EFFICIENCY EFFICIENCY EFFICIENCY EFFICIENCY EFFICIENCY
Intelligent questions are good--ask them. If any of the stipulations here seem obvious or condescending they are not meant to be so--most of what is here is here because somebody did it some other way.

A semi-philosophical point, or at least an epistemological one: keep in mind the much-recited-but-nonetheless-true fact that when you dig something up it's gone, and you were the last one to see it. The implications of this are that you need to record what you saw in a clear, complete fashion, and you need to describe it in a way that gives an idea about what it was like, and how it was different from or the same as other deposits. Who, What, Where, When, and Why are just as appropriate here as they are in the newsroom. Think also of the subsequent phases through which your notes must pass--first someone will have to go through them to write a site description, then analysts may look to them for information about given proveniences, then they may go into a file where someone in the distant future who doesn't know you or anybody else involved may be looking for some specific bits of information. What is important then? Clarity, accuracy, no assumption of prior knowledge, organization, and legibility are, among others. This is obvious stuff, but take the time to look through a big stack of field notes some time and you will appreciate how important it is, and how it is not always followed.

Excavation Methods

Safety Measures

When working in the right-of-way highway regulations require that everyone wear a flame orange vest. Backhoe monitors must now be wear hard hats, and hard hats must also be worn when working in situations in which there is potential for something dropping on your head. It is necessary that all of these precautions be followed from now on.

Safety regulations require that trenches greater than 5 feet (1.6 m) be stepped back at a ratio of 1:1; this will, of course mean that deep trenches will have to be very wide. In general, trenches should be limited to 1.6 m in depth, but if deeper excavation is required, the area of the trench should be increased. It is also required that fill from the trench be placed at least 2 feet (0.6 m) from the edge of the trench. This requires more space and somewhat more time, but it also leaves a more workable trench for profiling and access, as well as a safer one.

Procedures for Hand Excavation

Only those portions of sites located within the project right-of-way and adjacent zones of disturbance will be excavated. The transect provided by the right-of-way constitutes a fairly small sample of the sites in the area. In order to have some control on the variability within the site cluster, all manifestations within the right-of-way need to be excavated. Our objective is to investigate all intact features in the right-of-way and excavate them sufficiently to sample their contents and record their morphology.

Preliminary to work on any site to be excavated, a baseline for a grid system will be established. The grid system will be used for surface collection and for location of other excavation units. Surface collection in 3 x 3 m grid units was found to be too fine-grained and time consuming during 1988 given the disturbance in the right-of-way area and the extent of many of the sites. Use of a 12 x 12 m grid is much more efficient and can still reveal patterning in surface material distribution. In cases where large concentrations are present, activity areas are indicated, or disturbance is less, the site supervisor will reduce the collection grid size as seems appropriate. As are excavation units, grids are identified by their southwest corner's place in the site grid system.

Naturally defined horizontal and vertical units are considered optimal. Therefore, areas with probable features visible from the surface will first be cleared using grid control until such time as a unit such as a room is defined, at which time the room will become the excavation unit. Grid control will be maintained for extramural activity areas, and smaller extramural features such as firepits will be tied to use surfaces and excavated as part of their respective grids. Features inside architectural units are also tied to floors and excavated in floor groups. In general, stratigraphic control for any feature will be established through controlled excavation of part of the feature to provide a profile. The profile will then guide removal of the remaining fill in natural stratigraphic units.

During preliminary excavation, in cases where natural units are very thick, or where no natural units can be defined, 10 or 20 cm arbitrary units will be imposed, size again dependent on context. Fill immediately above defined use surfaces (formal floors or other activity surfaces) will be removed as single units of 10 cm or less, leaving floor artifacts in place for plotting. Very large features (such as pit structures) will be subdivided, usually into halves or quadrants, to increase horizontal provenience control. All materials excavated from undisturbed cultural contexts will be passed through quarter inch screen, unless features or small artifacts or bone indicate the use of finer screen. In badly disturbed contexts or where fill is known to have low artifact content and be noncultural in deposition, screening will be dispensed. In such cases, however, a control block will be excavated, the fill from which will be screened. Pollen and flotation samples will be collected from features and floor fill and from other contexts as deemed meaningful. Floor artifacts and samples will be numbered sequentially (point proveniences or PP numbers), located horizontally and vertically, and indicated on feature maps. Subfloor tests will be placed in any excavated architectural feature to ascertain whether cultural deposits continue; all excavations will be taken to sterile soil. When culturally sterile deposits are reached, hand auger tests should be placed in the bottom of the excavation. The auger hole contents should be monitored for changes in texture and for the presence of further cultural materials. Auger holes should be recorded on the last unit form, and depths should be recorded with relation to site datum.

Sampling and Excavation Unit Placement

Our objectives in conducting these excavations may be divided into archaeological and contractual categories. On the one hand, we want to extract the maximum information possible about the prehistoric use of the La Plata Valley; on the other we need to clear the way in terms of the cultural resources for the modification of the highway. These categories do not need to be in conflict, but they do condition what is done and how it is done. The challenge is to make the two complement each other to the highest possible degree.

Ideally, from either standpoint, we would know everything about every artifact and feature to be affected. Practically, this is of course impossible; therefore strategies for locating as many features as possible with the greatest statistical reliability are necessary.

The entities termed sites vary widely within the project area. Some contain very definite surface indications of structures, while others consist of large areas of surface artifacts with little surface indication of features. Given these wide differences, differing strategies are required. Substantial portions of some sites will be excavated in the process of investigating surface manifestations, while such investigations will account for only very small percentages of others. In terms of devising excavation strategies yielding sufficient samples, the most problematic areas are those which are very large and lack surface indications of features. Not only is it infeasible to obtain a sample of adequate size with hand trenches, it is also less likely that indicators of site function will be encountered. Particularly in these instances, extensive backhoe trenching will be necessary (see below). The "sites", or, more correctly, the portions of sites which we excavate are predominantly much longer than they are wide because of the constraints of working in the right-of-way. It is therefore possible to place trenches that will provide profiles of substantial portions of the width of the affected area.

Screening

Screening has two purposes. The primary one is of course increasing the probability that items larger than the screen mesh will be recovered. The second derives from the first in that it provides a control on the resolution with which deposits are viewed and recorded. If a deposit is recorded as having been screened, then, it is important that all the clods be passed through the screen. If for some reason the clods could not be reduced or not all the fill was screened, that fact should be noted. Excavation unit forms have a space labelled "screen turnback %" for inclusion of this information. What should be inserted is an estimate of the amount of fill which did not pass through the screen and was dumped. Not only does this give an idea about the level of resolution, but it also says something about the nature of the fill.

Screening is a time-consuming procedure, and there are situations in which it is not warranted. The main case in which this is so is during the movement of large quantities of fill by heavy equipment. Any materials collected during such procedures must be FSed and analyzed separately from deposits which have been screened. Other cases in which screening may be dispensed are in disturbed deposits or in deposits which are known to be non-cultural. Optimally, however, a screened, vertically controlled block of non-cultural fill of major units (a pitstructure, for example) should be excavated if rapid removal of the remainder of the fill will take place.

Follow-up Procedures

Following and/or concurrent with excavation of all features visible from the surface, trenching and surface stripping with power equipment will be used to maximize the discovery of cultural features. Mechanical excavation at any site is regarded as a method of increasing the likelihood that features that would otherwise be missed will be located and investigated. In describing his 1916 investigations of his Site 39, only 5 km from the largest concentration of sites in this segment of the highway project, Morris found deposits up to 5 m deep in areas with little surface indication of subsurface materials (Morris 1939:50). Morris' experience serves as an excellent caution against relying too heavily on surface evidence, as does the discovery of LA 50337 in the first segment of the highway construction (Vierra and Anschuetz 1987).

Placement of backhoe trenches must be tailored to the presence of utility lines and to the existence of known features. Generally, because of the linear nature of the right-of-way and the utilities within it, trenches parallel to the highway are logistically preferable. If, however, trenches of some other orientation will provide more information, they should be so placed. The use of blade stripping may in some cases be indicated, but our experience in 1988 was that deposits are frequently so deeply buried that blading does not reveal them; moreover, the amount of backdirt generated by deep blading is so great that it becomes a hindrance.

Recording

Locations of all tests and features will be mapped using a transit. Artifacts will be kept in provenience groups, cleaned (if appropriate), and analyzed. Records, artifacts, and write-up will be housed at the Museum of New Mexico Laboratory of Anthropology in Santa Fe. With the exception of historic structures we are endeavoring to be completely metric: metric measurements, scales, etc.

NOTE ON NORTH: For reasons historical and otherwise, clear and otherwise, we used magnetic north in 1988; henceforth we will use True North. The compass declinations will be set and should not be changed. Remember that in this part of the country, true north is slightly to the left of magnetic north.

Profiles

Fill profile and their descriptions are one of the most important records we make. They can potentially tell us about the construction sequence, use, reuse, abandonment, deterioration, and subsequent uses and conditions of a location, but only if they are accurate, observant, and well described. Profile descriptions have a tendency to be cursory and rote, but when this attitude is taken, much of the care and time devoted to making a nice drawing is negated. A Munsell color and a word or two about the texture of profile units are a minimal beginning of a description. Notes on lamination, charcoal/ ash/ artifact content, texture, hardness, similarity or difference from other units, should all be made. Remember that you are the only one who will see this fill unit--you need to think about what the units mean and you need to include those thoughts in your description--is the layer natural or intentional?; is it structural debris or is it alluvial?; is it trash? etc. Profiles which contain several fill units should have photos taken as well; the photo means that you do not have to draw every rock and tiny detail, but there are several things, most importantly fill changes, that do not always show on a photo and that should be on the drawing. Horizontal locations such as where grid lines cross the profile should be indicated on the profile, and the edges of the full feature should be indicated. It is also important to provide some other context for the feature itself, such as adjacent floor levels and adjacent features; if the feature disappears into an unexcavated balk or a backhoe cut indicate that and why the feature is not fully represented. Always indicate the profile line on a plan view of the excavation unit, feature etc. (the convention for this is to show A-A', B-B', etc. for each profile on the profile and on the plan).

The following pointers on stratigraphic description are modified from a set used by the Office of Contract Archaeology.

Stratigraphic Description

Color

Note whether the sample is moist or dry; dry colors are preferable. Use the Munsell Color Chart, recording the number. If there are nuances you feel are not recorded by the Munsell, record them.

Texture

The proportion of silt, clay, and sand. Judge the plasticity and stickiness, and the dry consistency. Dimensions of texture and relevant terms are shown more graphically in Figure 1 [OMITTED], also borrowed from OCA. Choices for description include:

sand: particles visible to the unaided eye

silt: individual particles cannot be distinguished confidently without magnification; gritty between the teeth

clay: individual particles cannot be distinguished; not gritty between the teeth

stickiness

non-sticky

slightly sticky: soil adheres to both thumb and finger but comes off cleanly and does not stretch

sticky: soil adheres to thumb and finger, stretches slightly

very sticky: soil adheres strongly, stretches

plasticity

nonplastic: a coil ("wire") cannot be formed

slightly plastic: coil will form but breaks easily

plastic: coil forms and bends considerably without breaking

very plastic: coil will bend sharply before it breaks

dry consistency

loose

soft: weakly coherent

slightly hard: easily broken

hard: can be broken with the hands, but is difficult to break with thumb and forefinger

very hard: can be broken in the hands but only with difficulty

extremely hard: cannot be broken in the hands

Structure

The shape, size and strength of units of aggregation. Record depositional features (laminae, frost cracks, gravel lenses, etc.) and units of aggregation or peds (blocky, columnar, platy, single grain); if other than single grain or massive, give the size range of the peds. Terms used in describing structure are as follows:

shape

structureless: no peds observable; single grain will not hold a face, massive will hold a face though no aggregates are visible

platy: peds are flat or plate-like; note the orientation of the plates; if plates are thicker in the middle than at the edges, the structure is lenticular platy

columnar: peds are higher than long and have well defined vertical surfaces

blocky: peds are approximately the same width and height; the peds may be angular or subangular

granular: peds are spherical or polyhedral, but are not mirrored by adjoining peds as are blocky peds

strength

weak: poorly formed, indistinct peds, not observable in place, easily broken

moderate: well-formed distinct peds, moderately durable and evident, but still may not be visible in undisturbed soil

strong: durable peds quite evident in undisturbed soil; adhere weakly to one another and withstand displacement; become separated when soil is disturbed.

Lower Boundary

Describe the shape of the contact (e.g., flat, wavy, concave) and give the distance over which the boundary can be confidently detected.

distinctness

very abrupt: less than 1 mm
abrupt: 1 mm to 1 cm
sharp: 1 to 2.5 cm
clear: 2.5 to 7.5 cm
gradual: 7.5 to 12.5 cm
diffuse: greater than 12.5 cm

topography

smooth: nearly a plane
wavy: pockets with greater width than depth
irregular: pockets with greater depth than width
broken: discontinuous

Photos

Photos are a very important supplement to verbal descriptions and drawings. Most features should appear in a photo somewhere, but this, like anything else, can be overdone. When taking photos remember to maximize the information content. If, for example, you are excavating several fairly nondescript pits near each other, one photo showing all of them together is better than 5 individual pit shots. Also remember that any photo could ultimately end up in a publication--clean up the area sufficiently that we won't be embarrassed. **Overall shots from several angles are encouraged**--these are the photos that are most likely to be useful in reports and they tie together features, structures, and other contexts. It is truly a let down to look through many contact sheets from a complex site and see lots of pictures of features but none of whole structures or groups of structures; that is, it's important to carefully record the trees, but don't forget the forest. Overall shots are especially prone to contrast problems, and, because they are very important some investment of effort is worthwhile in solving or compensating for those problems: for example, shade the subject, wait for a cloud, take the photo when the sun angle is most favorable. The cost of film is very low compared to the cost of fielding the project, so do not be hesitant to take **useful** shots. In the same vein if there is some exposure/contrast problem bracket exposures to increase the likelihood that we will wind up with a really good photo. Color photos are also strongly encouraged. Since color photos are more expensive give some thought to using them where color adds information to the record, but don't hesitate to take them when it does. Instances in which they should be taken are large profiles, structure overviews, and major features.

Mechanics.

1) ASA. For black and white we expose ASA 400 film at ASA 200. Color film is shot at the ASA of the film.
2) Loading. For purposes of storing negatives, no roll should have more than 35 exposures. All 36 exposure rolls **of black and white film** should be started on exposure 3; so that the record, the notes, and the counter on the camera are in accord, use 3 on the photo record. **Color rolls and 24 exposure rolls should be started on frame 1**. A good use of the leader shots is to take a photo of the site and roll number as a record keeping backup. Make sure that the take up reel is engaged--watch for the rewind crank to turn when the film is advanced.
3) Exposure. When taking photos use as high an f-stop as possible (to gain better depth of field) without using a shutter speed of less than 1/30th. Set the exposure according to the light on the item you are actually photographing; high contrast is a big problem in the field, and the meter will read the whole scene and set to the bright parts of it. If a shot can be taken fully lit without losing detail in shadows, good; if there are things you want to include that are in both sun and shade compensation should be made either by shading the whole subject or taking photos of each or waiting for a cloud.
4) Site cameras. Except in extenuating circumstances, cameras/rolls should be restricted to use on the site to which they are assigned; this makes curation, record keeping, and photo selection much easier. Roll numbers are

assigned sequentially by site and exposures are given sequentially and recorded on the photo sheet.

[OMITTED]

Figure 1. Dimensions of soil texture for profile descriptions.

5) Photo sheets. Please fill these out in ink. In addition to full provenience information, if there is some item that the photo is supposed to show, note it. It is alright to go to a second line if necessary.
6) Care and problems. If you are unsure about loading, rewinding, metering, or anything else please ask--bulling through only means lost shots. If something is wrong DO NOT open the camera. **Keep the cameras clean and out of the sun**. Each camera has a blower brush, lens tissue, and lens cleaner for cleaning. Remove as much dust and grit as possible with the blower before you use lens paper. Anyone who puts a camera down in the dirt is prone to some form of deserved humiliation.

Photo Boards, Scales, and Arrows. If an arrow is placed in a photo it should be set to true north using a compass. Include a scale whenever possible. Photo boards are a more difficult proposition. They are very useful for identifying negatives and should be used in some frames on any roll. They can also detract a great deal from a photo by trying to include too much information, by being the main thing in the photo, or by saying something that the person writing up the site disagrees with. They are a good illustration of the validity of the KISS principle (Keep It Simple Stupid, Chasko p.c. 1981). If you try to give the provenience down to the last level you will wind up with alphabet soup that nobody else is likely to comprehend. A maximum amount of information on a 2 line board would be site number, major provenience, floor and feature numbers; less is probably better (that is why we have photo sheets and notes). If a feature is an important one and it is likely that it will be included in a report take at least one shot with no board.

Equipment

Especially with this many people working for this long, it pays to take care of the equipment and to return it to where it belongs. Archaeology is in its very essence dirty; dirt is bad for a lot of the equipment we use such as cameras, transits, compasses, and tapes; make the effort to keep that sort of thing clean (get yourself as dirty as you like).

REMEMBER: TAKE LOTS OF GOOD PHOTOS AND RECORD THEM IN THE RELEVANT PLACES!

Provenience Information Recording

General Principles

Each unique provenience will be assigned a single unique FS number that will identify all associated artifacts and samples through excavation, analysis, and write-up. FS numbers should be assigned as proveniences are opened so that the numbers can be included on all field records as the notes are taken and on bags as artifacts are collected. Blocks of FS numbers should be reserved for particular study units with the goal that proveniences from a single structure will be labeled with a single FS sequence. Maintaining blocks of FS numbers in this manner facilitates locating collections and managing collections, but the most important relationship is between a single FS number and a single provenience rather than the integrity of the block (in other words, although it is undesirable, it is not a mortal sin to violate the integrity of a block or to use two different blocks for a single study unit). A further advantage to assigning blocks of FS numbers to, for example, a pitstructure is that duplication of FS numbers is much less likely because one set of excavators is using the block rather than having to draw from one big pool (which is also inefficient). Since an FS describes a provenience rather than artifacts, empty FSs are perfectly compatible with the system and can be used to document the absence of artifacts as well as the presence of artifacts.

FS numbers are assigned and defined on the FS sheet with parallel information recorded on field bag labels. Most proveniences should be adequately described by the six fields: unit, subdivision, vertical, feature, subdivision, and vertical. Entries on the FS sheet should be made in pencil where possible, while those on the bags should be made in legible "Sharpie." When an FS sheet is completed (six entries), it should be sent in to the field lab. The original will be retained by the field lab and a photocopy will be returned to the field the next day.

Units are major cultural or arbitrary excavation units such as rooms, pit structures, extramural surfaces (plazas), middens, surface collection grids, test pits, backhoe trenches, etc. Each of these will be described by the type of unit and a unique number for that unit type (assigned within the site). Unit numbers for grids will consist of the north and east coordinates of the southwest corner of the grid, and the unit type will specify the dimensions of the grid. The latter should be used as precisely as possible (e.g., a 2x1 is a short trench oriented north-south, whereas a 1x3 is a longer trench oriented east-west). Other units should be assigned sequentially so that there is only one Backhoe Trench 3 or Room 106 on the site. Unit numbers should also be blocked where convenient, such as designating all rooms within Roomblock 1 with numbers in the 100s and all rooms within Roomblock 2 with numbers in the 200s.

Subdivisions of units are usually arbitrary rather than cultural and are usually dictated by excavation strategy. Subdivisions are generally horizontal by definition and can be quads, halves, grids, trenches, etc. In the case where the FS applies to the entire unit, record "WSU" (whole study unit) as opposed to leaving the entry blank which implies that subdivision is not applicable. The labels for subdivision should be unambiguous (such as NE quad, south half) and grid-defined subdivisions should be described in terms of both grid size and southwest corner coordinates.

Vertical entries describe the stratigraphic characteristics of the provenience in terms of layers, levels, levels within layers, or surfaces. Layers are naturally defined stratigraphic units and are numbered sequentially within study units as they are defined. Levels are arbitrarily defined and should be numbered sequentially, with metric descriptions included in the field notes. Levels can be defined within layers and both designations should be squeezed into the space on the form and bag labels (eg., Layer 3, Level 2). Surfaces include the present ground surface (PGS) for surface collections, and occupation surfaces or floors. Other than PGS, surfaces are assigned sequential numbers as they are defined within each study unit. If an excavation ignores internal stratigraphy and is not characterized by levels (a rare occurrence under normal circumstances), the vertical description should be "full cut."

Features are cultural subdivisions of larger excavation units. Features should be identified by type and number, with numbers sequentially defined within study units and cross-cutting feature types (Hearth, Feature 1; Posthole, Feature 2; Pits, Feature 3, 4, and 5; Posthole, Feature 6...). Feature subdivision and vertical designations follow the same conventions as those for the larger study units, but there may be more occasions to use "full cut" when initial halves of small features are excavated to expose the stratigraphy for subsequent excavation and sampling by layers or levels.

As was profusely illustrated in 1988, cultural deposits often continue below architectural units. In cases where this happens, it is preferable to revert to the grid system from the architectural unit. This will provide better spatial control, and will provide a means of sectioning walls or other architectural units after they have been fully recorded. Layer numbering should continue that in use in the room.

Burials are a special class of features with complex proveniencing implications. Formally designated burials are whole or partial, articulated or disarticulated human remains that can be attributed to the interment of a substantially intact individual. If several individuals are buried in the same feature, each individual should be assigned a separate burial number, and burial numbers should be assigned within a site-wide sequence. The distinction between isolated human remains and burials can be arbitrary, and problematic cases should be discussed. Burial FSs should include all items that are confidently associated with the interment (the skeletal material and associated grave goods), but the burial FS should not include items probably associated with the surrounding fill. Burial pits should be given separate feature and FS numbers and are the appropriate place for proveniencing fill items or items not confidently associated with the burial. Samples should also be provenienced with either the pit fill or the burial, depending on their relevance to the interment.

Whereas the linkage between an FS number and an artifact is inviolate, the provenience description associated with an FS number can be edited as more information is developed during excavation or analysis. While the original FS sheet is in the possession of the excavator, the change can be penciled-in, and any available bag labels should be amended. Bag labels for materials already submitted to the field lab will be amended by the field lab after consultation with the crew chief to verify that an amendment rather than an error has occurred. After the FS sheet has been submitted to the field lab and a photocopy returned to the field, the change should be made in pencil on the photocopy and the altered FS sheet should be resubmitted to the field lab. The field lab personnel will fix the original FS sheet, change bag labels previously submitted, and return a new photocopy of the amended FS sheet to the crew chief.

In addition to FS numbers, more precise proveniencing can be achieved by using PP (point provenience) numbers. These numbers are used to identify specific artifacts, clusters of artifacts, or samples within a provenience. The principal uses of PP numbers are the identification of individual structure floor artifacts, but they can also be used to designate particular items, clusters of items, or samples where reliance on an FS designation alone would either lose data or be ambiguous. Examples of this type of use would be to distinguish a cluster of artifacts in a midden layer that might represent a single basket load of refuse, to distinguish different flotation samples taken from the same FS, and to identify individual grave goods within a burial. Since nearly all samples are subunits of proveniences, most samples should have PP numbers. In all cases, one implication of the use of PP numbers is that there is a map or discussion in the field notes that describes the location and importance of the items or samples as distinct from other items in the FS. PP numbers must be unique within an FS and should be unique within major study unit surfaces. Different material types may have the same PP number if they were collected from the same location.

Tying feature numbering to grid units in extramural areas creates so many Feature 1s as to make reference confusing. To alleviate this problem extramural areas should be divided (NW, NE, SE, SW, for example) and extramural features numbered sequentially. The most important aspect to try to control for is to track surfaces over as large an area as possible. Whenever possible, keep extramural features in "floor" groups as is done for intramural features.

A convention begun in 1989 is to include all items for which the only known provenience is the site in FS 1. This will be convenient for items appearing in generic backdirt or items collected and turned in by visitors to the sites. Items found in backdirt from known features, however, should go into an FS indicating that provenience. For lab purposes avoid assigning FS blocks higher than 1500 without warning field lab personnel first so that inventory forms can be prepared.

Artifacts sometimes "appear" from unknown proveniences. *Please* do not make little piles of artifacts around the site. The next person who comes along will have to waste time trying to determine whether or not these artifacts are from a known provenience. Put your little piles of unknowns in a bag as FS 1, if you know no more than that about their provenience. This all implies, of course, that you would *never* leave a little pile of artifacts of known provenience lying around.

Datum

Vertical control is essential but it causes some conceptual and practical problems. Each site will have a master datum established and marked with a rebar; this datum should be placed outside the right-of-way, in hopes that it will remain as a reference. In 1988 the ground surface at the datum was used for all site elevations, which meant that in some cases excavations took place at elevations above the site datum. To avoid the confusion caused by those cases, site datum elevation will be set at 10.00 m above the ground surface at the datum. Using this figure all depth measurements will be below datum plane, eliminating the need for having to remember whether to add or subtract. As always the elevation of each subdatum will be determined by transit from the main datum; depths taken from the subdatum are then added to the depth of the subdatum, to yield a depth below the datum plane. This process is illustrated in Figure 2.

Illustrations of Unit Numbering

Every **meaningful** separate unit of fill removed should receive a unique number, which will in turn receive an FS number. It may be helpful to think of this in terms of what will eventually happen to these numbers and FS's: they will all be computer coded. You may know that you designated layers in two different parts of a feature both Layer 1 (see the second example below), and your bags and notes will say so, but when it's coded, the computer will not. This is normally, but not always, straightforward.

Some examples:

--The ceramics, lithics, flotation, and pollen from LA 60749, 116N/150E, general Level 2, will all be given FS 185. If that unit contained a hearth, however, the contents of the hearth will be given a different FS number, since that location is a different resolution of provenience. This practice has the advantage of relating materials in different analyses to one another; as a corollary to that advantage, if proveniences are grouped for some analytical purpose it requires that fewer numbers be used to make the groups and that the grouping routine can be used for several analyses. This approach and that of grouping FS numbers were devised by Tom Windes of the Chaco Project and were found to be very useful during analysis phases.

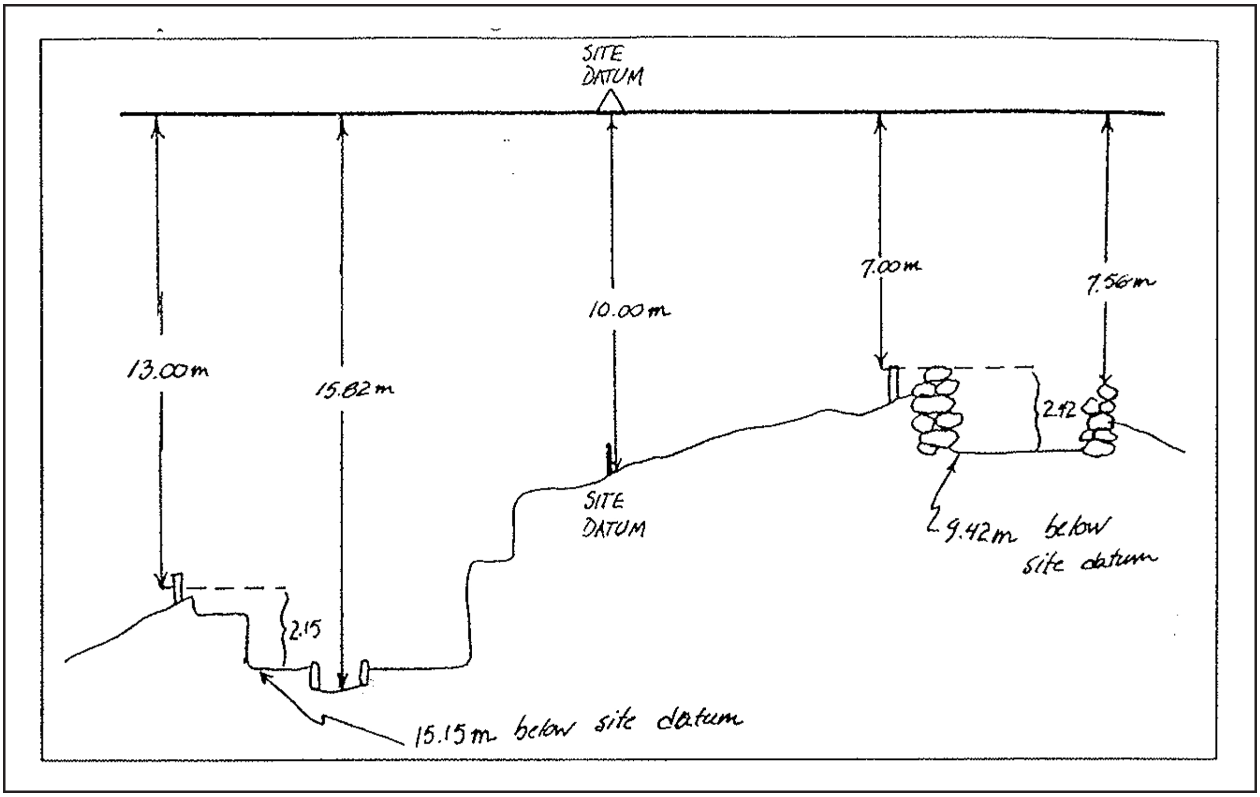


Figure 2. Schematic showing the site datum plane placed at 10.00 m and the method of determining depths from subdata.

--Suppose a feature is initially defined as being smaller than subsequent excavation eventually reveals it to be. The initial excavation defines fill units and makes collections accordingly, and the expanded definition redefines fill. To the extent that layers in the second excavation can be determined to be the same as the original ones, the layer numbers can--should--be the same; the different parts of the layer can be kept separate by multiple FS numbers within the same layer, if the excavator feels that such separation is meaningful. More often than not, however, such identity cannot be established. Several approaches are possible; if the layer is probably the same as an earlier one but the position make it seem worth distinguishing, subunits of the layer can be indicated by assigning levels of the layer; if the stratigraphic units seem different then new layer numbers (or level numbers) can be assigned. AVOID DUPLICATE NUMBERS within the unit or feature.

--A room is excavated, and due to a distinct color change the floor is divided into halves, though the floor numbers are the same on both halves. The features are then numbered starting with 1 for the north half and with 1 for the south half; right or wrong? [1]

--A trash deposit with definable, but thick layers is being excavated; the layers have been divided into arbitrary levels to provide extra vertical control, but the decision has been made to take samples only from whole layers rather than from each layer-level unit. The samples from whole layers should be given their own FS number, because the provenience is different (i.e., more inclusive) than the layer-levels. If the samples are thrown into a layer-level FS it will be confusing to the person who comes along later because it is quite logical to think that the samples came from only that layer-level rather than from the whole layer.

[1] Wrong--the numbering described means that there will be 2 Room x, Floor y, Feature 1's, 2's etc. Numbers are free--number these features consecutively with no duplicates.

Unit Numbering

Assigning numbers and unit types needs once again to avoid duplication of any combinations of codes, and needs to convey the maximum amount of information in the most consistent way possible. Some conventions that should be observed are as follows:

Rooms and Roomblocks. It is quite possible that more than one roomblock will be present on a site. Roomblocks make very logical FS blocks, but we have not thus far inserted a special code for roomblocks; the logical assumption was made in 1988 that such a code would exist, leading to there being more than 1 room 1 on one site. To give each room a unique number without adding more bag and code entries, we will instead assign room numbers in the following fashion: each room will have a 3 digit number which will reflect both roomblock and room number; that is Room 101 is room 1 in roomblock 1, Room 201 room 1 in roomblock 2 etc.

In some instances a provenience will contain two aspects that are at the same level of proveniencing. For example, a burial may be placed in a pit, and there will be a feature and a burial which are closely associated. In such cases the excavator must make the determination whether artifacts or samples are associated with the burial or the feature and so indicate on the bags and FS sheets. Saying Burial 1 Feature 6 is not necessarily incorrect, but the lab staff is in a poorer position to determine whether the items are in fact associated with the burial or the pit than is the excavator. Determining such association is of course sometimes difficult; in cases where it is, make the determination and explain why it was difficult or could be otherwise in the notes.

Forms in Use

We have a lot of forms. They are meant to standardize the information recorded about various aspects of excavation. They form the majority of the most basic archive about the site. They need to be legible, well thought out, and in good condition. They will probably be copied, so their contents should not run to the edges of the sheet. Because of the variety of situations we encounter, however, there is not a perfect form for every instance, and some flexibility and imagination is required in coming to the right combination of records. The most important thing is to get the best, fullest record possible. Part of obtaining the most usable record is avoiding unnecessary redundancy and unnecessary paper work. It is a natural part of excavation for information to unfold as excavation progresses; the unfolding process *is* a part of the record; even more important, however, is what the final full understanding of the feature or deposit. It should be made very clear which are the **final** conclusions, and any contradictions in the notes and changes in numbering should be resolved by the excavator.

Most of the forms call for depths below datum. The depths will on the whole be from line level measurements from a datum established for a unit or group of units. The elevation for each such datum with respect to the site datum will be established with the transit. The depths entered on forms are in relation to the site datum, which avoids the need for massive corrections later. The relationship of the datum in use to the site datum should be given (usually in the "@_____below site datum" blank) so that the correction in use is always evident, in case of later revisions. Line levels are notoriously capricious. To minimize the variability in line level readings, the following steps should be taken: the string should be held as taut as possible, the line level should be at the midpoint of the string (which may require two people to level and measure), and there should be nothing impinging on the string.

Surface Collection Record. This form is to record the surface collection procedure for the entire collection area, and to formalize a place for pre-excavation appearance of the site. A map of the site and the collection area is important and useful in summarizing not only surface collection but subsequent unit placements.

Excavation Unit Form. Provides notes, measurements, and collection information on each stratigraphic/spatial unit excavated. A primary responsibility of any excavator is to be thinking about what he is digging; those thoughts and observations of possible relationships with other units. Comments should include description of soil, charcoal and artifact content, changes, rock content, likely source of fill (alluvial, aeolian etc.). Sketches of the unit can be very helpful in understanding its nature. See also Screening, above. A great deal of the content of units we dig is rock. Rock should be separated during screening and excavation and then recorded by fill unit in terms of the following crude size classes: 5-10 cm maximum diameter, 10-20 cm; stone bigger than 20 cm maximum dimension should be measured for length, width, and thickness. As the use of sandstone (or any material other than cobbles) is uncommon, rock should also be recorded by material.

Excavation Unit Summary. Units with a number of stratigraphic levels generate a number of excavation unit forms; this form is designed so that the excavator can sum up the unit as a whole as an aid to the person writing up the site. It also formalizes the request for screening procedure, selection criterion, datum used, etc.

This form should not be redundant with the excavation unit forms; it is an opportunity to make observations about the unit as a whole, and to direct attention to especially pertinent unit forms. This is an appropriate place to summarize the relationships of various units; for example: Layer x occurs throughout the unit, but Layer y is only in the E end of the room; both are above Floor 1, and Layer z is between Floors 1 and 2. In cases of complex stratigraphy schematic drawings of layer relationships can be very useful in clarification.

Floor Form (2 pages). Completion of excavation of a living surface is the culmination of many different types of excavation: features, fill, surfaces. Living surfaces are, of course, important foci of information about activity at the site. This form is intended to summarize or in effect index the several other kinds of form filled out, as well as provide a place to specifically describe attributes of the floor as a whole. As with the other summation forms, the excavators' synthetic thoughts on function and relationship to other floors and features should be included.

Feature Form. Should be filled out for each feature defined and excavated. Should include a plan and profile of the feature; whenever possible the profile should include the feature fill. Features can obviously be very simple (a small floor pit) or very complex (a ventilator shaft). If the feature is very large and has many stratigraphic units, it may be most efficient to use Excavation Unit forms for the units removed. For most features, however, a single feature form should be sufficient. The blank for whether the feature is sealed refers to whether the Anasazi discontinued use of the feature and then plastered over it; this can occur when a floor is plastered over with a new floor or while a floor remains in use. It is important to distinguish between these types of sealing, as we want to be able to estimate how many features were in use at the last use of the floor. The fill section should list and describe the strata of the feature, and give all FS numbers for each unit removed; if not all stratigraphic subunits yield samples or specimens, it should be made clear which do. The description should include all significant structural aspects of the feature, observations about condition (e.g., burning, remodelling), and suggestions (and their rationale) for function. Pay close attention to shape and dimension recording, since both are critical to determining volumes, and volumes are often the best measurement for comparing features; where appropriate give both the plan shape and the shape of the section of the feature. Accurate, comprehensive measurements are essential for characterizing features and for computing feature volumes; characterize the shape of features by geometric solids and take the appropriate measurements for calculating volumes for the shape involved: remember that different shapes require different sets of measurements, and that any three-dimensional shape requires at least three measurements (length, width, depth). Because of frequent problems with insufficient measurements being recorded we now require that the excavator calculate a volume for features; be sure to record the numbers used in arriving at the volume so that geometry and arithmetic can be checked. Interior/Exterior refers to whether the feature was inside an architectural unit or was outside during its use. Normally each feature will have a plan and profile done; in cases where several features are near each other and can be fit on the same plan without loss of information/detail that approach is preferable both for efficiency and increase in information content. It is advisable to excavate a portion of a feature to obtain a fill profile and thereby a sampling and excavation strategy. The profile should of course be indicated on the plan, and the *whole* feature as finally defined should be clearly shown on the map (this caveat results from more one of those truth-is-stranger-than etc. cases).

Structural Unit Summary (2 pages). This form (revised for 1989) is designed to complement the floor form; it is similar in concept to excavation unit summary. It provides a place to record architectural elements--primarily walls--that are not covered by either the floor record or by feature forms, and to treat a structure above the floor as a whole. All of this information is very important to the site description. Wall measurements and descriptions are in terms of the cardinal directions; structures are, of course, rarely perfectly aligned to the compass, but some semblance can be reached (see Orientation). In circular structures walls can be divided into quadrants (i.e., NW to NE = N), which makes more sense relative to the way which Anasazi pitstructures are laid out. Orientation in pitstructures will be determined by the alignment of the ventilation system/ deflector/ hearth; in rectangular structures the line connecting the midpoints of the more or less south and north walls should be read with a Brunton and recorded in degrees true north; indicate whether this is the long or short axis of the room. If there are insufficient walls remaining to follow this procedure, the orientation of a wall can be used; be sure to indicate what has been used. Unsealed wall features will be associated with the top floor; sealed wall features should be assigned to the floor that makes the most sense given the overall context. Many of the other blanks are, as with the floor form, like an index of other forms relevant to the structure, highlighting especially salient attributes. The construction section makes explicit a request for description of how the structure was built. In the final section thoughts on the use of the feature and other synthetic description are encouraged.

Botanical Sample Collection Form. Used in conjunction with the Feature Form, and in other situations where pollen and flotation samples are collected. This form has been revised several times, including for 1989. In its current incarnation, it is intended to do several things. Primarily, it communicates information about the sample to the analysts. Other functions it performs are to catalogue samples taken and to aid the site reporter in the selection of samples to be analyzed (this is an important function--this selection process is long and tedious when faced with several hundred samples, and the excavator's observations are important). The top line for each sample is as on the FS sheet, and provides provenience information. The next lines show which samples have been taken and give the excavator's rating of the particular sample. The excavator's assessment of importance and conditions are very important to this selection process. Pollen and flotation samples complement each other, but they are not equally good from all proveniences; for example, burned features such as hearths are often excellent sources of flotation data, but poor for pollen, while living surfaces can be the reverse; "good trash" can be good for both. The rankings that should be used are as follows:

--Top. For proveniences that are very likely to yield information and that are located such that the information from them is important to understanding the site.

--High. The provenience, sample characteristics (content, lack of disturbance, etc.) all indicate that this is a good sample that should probably be analyzed.

--Fair. A sample with some problems, or a feature which is of unclear or marginal significance.

--Reserve. A sample which might at some time have some utility, but which the excavator does not foresee analyzing in the top round of samples.

Note that there are no low priority samples. This is because samples considered of low value should not be taken; do not avoid taking samples, just avoid taking samples that have no reasonable utility.

Squash, corn, and beans are often identifiable in the field and their presence in a sampled provenience should be noted. If collected separately such items should be protected with vials and tissue; normally they will be sent in separate bags, unless something in the sampling strategy dictates otherwise, such as collection of the entire contents of a feature. Extent refers to the amount of the feature sampled, e.g., whole contents, pinch from north half, pinch from scattered points over the whole quad. Conditions refer to wind and precipitation that may have an affect on the sample in terms of contaminants; sun and temperature have little relevance to pollen and flotation samples. Length of exposure refers to how long a feature was exposed before samples were taken, and length of sampling to how long collection took. Depth below PGS refers to the surface when the excavation began; this is relevant to the types of preservation and contamination that can be expected. Burning is assessed both by color of matrix and content; indicate whether the contents are all fine ash, mostly charcoal, or unburned. Again, the excavator's comments are important, and the analyst needs a few words about what the feature is like.

The form has space for two sets (i.e., pollen, flotation, macrobotanical) of samples; the samples on the same form need not be closely related, but they should be from the same major provenience for purposes of sorting. If other pollen and flotation samples are somehow related to the sample being documented, as other layers in the same feature or other samples from the same floor, that relationship should be indicated in the "related samples" blank. Also indicate whether other related samples were taken (dendro, ^{14}C, archaeomag). In the space provided for comments give a brief synopsis of what the feature is and what the samples' utility could be. If you have clear indication that the materials in the sample are roof fall or hearth contents, note it. Continue on the back if necessary, with clear indication of the continuation on the front of the form.

This form will accompany the sample as it proceeds through processing there are thus LAB blanks for volume and weight (as measured by the person doing the flotation), and comments by the person doing the flotation.

Burial Form For recording human remains that can reasonably be attributed to a single individual. Burials should be excavated only by someone who has a knowledge of human osteology, and who understands fully the seriousness of the procedure. The burial form is divided into three sections: provenience, grave characteristics, and burial characteristics. The provenience information is standard; it must be remembered that burials require special treatment and are subject to special collecting conditions. Thus, we are required by our burial permit to take at least one sample, and to photograph and map each burial; when burial goods are present the map and photo must show them in situ, and the photo should be adequately detailed that the artifacts could be identified from it. These are *minimum* requirements and photos and drawings should be made as required to fully document the burial. The in situ burial may preserve element relationships that will be lost when the burial is removed; these include occlusal positioning of the mandible and joint relationships. These aspects should be recorded photographically with closeups. Items that are incidental to the fill should be kept separate from items that were intentionally placed with the burial. Remember that grave offerings are considered to be part of the burial and should be treated with the same respect that the skeletal remains receive. If the burial is intact a true north Brunton reading should be taken for the vertebral column pointing toward the cranium; if readings are possible for the face or head they should also be taken, otherwise the relative head position should be noted. Field assessments should be made for missing elements and general condition and attributes, but it should be remembered that more complete inventories will be made in the lab. The excavator's primary duties are to fully observe and record the burial and remove and pack it appropriately. The space for comments and other observations is relatively small on this form, and the excavator should not feel constrained by this: continuation of observations is encouraged.

Backhoe Record. Each backhoe trench should be recorded.

Blading Record. Summarizes blading procedures.

Form Continuation. This form is for extensive continuations of text onto a second page; primarily it provides blanks for filling in all the provenience information.

FS sheets. An important aid to analysis (see below). The date requested on the FS sheets is the date of excavation. The FS sheet has been revised for 1989 providing blanks to check for material categories and greater guidance for provenience information. Each lined in block is for an FS group, or single provenience. Remember to indicate whether the vertical location is a surface, a layer, a level, or a layer-level. The blanks provided are discussed more fully under specimen bags below. The FS sheet also includes spaces to tally the artifacts and samples, if any, collected from an FS. These tallies are intended primarily to record the types of materials and samples collected and secondarily the numbers of bags of materials sent to the field lab. The field lab will separate materials in mixed bags and will compile formal counts of items of each material type, eliminating the need to make field counts.

Specimen Bags

In order that provenience information can be transferred to analytical files with the optimum of consistency and speed, bags and FS sheets should contain systematically recorded entries. Each bag should contain the following entries, entered in the order shown below. We have prepared a stamp to guide filling in the bags. Because there are different types of proveniences, not all of the categories are relevant to every bag. **NEVER PUT MATERIALS IN AN UNMARKED BAG**. To save field time, items that can be put in the same bag without causing damage will be put in the same bag and separated in the lab. This procedure must be done sensibly--large hammerstones, manos, cores, etc. will break sherds and create new edge damage on flakes.

--Project. Write in the project number. Materials from testing and excavation from different years and different segments have different project numbers. Particularly in the Santa Fe lab, it is quite possible that materials from different projects get mixed, so be sure that the La Plata from the stamp is visible.

--FS. As discussed above.

--LA. Site number.

--PP. Point provenience, for point located floor artifacts, samples within a specific part of a feature.

--Unit (Type/#). Unit types include surface collection grids and trenches, which should have the size and orientation and be identified by its SW corner, and architectural units, which have numbers assigned by the supervisor. Roomblocks will be reflected in room numbering; thus rooms in Roomblock 1 will begin with 101, in Roomblock 2 with 201, etc.

--Sub. Subunit: for architectural units excavated in segments, such as floor quadrants or room trenches.

--Vert. Vertical location, which includes one of three basic categories of information:

1) Layer. Layer and level are considered to denote two distinct types of units. A layer is a natural stratum. Usually a layer will excavated as a single FS; if it is very thick, however, it should be subdivided into arbitrary "levels". It is therefore possible to have both a layer and a level designation (understood to be level x of layer y). Either type of unit is numbered independently, with number 1 at the top of the stratigraphy.

2) Level. An arbitrary stratigraphic unit of predetermined thickness unless terminated by a natural unit such as an occupation surface.

3) Floor. Should include floor number and relationship, such as Floor 1 contact. Floor fill is considered to be fill up to 10 cm above the floor surface unless there is some naturally defined unit; it is possible (and desirable) to have a layer be floor fill. Defined occupation surfaces are considered to be "floors" even if they have not been formally prepared. Items that are in contact with floor and which may thus reflect activities that took place on that surface should be point located on the plan map of the study unit. Such artifacts can be put in a single FS, but each should be bagged separately with identifying PP numbers.

--Feature type. Identifies formal/functional category of a feature (such as pit, firepit, posthole).

--Feature number. Features are numbered beginning with 1 for a given living surface.

--Feature sub. Wholes, halves, quadrants, etc.

--Feature vert. Again, layers and levels.

--Item. This gives the item(s) in a given bag; where possible it is desirable to give a count for the item, but counts for numerous items such as ceramics and lithics from prolific provenience should not be made (these counts will be made in the lab).

--Excavators initials.

--Excavation date.

--Special Instructions. If an item is very fragile or should not be washed (pottery with fugitive red, for example), or needs other special attention in the lab or in transit mark it so here.

The FS sheets have been structured to reflect this ordering as well. Remember that FS sheets have an important role in subsequent handling and analysis of the material--do a careful job of filling them out. If FS sheets and bags do not agree, the lab will reject both pending resolution.

Material and Sample Collection

Specimens

Most artifacts will be transmitted from the excavations to the field lab in labeled bags. Material types should be segregated as necessary to prevent undue damage during storage and transport. This will usually mean that fragile materials such as bone and macrobotanical remains will be bagged separately from other artifacts, but that most lithics and ceramics can be combined. Material types included in the bag should be checked off on the label, and any special instructions should be noted clearly. Special instructions should alert lab personnel to any conditions that would warrant other than normal processing: extremely fragile items, fugitive red pigment, items to be reserved for pollen wash, etc.

Some artifacts, due to size or condition, cannot be transported in bags and should be securely labeled with tags tied to encircling string or with bag labels affixed to boxes. Tags should convey the same information categories as the bag labels, and small bags can be used as tags if convenient.

Bag labels should be filled out completely as soon as the bag is needed, and bags should be turned in to the field lab on a regular basis (tentative plans are to have regularly scheduled pick-ups on Wednesday morning and Friday afternoon). Multiple bags can be sent in from an FS, and there is no need to retain bags until a protracted excavation is completed. Also, do not overfill bags--try to use the appropriate sized bag for the provenience or simply use multiple bags. Each bag should be tallied on the FS sheet as it is sent in to the field lab.

A balance that must be struck is that between curation of materials with their best possible organization. Optimal care of artifacts is promoted by getting them from the field (including whatever field storage is in use) into the lab. Rushing artifacts to the lab, however, means that routine initial misinterpretations (falsely divided strats or incorrect feature extent definition, for example) go into the lab, requiring later correction by someone other than the person who understands why the change is necessary and exactly what it entails. Therefore, an FS number should be assigned when a unit is opened, but where provenience definition is difficult, materials may be held until definition is resolved. Material transfer to the lab should not, on the other hand, be left for more than a week, or, if materials are very fragile or very cumbersome, it can be done sooner with subsequent clarification.

Bags should be securely closed, usually with the aid of rubber bands. However, rubber bands can damage fragile materials and should not be used without considering possible consequences. Past examples of incautious use include shattered tree-ring samples, crushed bones, and mangled basketry.

The material types listed on the bag labels and the FS sheet correspond to major analytic subdivisions. All sherds, vessels, and unfired clay are ceramics, and unfired clay should be segregated in a separate bag and labeled "DO NOT WASH" as a special instruction. All flakes, tools, projectile points, and hammerstones qualify as lithics. Tools and flakes need not be segregated apart from protecting fragile items by wrapping items in toilet paper or placing wrapped items in vials. Groundstone describes mealing equipment, polishing stones, other obviously ground tools, and stone ornaments (such as jet or turquoise) that have been shaped by grinding. Although the association of metates and beads is disquieting, all groundstone artifacts are analyzed in the same system, and they should be segregated only as necessary to protect fragile items. Bone samples include NHBone (nonhuman bone and shell--both marine and eggshell) and HBone (human bone). The acronyms are intended to minimize the visibility of human remains to visitors to the sites and field lab. Bones are often particularly fragile and specimens should be wrapped in small quantities of toilet paper or protected in some other fashion as warranted. Vials protect small bones from crushing, but if the bones are not also wrapped, they will rattle and break apart in the vial, defeating the purpose of the vial in the first place. All vegetal artifacts not collected as flotation or pollen samples are called macrobot (macrobotanical) materials. These include seeds, corn cobs, basketry, worked wood, firewood, roofing material, and anything else that warrants taxonomic identification or technological description.

Other samples and artifacts should be bagged separately, labeled by hand, and noted on the FS sheet. The former category would include tree-ring (dendro) samples, archaeomagnetic cubes (archmag), radiocarbon samples (C-14), and sediment samples. Examples of other artifact types include jacal with plant or structural impressions, unworked raw materials such as turquoise or pigments (worked pigments should be sent in as groundstone), and crystals.

Samples

Flotation. Flotation samples are taken in order to identify botanical residues associated with features, floors, and deposits resulting from activities at the site. When collecting flotation and pollen samples the excavator should think about what the sample will be useful for, and that information should be indicated on the botanical form. If a feature has a number of distinct layers samples should be taken from individual layers as it is likely that those layers represent different activities or different phases of the feature's use. This does not mean that every layer must always be sampled; if, for example, the top fill of a firepit is roof fall that has been sampled from the excavation of the floor there is no reason to collect more. Each feature layer should receive a different F.S. (again: every change in provenience means a change in F.S.). Remember that samples are costly--in addition to the time taken in collecting them, they must be processed, and then analyzed. This is by no means to say not to take samples, just to avoid samples that are unnecessarily redundant or are likely to be meaningless.

Pollen. Pollen is everywhere. Collecting pollen samples, therefore, must be done with precautions to minimize contamination of the sample with modern pollen. These include using a clean trowel, putting the sample in the bag immediately after it is exposed, and keeping the bag sealed except for the moment the sample is being inserted. The pollen sample bags need to be stored in a way such that they don't get abraded--as soon as they have a hole in them they have lost their usefulness as pollen sample bags. The bags themselves are sterile and relatively expensive--please don't waste them. The majority of pollen samples are taken from soil; contexts in which pollen can be meaningful are trash deposits and occupational surfaces. When sampling a surface the soil should be taken from immediately on the surface. Intact, in situ vessels and grinding equipment are candidates for pollen washes, in which case the sample is removed from the surface of the artifact in the pollen lab. The same care to avoid contamination is necessary; this is often best done by leaving a layer of intact fill on the surface to be washed. The vessel should also be placed in a ziplock bag if possible. Metates are, as always, more of a problem; protect them as best possible with a new trash bag. Pollen washes do not cost extra to collect or process, and, from appropriate contexts, are more likely to give direct cultural information than pollen fill samples. If an artifact/context is deemed especially important both pollen wash and pollen fill samples should be taken, as the fill sample can serve as both backup and provider of contextual information. Be sure to clearly and boldly mark artifacts intended as pollen wash samples.

Charcoal. Tree-ring, macrobotanical (species i.d.), and C-14 samples all involve charcoal. While wonderfully durable in deposits, this important material needs some care when removed from the ground. Charcoal will check and disintegrate in the sun in very little time--protect it. Conversely, wet or damp charcoal will turn to mush if it is put into an airtight container. Especially if the samples are damp, work out a way for them to breathe and dry slowly.

C-14. Carbon-14 dating is a wonderful thing for deposits about which there is little or no way of knowing the age. It is also very expensive, subject to a number of assumptions, and the date obtained has an error of variable size, usually large relative to the accuracy of ceramic dating. Most of the contexts that we excavate on the La Plata can be dated as well by ceramics, or, better still, ceramics and tree-rings or ceramics and archaeomag (which also has an associated error, of course, but is less expensive). Except in cases where other means of dating are lacking, then, ^{14}C samples will not be taken; if there is a lot of good charcoal a macrobotanical sample or a flotation sample may be appropriate, but not radiocarbon. In cases where C-14 is appropriate, contamination should be avoided; prominent sources of contamination include smoking/chewing materials (smoking and tobacco chewing should not take place in excavation areas anyway), any form of treatment, tool splinters etc. In the vein of avoiding contamination, these samples should be handled with tweezers or a clean trowel and should be collected in foil. It is good to know the species of samples, so that samples should be protected from crushing and breakage. Damp samples should have small holes in the foil to allow drying.

Macrobotanical. Specimens in this category include corn cobs, seeds, twigs and other plant parts. These are collected to gain closer ideas of the plant species in use. Most of the time they are small and fragile, and should be collected in containers that will protect them (film canisters are often the right size), sufficiently padded so that they will not rattle. Paper (preferably acid free) is preferable to cotton since the latter can adhere to and tear the specimen. It is important to keep items such as corn cobs as intact as possible, as their measurements are important attributes in their analysis.

Dendro Samples

Tree-ring samples are very important to us. Treating them carefully is worth the time required. If there are many pieces of a single beam the fullest possible cross-section of the beam should be collected, but it the outer rings that are the most important. If there is some reason to collect a number of pieces of the same sample (to provide several opportunities to get a full section, for example) it should be clearly indicated that they are from the same beam. Again, these are our best dating opportunity, so don't throw away chances for dates. At the same time, do not send in lots of specimens that probably represent one sample--having multiple dating the same beam multiple times is meaningless or misleading.

Packaging. Ideally specimens should be well-enough packed in the field so that they will be ready to go to the Tree-Ring Lab. String IS OK, just not total entombment in string. Optimally string can be placed on the sample directly followed by wrapping in batting. If a specimen is fragile there are a couple of options. The first is to use string outside a layer of cotton. If the condition is very fragile a mixture of paraffin and gasoline can be used to consolidate the sample; the sample should be wrapped in string and then placed in the solution, and then wrapped in batting and more string if indicated. In cases where the condition of the sample is very poor some of the solution can be poured on the sample before it is removed.

Labelling. Each sample should have both a bag label and a tag attached to the inner string of the sample. The bag should have all the standard information. The tag should include project name, site number, FS number, a consecutive DD (dendro) number within the FS (that is, FS 99, DD 1, FS 99 DD 2, etc.), and the unit and subunit (for example Pitstructure 1, SW quad). The tag is for the use of the Tree-Ring Lab.

Human Skeletal Remains

Of all the actions involved in excavation, the removal and handling of burials is the one that entails the greatest responsibility. Our responsibility is to human sensibility, to the descendants of the individuals involved, to the individuals themselves, and to the profession. We regard ourselves as anthropologists, and these are the people we are studying; we must therefore treat them with the utmost respect. Death and human remains make many people uncomfortable, and the way that some of those people deal with their ambivalence is to make jokes or otherwise assume casual or flippant attitudes. Those behaviors are absolutely inappropriate and must be avoided; indulging in them is sufficient cause to be removed from the project. If you feel that you do not want to be involved with handling human remains let your supervisor know and your assignment can be changed. Burials should not be photographed except for record shots, nor should they be treated as curiosities. In general, when members of the public visit a site where burials are being excavated, the remains should be covered and left until the visitors have gone.

The sites excavated in 1988 contained several instances of scattered human remains. To the degree possible, lots from single individuals should be excavated and recorded together, and treated as burials. In cases where there is severe mixing or isolated elements, location and relative positions should be recorded and the material packed as HBone with PP numbers if appropriate.

LA PLATA HIGHWAY EXCAVATIONS--FIELD LAB PROCEDURES

PURPOSE

The principal functions of the field lab are: 1) to verify the consistency of field provenience designations of artifacts and samples; 2) to clean, package, and label artifacts in preparation for analysis; 3) to process flotation samples; 4) to store materials and artifacts prior to shipment to Santa Fe; 5) to implement any changes or corrections in field proveniences; and 6) to provide logistical support for excavations in the form of maintaining stocks of expendable supplies (e.g., bags and forms).

ARTIFACT FLOW

The normal life-history of collected materials should be as follows: An excavation provenience is defined, assigned an FS number, and recorded on the FS sheet by the excavator. Materials recovered during excavation of the provenience are placed in labeled bags by the excavator. When excavation of the provenience is complete or has been suspended for more than a day or two, the bag or bags are placed carefully in a box designated for transmitting materials to the field lab. These boxes are collected each Wednesday morning and each Friday afternoon (Thursday afternoon prior to holidays that fall on a Friday), and empty boxes will be exchanged in their place. Prior to each artifact pickup, the crew chief or designated individual assembles all completed or amended but not yet photocopied FS sheets for transmittal to the field lab with the artifacts. All completed botanical sample sheets should also be assembled and submitted to the field lab. Field lab personnel deliver the boxes to the field lab, amend the originals of the FS sheets, photocopy the new and amended FS sheets, and arrange for the photocopies to be delivered to the crew chiefs the morning of the next field day. The originals of the FS sheets are placed in the lab notebook, and originals of the amended FS sheets are filed as backup documents. Artifacts are washed or cleaned as they come into the field lab and are held in their original bags until the original of the FS sheet is available for provenience verification. After provenience verification, material types are sorted and counted (material types and counts are entered on FS inventory sheets, not FS sheets), and the material types are placed in labeled repository bags. If more than one bag of an artifact type from an FS is sent in from the field, materials should be combined into a single repository bag only after the evaluating the possibility that an error has occurred. If there is any uncertainty as to the appropriateness combining materials (such as widely spaced dates of excavation or different initials on bags from the same day), combination should be delayed until the crew chief confirms that combination would not be an error. Repository bags are organized by material type in preparation for transmittal to the different analysis personnel, and the bags are stored in FS order until site excavation, or a substantial portion of site excavation, is complete. Once the likelihood of provenience changes is minimal, repository bags are packed, by material type, for shipment to Santa Fe.

PROVENIENCE VERIFICATION

The process of provenience verification will be a careful comparison between information recorded on the original FS sheet and information recorded on bag labels or tags. As each bag or label is verified, tally marks on the FS sheet for bags of materials sent to the lab will be checked off, confirming that the lab has received all materials collected by the excavators. In the event that a discrepancy is noted, a note will be written to the crew chief (the label will be photocopied and attached to the note if appropriate) requesting clarification. The crew chief should rectify the problem as soon as possible. Once the crew chief responds, changes will be made on the bag label or on the FS sheet as appropriate. If changes are made on the FS sheet, they will be treated as an amendment and a new photocopy of the FS sheet will be generated and given to the crew chief.

PROVENIENCE AMENDMENTS

Not all initial field descriptions of proveniences will stand the test of time, and the flow of materials and forms outlined above tends to lock-in initial perceptions. This means that a formal process of provenience amendment will be necessary. While the original FS sheet is in the possession of the excavator, the change will be penciled-in, and any available bag labels will be amended. Bag labels for materials already in the possession of the field lab will be identified as discrepancies during subsequent provenience verification and will be amended by the field lab after consultation with the crew chief. After the FS sheet has been submitted to the field lab and a photocopy returned to the field, the excavator or crew chief will make the change on the photocopy of the FS sheet and send the altered FS sheet to the field lab. The field lab personnel will amend the original FS sheet, will change bag labels previously submitted, and will return a new photocopy of the amended original FS sheet to the crew chief. The return of a new photocopy is necessary to insure that all pencil marks on photocopies in the crew chiefs notebooks (other than penciled tally marks for bags submitted) can be interpreted as changes that have not yet been made.

BOTANICAL SAMPLES

Botanical samples will be treated in the same manner as other material types during provenience verification. In addition, information on the botanical sample sheet will be checked for completeness by the field lab as the next step after provenience verification. Incomplete or ambiguous botanical sample forms will be returned to the crew chief for correction prior to any samples being processed. The originals of the botanical sample forms will be retained by the field lab until all processing is completed (after excavation of the site is complete), at which time the sheets will be returned to the crew chief for use in selecting samples for analysis. Interim photocopies will not be made unless specifically needed by the crew chief prior to the close of excavations.

HANDLING PROCEDURES WITHIN THE FIELD LAB

Handling procedures must be tailored to individual material types and at times will have to be tailored to the condition of individual artifacts. The basic rule is that most cleaning or processing be carried out only to the minimum extent required for subsequent analysis, and that no actions be taken if those actions pose a significant threat to the integrity of the item. In all cases, field lab personnel should check for special instructions on field bags before cleaning materials, and any questions should be resolved by the lab supervisor before proceeding. In addition to concern over the integrity of artifacts, the major responsibility of the field lab is to maintain the integrity of the proveniences: THERE MUST BE NO MIXING OF MATERIALS BETWEEN BAGS DURING PROCESSING!.

CERAMICS

Ceramics include both fired and unfired clay artifacts. Unfired clay can occur as lumps and as portions or sherds of unfired vessels. When it is unfired, clay tends to be dull in luster, its surfaces are soft and easily abraded, it is very flexible if moist, in comparison with fired sherds clay sounds dull when tapped, and most clays begin to disintegrate almost immediately after being placed in water. In most cases, unfired clay should be identified as such in the field and its presence will be noted on the bag label. Unfired clay should be dry cleaned only, and if accidentally exposed to water it should be dried slowly. Most fired ceramics are robust and can be cleaned by gentle brushing under water, but poorly fired sherds can soften and disintegrate during this cleaning. Any sherd that appears flexible should not be washed, and any sherd that begins to fall apart during brushing should be removed from water immediately and allowed to dry slowly. Fired sherds can also have coatings or deposits that are ephemeral and should not be washed off. These include fugitive red pigment (powdered hematite) that gives the surface a pink or red blush. Sherds with suspected coatings or deposits should be dry-cleaned only. Some whole or partial vessels will be identified in the field as candidates for pollen washes and should be sent to the field lab with botanical sample forms. Proveniences for these items should be verified, forms should be checked for completeness, their packaging should be examined and replaced if necessary, and the items should be set aside (apart from both the ceramics and the pollen samples).

LITHICS

In the La Plata Highway terminology, "lithics" is shorthand for all flaked lithic artifacts. These artifacts are generally robust and can be cleaned by brushing under water. Although robust and unaffected by water, edges of lithic artifacts can be fragile and should not be subjected to impacts. They should be placed rather than dumped when being transferred from container to container, and smaller more fragile items should be cushioned or segregated from larger heavier items in vials (anything placed in a vial must be cushioned, rattling can damage an item as fast as crushing). No residues have been noted during the processing of lithics from previous excavation seasons, but if any are noted in the field (they should be noted on the bag label) or in the lab, the item should not be washed and should be packaged separately from other lithics in the FS. Lithics should be washed thoroughly, since even small amounts of dirt adhering to the edges prevents analysis.

BONE

Both nonhuman and human bone require the same considerations in cleaning and handling. The integrity of individual bones can be affected by a variety of factors, and fragility can vary tremendously from bone to bone and provenience to provenience. Particularly fragile bones will be packed in toilet paper or acid-free tissue in the field. These bones should be unwrapped carefully, and cleaning in most cases should be limited to dry-cleaning--gentle brushing and picking. More robust bone may be bagged in the field without cushioning. These should be evaluated for their strength in the field lab; most should be dry-cleaned but some may be robust enough to support washing if washing is necessary. Any bone that is washed should be thoroughly but slowly dried. All bone should be cushioned after cleaning by wrapping in acid-free tissue paper. Bones of similar shape and strength may be wrapped together (such as a set of long bone splinters). Avoid using excess paper, and make folded packets rather than rolls. The process of unrolling excess paper can often damage items (from tumbling). Although they will be cleaned and packaged using the same techniques, human remains differ from animal bone in that they must be treated as culturally sensitive items. Human bone should not be displayed to field lab visitors and should not be handled in any manner that could be interpreted as irreverent. Individual skeletons should be packaged within burial boxes supplied by UNM, and isolated bone should be placed in ziplock repository bags and stored in repository boxes. Boxes containing human remains should be labeled "HB" rather than with more specific descriptions of content to minimize the risk of offending visitors to the field lab.

GROUNDSTONE

Groundstone includes lithic artifacts whose principal characteristics are the result of grinding in use or in manufacture. This definition includes a range of artifacts, from metates to turquoise beads. Most groundstone may be washed and brushed, but friable specimens will have to be dry-cleaned. Bag labels or tags should be checked for special instructions such as pollen washes, and all manos and metates should be examined for any residues of pigments, clays, or organic substances prior to cleaning. Labeling large groundstone items is difficult, and no adequate solution has been forthcoming. The simplest, but not necessarily most effective, solution is to wrap each piece with string and tie a label to the string. Under no circumstances are labels to be taped to the item or written on the item prior to analysis. Items that can be placed in zip-lock bags should be packaged in that way, and extremely small or fragile items should be wrapped in acid-free tissue and placed in vials before being placed in repository bags. Groundstone items that are identified as candidates for pollen washes should not be cleaned. They should be accompanied by botanical sample forms and should be set aside in plastic for later processing.

HISTORIC ARTIFACTS

Historic artifacts are expected from one site but may be recovered from others as well. Glass and ceramics should be washed unless adhering paper or residues are detected. Metal and bone should be dry-brushed. All historic artifacts should be allowed to dry thoroughly before packaging in repository bags, and fragile or delicate items should be padded with acid-free tissue. Any extremely corroded metal should be brought to the attention of the lab supervisor for evaluation and possible special treatment.

POLLEN SAMPLES

Pollen samples are taken in labeled Whirlpak bags in the field and are sent to the field lab in labeled paper bags. Unless there is too little material, pollen samples will consist of two Whirlpaks. Pollen samples should be examined in the field lab, and if samples are visibly moist or show any condensation, the Whirlpaks should be opened and set upright in the paper bag which should then be closed and set aside to dry slowly. Once the samples are dry (they should be checked regularly), the Whirlpaks should be closed and the samples transferred to repository bags. If samples are dry when they are brought in from the field, they should be transferred to repository bags after their proveniences have been verified and sample forms checked for completeness.

FLOTATION SAMPLES

Flotation samples will usually consist of slightly more than 1 liter of material (collected as 1 and one-half standard [13 oz] coffee cans), and the samples will arrive at the field lab in a labeled paper bags. Most samples will be moist when collected and should be allowed to dry slowly and thoroughly before processing. Provenience information should be verified and sample forms checked for completeness before any processing begins. Processing of most flotation samples will begin with measuring out 1 liter of material and recording its weight. Samples requiring the processing of a greater volume (such as for radiocarbon dating) will be clearly marked for special handling. Unused portions of samples that are not designated as special should be discarded. The soil should be dumped into a bucket 1/4 full of water, and water should be added vigorously until the bucket is about 2/3 full. After about 1 minute (time for sands and some silts to settle), the water should be poured through a labeled cloth (chiffon) square, leaving the sludge in the bucket. More water should be added to the bucket and the process repeated until little if any material floats to the surface. Material in the cloth should be rinsed and the cloth placed where it and its contents can dry slowly. The sludge remaining in the bucket should then be washed through a coarse screen to separate the silt and sand from the coarse fraction which is then set aside to dry. Both the dry float material and the coarse fraction should be weighed, and the float material should be passed through nested screens. The different size fractions of the charcoal should then be labeled, placed within acid-free paper packets, and placed within small ziplock bags. The ziplock bags should be labeled with the site, FS number, PP number (if appropriate), and the screen size of the material in the packet. All of the smaller bags and the original bag label should be placed within a labeled repository bag (preferably 6x8" size).

MACROBOTANICAL SAMPLES

Vegetal samples collected as part of routine excavation (as opposed to being collected as part of flotation samples) are called macrobotanical samples. They include both artifacts (such as basketry, matting, or worked wood), and things like corn cobs, squash seeds, firewood, and roofing materials that are not suitable for tree-ring dating. These items are usually extremely fragile and should be packaged carefully in the field. Laboratory handling will consist of provenience verification and an evaluation of the packaging to make sure that the field packaging is adequate to protect the item during shipment to Santa Fe for analysis. In rare cases, the materials may be dry cleaned in the field lab, and extremely fragile items may warrant interim analysis and description prior to being shipped to Santa Fe.

ARCHAEOMAGNETIC SAMPLES

Archaeomagnetic samples consist of sets of plaster of paris cubes, usually between 4 and 12 in number. Each cube should have an inscribed label, and all of the cubes of a single sample should be sent to the field lab within a labeled paper bag and should be accompanied by the archaeomag sample form. The cubes will be moist, and they should not be placed in repository bags. Instead, the paper bags should be placed where the contents can dry slowly, and the sample form should be filed with all other archaeomagnetic sample forms from the project. If the paper bags have been ripped or are weak, a new bag should be filled out and the old bag and samples should be placed within the new bag.

TREE-RING SAMPLES

Tree-ring samples will come in from the field as charcoal or wood specimens that have been wrapped in string and that may have been soaked in a paraffin-gasoline mixture. The samples will usually be fragile, and if all has gone according to plan, they should be so securely wrapped in the field that no more packaging will be necessary. The field lab responsibility will be to examine the field packaging to make sure all wrapping is tight, to ventilate any samples soaked in the gasoline and paraffin mixture, and to fill out an identifying tag for use by the Tree-Ring Laboratory. The identifying tag need not contain all of the provenience information associated with the FS, but should include "La Plata Highway 41.454," the site number, the structure or study unit, a vertical designation if appropriate, the FS number, and a DD number. If the sample has been wrapped as several pieces, the individual packages should be individually labeled and should included "(Piece __ of __)." Tree-ring samples should not be placed in repository bags.

RADIOCARBON SAMPLES

Radiocarbon samples will be used relatively less often than other dating techniques. This will reduce the volume of radiocarbon samples from the 1988 field season, but it means that individual samples will increase in importance. Samples should be wrapped in the field with aluminum foil to protect them from external contamination. They should be examined in the lab for moisture content, and any moist samples should be allowed to dry slowly and thoroughly before rewrapping in foil. Once dry, the sample should be transferred with its label to a repository bag. In some cases, flotation samples will be collected for the express purpose of providing enough charcoal for radiocarbon dates. These samples should be handled as other flotation samples, but with extra care to insure that all equipment is clean and no contaminating charcoal or organic matter is introduced. Keep both the floated material and the heavy fraction, but do not screen either segment of the sample. Package the fractions in acid-free tissue in repository bags once the materials are dry. The sample will be cleaned, sorted, and weighed once decisions are made about which radiocarbon samples will be submitted for analysis.

REPOSITORY PACKAGING

The Laboratory of Anthropology repository provides the project with ziplock bags and boxes for artifact storage. These materials are provided free of charge, but they are eventually paid for out of the per-box repository fee that is billed by the repository at the end of the project. One condition placed on the use of these supplies is that they be used only for artifact storage and that they not be diverted to other use or wasted. Repository bags are to be used only for artifact storage and should not be used in the field. Repository boxes should be used only for the final packing of materials for shipment to Santa Fe, and other boxes should be used in the field and for interim storage in the field lab. Repository bags should be labeled with Sharpies and the labels for excavated materials should conform to the example in Figure 1 [OMITTED]; labels for material cokm llected as part of the testing program will require a different segment name (Dawson Arroyo) and project number (not yet assigned). Ink labels should not be placed on the repository boxes, and large Post-its are the easiest alternative. The Post-its labels should always include the project number, the site number, the material type, and the FS range of the included materials.

FS INVENTORY FORM

This form is designed to provide a precise inventory of materials processed by the field lab. The inventory will be used in planning budgets for analysis effort and for tracking materials during analysis. The form is essentially a table with preprinted FS numbers. Each bag of material is washed, and the provenience data are verified by comparison with the entry on the FS sheet. The material types within the bag are separated, checked against the FS sheet bag tally, and counted. The counts are recorded in pencil in the appropriate blank on the FS inventory. If multiple bags are sent in from the field, the entries on the FS inventory should not be combined until the materials are physically combined.

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That we may learn from the mistakes of others and ourselves, here are some mistakes that have been observed in the process of going through the '88 materials.

Profiles

Profile line not located on plan
Sides/full extent of feature not indicated
Feature layers not designated
Minimal to missing descriptions of units.
More or different layers drawn on profile than described in notes.

Forms in General

Failure to include date and/or initials--these are important for organization (not just for blame) more often than you might think.

Botanical Forms

Comments omitted--both the sample selector and the analyst need to know about the feature and what key considerations about it are. If several layers in a feature are sampled, indication of which are more important should be given.

Form omitted altogether (this is a **frequent** mistake, but not a **popular** one when it comes time to select samples).

Feature Forms

Feature depths not measured (a lot of them)
Datum used for depths and correction depth not specified
Shapes not specified; measurements omitted entirely
Features with multiple layers indicated fail to indicate which layers samples and specimens come from; failure to give FS numbers for the feature as a whole or for subunits in the fill section.

PENCILS

People need to be aware of the right writing implement for their particular hand--if you're a heavy writer, and a smudger (or left handed [one of the chosen]), a form done in a soft pencil becomes an illegible smudge; if you're a dainty writer a form or especially a map done with a hard lead is so faint as to be equally illegible. Forms should not be filled out with sharpies--they're expensive and the forms look horrible. Again, what you are creating is an archival document--make it so someone else can read it.

CARE OF FORMS

When forms are completed they should be put in the site notebook. Avoid leaving them on a clipboard or in a dig box or at home indefinitely. This is yet another aspect of *curating the archive*. Tattered, spattered, and shredded forms are not in archival condition.

FIELD FORMS [OMITTED]

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[AN 242 NOTE: CONTENTS PAGINATION IS PER THE 1990 DOCUMENT; DUE TO REFLOW FOR THIS REPORT, IT MAY NO LONGER BE ACCURATE]

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